Answers to revision questions for NGC2 element 1

Answer 1 The four types of occupational health hazard (as categorised by the syllabus):

- physical hazards, including:
  - » noise
  - » vibration
  - » electromagnetic radiation including visible light, ultraviolet, microwaves
  - » ionising radiation: X-rays, alpha, beta and gamma radiation
  - » thermal environment hazards, both hot and cold
- chemical hazards, which may be sub-divided in a number of ways, including:
  - » toxic, harmful, corrosive, irritant, carcinogenic (CHIP 'risk phrases')
  - » acute, chronic
  - » by target organ
- biological hazards, by way of examples you could give:
  - » hepatitis B
  - » AIDS
  - » legionellosis
  - » leptospirosis
  - » genetically-modified organisms
  - » diseases associated with the laboratory
- ergonomic hazards
  - » manual handling hazards
  - » musculoskeletal disorders
  - » hazards associated with display screen equipment

Alternatively, you could place biological hazards into the following categories:

- » virus - extremely small organisms: rabies, common cold, flu, AIDS
- » bacteria - single cell organisms: legionnaires' disease, anthrax, tuberculosis, tetanus
- » other micro-biological agents such as fungus conditions, bird-handlers' disease
- » genetically modified organisms

Answer 2 Acute, chronic ... words which, in normal speech, are used in a fairly haphazard manner; in health and safety the meanings are well-defined:

- an acute condition is one in which the body shows an immediate response to exposure; full recovery from an acute condition will probably occur unless of course, the victim dies.
- a chronic condition is one which develops over a long period of, probably, low exposure levels; chronic conditions may have periods in which they do not worsen, but full recovery will not occur.

As we explained in the text, some agents (carbon monoxide, benzene) can be responsible for both acute and chronic conditions. Our question specifically referred to acute and chronic biological health hazards; examples might be legionnaires' disease (acute), tuberculosis and athletes foot (chronic). Does the example of athletes foot show that some chronic conditions may in fact recover, contrary to what we said above; or do we say that in the long periods when the condition of athletes foot is not apparent it can be said to be dormant?

Answer 3 Local, target organ, systemic. Remember that the syllabus lists a dozen 'specific agents' (ammonia, chlorine, ...), the individual hazards of which you must know. It is useful to have a few other examples up your sleeve for questions like this ...

... carbon tetrachloride enters the body via the respiratory system and acts in the liver (target organ); acid burn (local); lung damage by a substance taken into the respiratory system (local). Systemic tends to be taken to mean that the effect involves the whole organism but strictly systemic means that the substance has to travel through the body to its place of action, for example tetræthyl lead which acts in the brain having travelled through the body from the skin or the gut or the lungs.

Answer 4 Toxic, harmful, corrosive, irritant, asphyxiant, narcotic, carcinogenic, teratogenic/ mutagenic. These are all defined in the study material; check your answers. In this sort of question it may be useful to 'place' the definitions of 'toxic' etc in the context of the CHIP legislation and guidance material such as EH 40.

Answer 5 Routes of entry into the body for (toxic) substances:

- inhalation
- injection
- ingestion
- skin absorption

Inhalation is usually described as being 'the most important' route of entry; we need to be careful here because, for example for (say) hepatitis B, injection is the route of entry. By now, you will appreciate that 'the most important route of entry' really is a shorthand way of saying 'the route of entry which is is applicable to most agents and substances which can cause harm to the body'.

Answer 6 The size of any airborne contaminant (gas, vapour, mist, dust etc) will determines how far they will travel in the respiratory system. Large particles (grit) will be unable to negotiate their way into the respiratory system at all (think of the orientation of the nose); contaminants of size 10–100 microns (10^{-6} metre) will get trapped somewhere in the upper respiratory system and very fine particles and gas molecules and fine mist will travel all the way to the gas transfer region of the lungs, perhaps becoming trapped or perhaps being subsequently breathed out.

Answer 7 Gas, vapour, mist, smoke ... the syllabus requires that you must know the meaning of these terms; if necessary, refer back to our text. Ensure that you appreciate the health and safety meaning of 'aerosol'.

Answer 8 The airborne concentration of a substance may be expressed:

- weight per volume: mg / m^3
- ratio: parts per million
- number of fibres in a given volume of air: fibres / ml

In the text we asked you to say which would be the appropriate way(s) of expressing the concentration of six substances; please make sure that you did indeed tackle this question and are happy with the answer.

Answer 9 Air sampling, air monitoring

As we mentioned in the study material, words like ‘sampling’, ‘surveying’, ‘checking’, ‘monitoring’ tend to have somewhat flexible meanings (unlike some health and safety terms such as ‘risk’ and ‘hazard’ which, as we have explained, have very clearly defined meanings).

Air monitoring implies a continuing fairly detailed evaluation of the levels of pollutants in the air, whereas air sampling implies a more limited exercise. It could of course be that the air monitoring is required because the results of a one-off air sampling exercise indicate that more detailed investigations are required. We refer you back to the text for a brief glimpse of some of the factors that would need to be taken into account in developing an appropriate strategy in investigating and controlling the pollutants in a particular environment - for example, don’t waste time and money on detailed air monitoring when it is obvious that the situation demands that resources need to be concentrated on improving control.

Answer 10 More on this in the text, but basically, for substances with a WEL, exposure must be kept below the WEL. In addition to substances with ‘only’ a WEL, there is another group of substances which, in addