January 2010

Examiners' Report

NEBOSH National Diploma in Occupational Health and Safety - Unit B

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NEBOSH LEVEL 6 DIPLOMA IN OCCUPATIONAL HEALTH AND SAFETY

Unit B: Hazardous agents in the workplace

JANUARY 2010

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tel: 0116 263 4700 fax: 0116 282 4000 email: info@nebosh.org.uk website: www.nebosh.org.uk

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 over 25,000 candidates annually and are offered by over 400 course providers in 65 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 to be recognised and regulated by the UK regulatory authorities:

- The Office of the Qualifications and Examinations Regulator (Ofqual) in England
- The Department for Children, Education, Lifelong Learning and Skills (DCELLS) in Wales
- The Council for the Curriculum, Examinations and Assessment (CCEA) in Northern Ireland
- The Scottish Qualifications Authority (SQA) in Scotland

NEBOSH follows the "GCSE, GCE, VCE, GNVQ and AEA Code of Practice 2007/8" published by the regulatory authorities in relation to examination setting and marking (available at the Ofqual website www.ofqual.gov.uk). While not obliged to adhere to this code, NEBOSH regards it as best practice to do so.

Candidates' scripts are marked by a team of Examiners appointed by NEBOSH on the basis of their qualifications and experience. The standard of the qualification is determined by NEBOSH, which is overseen by the NEBOSH Council comprising nominees from, amongst others, the Health and Safety Executive (HSE), the Confederation of British Industry (CBI), the Trades Union Congress (TUC) and the Institution of Occupational Safety and Health (IOSH). Representatives of course providers, from both the public and private sectors, are elected to the NEBOSH Council.

This report on the Examination provides information on the performance of 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.

Any enquiries about this report publication should be addressed to:

NEBOSH
Dominus Way
Meridian Business Park
Leicester
LE10 1QW

Tel:0116 263 4700
Fax:0116 282 4000
Email: info@nebosh.org.uk

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.

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 the question 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 any degree of understanding. Candidates should prepare themselves for this vocational examination by ensuring their understanding, not rote-learning pre-prepared answers.

Common pitfalls

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.

- 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.
- In some instances, candidates are failing because they do not attempt all the required questions or are failing to provide complete answers. Candidates are advised to always attempt an answer to a compulsory question, even when the mind goes blank. Applying basic health and safety management principles can generate credit worthy points.
- 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.
- Many candidates fail to apply the command words (also known as action verbs, 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.
- 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 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.
- Candidates should also be aware that Examiners cannot award marks if handwriting is illegible.

UNIT B – Hazardous agents in the workplace

Section A – all questions compulsory

Question 1 Outline signs that could indicate to an employer that an employee has an alcohol problem. (10)

Candidates did not seem to have much difficulty with this question and most were able to refer to specific signs such as sudden mood changes, unusual irritability or aggressive or erratic behaviour; a tendency to become confused; abnormal fluctuations in concentration and energy levels; impaired job performance and reduced productivity; a tendency to suffer an increased number of accidents; poor time keeping; an increase in short term sickness absence; deterioration in relationships with colleagues, customers or managers; dishonesty or theft; the smell of alcohol; slurred speech and poor coordination; a change in appearance, for example becoming scruffy when previously the employee had been well groomed and the evidence of drinking such as, for example, the discovery of bottles in the workplace. A few referred to the results of biological monitoring and alcohol testing which could not be classed as 'signs' as required by the question.

Question 2

(a) Outline the nature and properties of alpha particles. (4)

(b) Outline the principles that could be used to control exposure to alpha particles. (6)

For part (a), candidates should have outlined that alpha particles are a type of ionising radiation formed as a result of radioactive decay. The particle consists of two neutrons and two protons (ie a helium nucleus). Alpha particles travel only a few centimetres in air and may be stopped by intact skin or a sheet of card or paper. They are, however, more hazardous if the source is taken into the body, a point which was not appreciated by many candidates. This part of the question was not well answered and only a few candidates demonstrated an understanding of the nature and properties of alpha particles. There were only rare correct references to the structure of the particle, some confusion between alpha particles and gamma rays and a few candidates even suggesting that the particles were non-ionising.

Answers to the second part of the question were, however, a little better. In outlining the principles that should be followed to control exposure to alpha particles, candidates should have referred to the need to maximise the distance from the source and minimise the amount of time employees are exposed to the radiation since the effect of exposure is dose dependent and limiting exposure will limit the dose received. The source should be shielded or contained in a sealed unit or container and where possible, the work should be undertaken in a glove box or fume cupboard so minimising the opportunity for the alpha particles to enter the body by ingestion, inhalation or absorption. Equipment and surfaces should be decontaminated following work with the particles. The taking of food and drink should not be allowed in areas where the particles are likely to be present and all employees should ensure that all wounds, cuts or grazes are covered and protected. If there was a weakness, it was that few candidates recognised the particular risk of particles entering the body.

Question 3

(a) Identify the possible range of specialists involved in Occupational Health provision in a large manufacturing company. (5)

(b) Outline the specific activities that occupational health specialists could undertake as part of a programme to reduce accidents and absences relating to manual handling. For EACH activity identify the most appropriate occupational specialist to undertake the activity. (5)

The range will depend on the actual activity of the organisation but might include: an occupational health physician and nurse; an occupational health nurse; a physiotherapist; an occupational hygienist; a counsellor or psychologist; and an ergonomist. Most candidates were able to identify a reasonable range of specialists though some went on to describe their roles to no advantage. The use of generic terms such as occupational health advisor did not identify the range of specialists

The contribution the specialists could make as part of a programme to reduce accidents and ill health in relation to manual handling include the assessment of manual handling tasks - the ergonomist or physiotherapist; the assessment of the physical capabilities of the employees to carry out a task either pre-employment or after a return to work – the physician or nurse; the treatment of or referral for treatment of manual handling injuries – the physician or nurse; drawing up a rehabilitation programme for return to work – the physiotherapist or nurse; monitoring and recording sickness absence – the occupational health nurse; the provision of manual handling training – the physiotherapist or ergonomist; giving advice to management on controls for manual handling tasks – the physician or nurse; and the investigation of manual handling injuries – the physician, nurse or ergonomist. Some candidates did not read the question with sufficient care and dealt with the whole range of occupational health issues instead of concentrating on manual handling as required. Others, although they identified the specific activities, did not link them with the appropriate specialist, while a few covered every eventuality by assigning every activity to each one of the specialists.

Question 4

A welder undertakes work in an open plan workshop.

Outline the factors to be considered when selecting suitable Respiratory Protective Equipment for this work. (10)

Factors that should be considered when selecting respiratory protective equipment for the welding work described include: the type, duration and frequency of the work and its position in the workplace; the fume control measures currently in place such as general or local exhaust ventilation; the health hazard category of the welding fume for example whether toxic or irritant; the level of protection (protection factor) required for each substance based on considerations such as the amount of the substance, the volatility of the welding consumables, the concentration and particle size and the relevant workplace exposure limits (WELs); the choice of the equipment in relation to the protection factor whether half face, full face or forced air breathing apparatus; the choice of the correct filter type based on the determined protection factor; task related factors such as the work rate and wear time, the presence of humidity, the need for mobility and communication and the amount of physical effort and degree of movement required to carry out the task; the fit and comfort of the equipment taking into account facial hair and the need to wear spectacles; the compatibility of the equipment with other personal protective equipment such as eye, head or hearing protection; the heat resistant properties of the equipment; the battery life of specified types of equipment; the cost of the equipment and the amount of training and maintenance required for its use; the manufacture of the equipment to recognised standards and finally any relevant medical conditions of the potential user such as heart disease, asthma or claustrophobia.

Better answers were produced by those candidates who structured their responses round factors involving the individual, the task and the substance to be used. A few, however, did not seem to notice the reference in the question to 'selection' and described how the equipment should be used, maintained and stored. Examiners remarked that some candidates seemed to lack knowledge of welding/fabrication work which put them at a disadvantage.

Question 5 Work related upper limb disorders (WRULDs) can develop if ergonomic principles are not followed when designing work tools and work equipment.

(a) Outline what is meant by the term 'ergonomic principles'. (2)

(b) Outline how the design of work tools and work equipment can help to minimise the risk of a person developing a WRULD. (8)

For part (a), in outlining the term 'ergonomic principles', candidates could have referred either to designing the workplace, work methods and work equipment to suit the worker or ensuring a good fit between the person and their work as far as tools, equipment and workstation are concerned. Answers varied in quality with a few suggesting that the term meant fitting the person to the work.

In outlining how the design of work tools and equipment may help to minimise the risk of a person developing a WRULD, candidates could have referred to factors such as designing the tool specifically for the job to be carried out; designing different sized tools for different workers or making them adjustable; designing tools for left handed workers and providing lightweight tools where possible; providing suitable handles or supports for tools and designing them so that they are weight balanced in relation to the supports or handles; ensuring that tools are easy to maintain, clean and lubricate; designing tools to minimise the amount of force required to use them; designing tools to avoid extremes of posture and to minimise repetitive body movements and vibration and finally to design them to recognised standards such as EN 614. Candidates who did not do well appeared to have missed the reference to design in the question and wrote about selection and maintenance issues. Others concentrated solely on the components of a DSE work station rather than dealing with tools and equipment in general.

Question 6 Employees can be exposed to corrosive substances.

(a) Give the meaning of the term 'corrosive'. (2)

(b) The data below, for three forms of the same product, is taken from a supplier's catalogue.

Using the data outline the likely routes of entry AND effects of exposure when handling EACH of these products. (8)

Product Code	Chemical name/formula	Concentration	Physical Form
C1	Sodium Hydroxide (NaOH)	99.9%	Pellets
C2	Sodium Hydroxide (NaOH)	97%	Powder
C3	Sodium Hydroxide (NaOH)	50% in water	Liquid

In answering part (a) of the question, candidates should have included that a corrosive substance is a chemical that may rapidly destroy living tissue if it is inhaled, ingested or splashed onto the body. This is a formal definition and often candidates gave vague and inaccurate meanings of this term.

For part (b), candidates should have noted that the same chemical is involved in all three products and that the actual effect produced will be the same once they have entered or come in contact with the body. Sodium hydroxide is a corrosive chemical and has the potential to cause burns. The concentration of NaOH in the products varies and thus so will the extent of the burns they might cause – more concentrated C1 should in theory be more corrosive than C3 when it makes contact with the body. The likelihood of exposure, however, will vary due to the different physical form of the products. Since C1 is in pellet form, it may be ingested (accidentally) affecting the digestive tract and may contact or penetrate the skin. Additionally, dust from the pellets may be inhaled affecting the respiratory tract. C2, in powder form, is likely to become airborne during handling giving an increased opportunity for inhalation and contact with the eyes. C3 is in liquid form and though it has the lowest concentration of NaOH, will be likely to splash and affect the skin of the face and hands and the eyes.

Answers were generally poor. Candidates did not outline either the likely routes of entry or the effects of exposure as required. Many did not seem to understand that the route of entry was related to the physical form of the chemical. A few thought that NaOH was acidic while others believed it might be absorbed through the skin and enter the blood stream.

Section B – three from five questions to be attempted

Question 7

(a) Identify the published sources of information an employer could use to determine if carcinogens are used in their workplace. (4)

(b) Outline the control measures that should be used when, because of the nature of the work, it is not possible to eliminate a carcinogen or substitute it with an alternative substance. (16)

In answer to part (a) of the question, candidates should have identified sources of information such as those found on labels and SDSs for substances used in the workplace and in particular the relevant R (risk) phrases. Information might also be found in Annex VI of the CLP Regulation for classification as carcinogen; the European Chemicals Agency candidates list or list for SVHC (substances of very high concern); in schedule 1 of COSHH and also by the application of the criteria in CHIP in a self classifying approach which would be particularly relevant if a new substance was involved. Other useful technical reference sources include EH40, scientific papers and information from trade associations, The Chemical Industry Association and the International Labour Organisation. Despite the number of potential sources of information available, some candidates were able to refer only to EH40 and relevant SDSs. Many candidates seemed unaware of the changes brought about by REACH and continued to refer to the approved supply list.

For part (b), the required control measures would be guided by the requirements in Regulation 7 of the COSHH Regulations and the associated ACOP on carcinogens. These would include reducing exposure to a level as low as reasonably practicable by minimising quantities used and/or changing the physical form; use of a totally enclosed system or automation of the process to physically separate workers from the process and, where this is not possible, the use of a partial enclosure in the workplace or appropriate local exhaust ventilation. It would also be necessary to provide appropriate storage including the use of closed/sealed containers and recognition that it may be better to store one large quantity in a controlled manner than to deal with frequent supplies of smaller amounts. Materials would have to be correctly labelled and the areas of use restricted with identifying signs to indicate their boundaries. Any waste carcinogenic products should be labelled and stored in a secure area pending removal by a specialist contractor. The numbers working in the restricted areas should be minimised and non-essential personnel excluded. Precautions should also be taken against contamination including prohibiting eating, drinking and applying cosmetics in contaminated areas; providing appropriate warning signs to demark these areas; and providing adequate washing facilities. Monitoring of levels of exposure should be carried out on a regular basis to ensure the adequacy of the control measures in place with the recognition that the use of personal protective equipment can only be used as a secondary control in combination with other controls.

Many candidates appeared to be unaware of how to control carcinogens relying on the provision of personal protective equipment and environmental and biological monitoring. There were many generic and non-specific COSHH answers produced which did not provide the range of control measures required for the number of marks available in part (b).

Question 8	(a)	Outline the principles of a prospective cohort study, as used in epidemiology.	(4)
	(b)	National public health monitoring has recorded several hundred cases of an illness. In at least half the cases the cause has been confirmed, by laboratory tests, as a new strain of virus. Outline the possible data AND data sources that could be used for a prospective cohort study of this outbreak.	(10)
	(c)	Outline factors that may affect the reliability of such cohort studies.	(6)

This question was not popular and few candidates attempted to answer it. A prospective cohort study starts with a hypothesis to be tested. It involves looking for a link between cause (exposure) and effect (disease), using two cohorts in order to compare those that have been “exposed” against those that were “unexposed” and looking for a dose/response link. The study starts at the present time and follows the cohorts forward enabling the monitoring of exposure and health outcomes. There seemed to be little understanding of the nature of the exercise and in particular that the study involved two groups.

For part (b), the possible data and data sources that could be used in the scenario described include: the gender, age, occupation and employment records of those affected and the geographical region or regions involved; exposure data which might reveal the existence of any pattern and pre-existing medical records from GP surgeries; vaccination history since some may not display symptoms although exposed to the virus; clinical results by testing; morbidity rates; the cause of death of those who succumbed to the illness; the reports of interviews with confirmed cases and those with whom they have been in contact; hospital admissions with specific symptoms and laboratory reports of confirmed cases sent to the HPA. Not many candidates were able to provide a good range of data or data sources and few realised that this was a public health rather than an occupational issue.

Part (c) was again poorly answered especially by those candidates who had experienced difficulty with the first part of the question. They were expected to outline factors such as: the cohort size; the accuracy of historical data on exposure and health effects; the accuracy of diagnosis; the reliability of recall from interviewees; there may be non-occupational exposure; long latency periods for the effect; the frequency of disease in the unexposed cohort; lifestyle factors such as alcohol consumption, diet, smoking etc; there may be selection bias and the cohort may not be representative of the exposed population; and the difficulty in following up all members of the cohort for instance some may be involved in a geographic move while others decide to take no further part in the project.

Question 9 A company that operates hotels and health spas recognises the risks associated with the legionella bacteria.

(a) Identify specific locations where there may be growth of, or potential exposure to, legionella for employees AND guests. (5)

(b) Outline the control measures that this company should implement to minimise exposure to legionella bacteria. (15)

In answering part (a), candidates could have chosen from a list which includes; hot and cold water storage and transfer systems (including showers and taps) where the temperature is between 20 and 45 degrees; spa baths, saunas, steam rooms and pools in leisure facilities; water features such as fountains and cascades; fire and garden sprinkler systems; laundry rooms; pipe work where dead legs exist and stagnation may occur and wet or condenser air conditioning equipment. Most candidates were able to include the above in their answers.

Answers to part (b) were, however, not to the same standard. Measures which should have been outlined included identification of a responsible person to manage legionella control; regular disinfection of hot water systems with biocides; annual cleaning and disinfection of calorifiers; inspection and cleaning of water storage tanks; avoiding 'dead legs' in transfer pipe work; maintaining hot water storage temperatures at temperatures greater than 60 degrees C and cold water below 20 degrees C; keeping shower heads and taps clean and free from scale and running showers and taps for several minutes each week in unoccupied rooms; running showers and taps immediately prior to occupation of a room; treating spa pools continuously with chlorine or biocides and cleaning them on a regular basis; avoiding the use in systems of susceptible materials such as wood or rubber; training all relevant employees in risk factors and controls such as monitoring, dosing and flushing through; minimising biofilm formation, for example by covering water tanks and the use of chemicals, replacing wet air conditioning systems with dry air systems or ensuring their maintenance on a regular basis; undertaking regular monitoring of temperature and chlorine or biocide levels and periodically sending water samples for analysis.

Many candidates again did not provide the technical detail necessary for a question at Diploma level. There was a tendency to provide generic answers which lacked specificity such as a reference to the need for cleaning, maintenance and training without giving examples of what these might entail. Training providers are urged to make candidates familiar with the technical content of the HSE document L8 on the Control of legionella bacteria in water systems.

Question 10

A noise survey is to be carried out in a large enclosed turbine hall within an electricity generating power station.

In the turbine hall there are three steam driven turbines and other mechanical plant associated with power generation.

Exposure to noise is a considerable problem for the 50 employees who work on each shift in the turbine hall especially when all three turbines are running.

Explain how a noise survey should be planned and undertaken in order to assess employees' noise exposures in this workplace. (20)

In answering this question, candidates should initially have stressed the importance of providing information to and consulting with the workforce prior to the survey, using a competent assessor, considering all available relevant information such as previous surveys, existing controls, machinery manufacturers data, maintenance and audiometry records and calibrating measuring equipment before and after measurements were taken. A suitable framework for the exercise could be based on a basic survey, a detailed survey and then a section on frequency analysis and personal noise exposure.

A basic survey would involve the use of simple sound level meters or integrated sound level meters to measure noise levels at planned points around the turbine hall. This would enable identification of areas where noise exposure was at or above action levels and would identify the main sources of noise. A record would have to be kept of the machinery that was in operation when the survey was carried out.

The detailed survey would involve the use of integrated sound level meters. A decision should be made on suitable sample times over which to measure Leq with the measurement of noise levels being made at operator positions averaged over typical time periods, a note made of the employees' length of exposure, and a calculation method such as a nonogram used to determine exposure (LEP,d). The survey should include the measurement of peak noise levels with the results being plotted on a noise map. Using the octave band frequency analysis function on the sound level meter, measurements would have to be made of noise levels at each frequency band. This would help in making decisions both on the noise control measures to be taken and also on the selection of correct hearing protection.

As for personal noise exposure, dosimeters could be issued to a selection of operators and peripatetic workers to measure noise dose over a representative period of time. The start and finish times of the exercise would have to be noted and care taken to ensure that the microphone was positioned close to the ear. This exercise would determine the actual LEP,d and LEP,w of the individuals concerned.

If there was a fault in answers to this question it was that many lacked structure and did not address the basic and detailed steps required in carrying out the survey. Some candidates seemed unable to relate to the scenario while others discussed control measures rather than how a survey should be carried out. There was evidence that a few candidates did not have a basic understanding of the units of measurement for noise or of the meaning and use of octave band analysis.

Question 11 A manufacturing process involves the use of three organic solvents, exposure to which is controlled by local exhaust ventilation (LEV) and personal protective equipment. The LEV system is regularly inspected and is subject to thorough examination and testing on an annual basis.

(a) Outline how the exposure of the process workers to solvent vapours could be assessed. (10)

(b) Outline how the data obtained could be used to determine if the exposure of the process workers to the solvents is adequately controlled. (10)

In answering part (a) of this question, it was expected that candidates would refer to the three stage monitoring strategy as described in HSG 173 comprising an initial appraisal and then a basic and, if required, a more detailed study.

The initial appraisal would consider: the nature of the solvents involved, for example whether they were toxic, harmful or irritant; the existing control measures such as the local exhaust ventilation and the personal protective equipment provided; the health surveillance records; the known health effects of the solvents on the body and target organs; the volatility of the solvents at the process and/or workplace temperatures; the synergistic or additive effects of the three solvents; the frequency and duration of exposure and any WELs or relevant biological guidance values. As a result of this appraisal a decision could be taken on the necessity to undertake workplace monitoring.

A number of sampling methods could be used including static, personal, passive, active, direct reading and laboratory analysis. The equipment used would include stain and adsorbent tubes. It would also be necessary to carry out biological monitoring to measure what has actually been taken into the body rather than the airborne concentration. Answers to this part of the question were to a reasonable standard though some candidates did not have a good grasp either of the sources of information that should be consulted or the approach that could be used to assess the levels of exposure.

For part (b), candidates were expected to outline how the data obtained would assist in determining whether the exposure of the employees to the solvents was adequately controlled. The data would enable comparisons to be made: between actual exposures from personal sampling to the relevant WELs; between the workplace monitoring results and in-house and industry standards; and between the results of biological monitoring and those of biological monitoring guidance values (BMGV). If personal monitoring exposure values were very close to the WEL or one or more of the solvents was a carcinogen or asthmagen, then further monitoring would have to be undertaken as advised in HSG 173 to confirm whether the solvent required further control to bring its exposure to a level as low as is reasonably practicable. A comparison would also have to be made between the performance of the personal protective equipment provided against information contained in MSDS such as for example the chemical resistance of gloves. Finally the results of the annual examination and testing of the local exhaust ventilation could be compared with its commissioning data and the performance recommended in HSG 258 to ensure the adequacy of its level of control.

Answers to this part of the question were not to an acceptable standard with many concentrating only on comparisons with the relevant WELs. Many did not appreciate the significance of other data such as the testing and inspection results for the local exhaust ventilation or the performance data for personal protective equipment.

The National Examination
Board in Occupational
Safety and Health

Dominus Way
Meridian Business Park
Leicester LE19 1QW

telephone +44 (0)116 2634700
fax +44 (0)116 2824000
email info@nebosh.org.uk
www.nebosh.org.uk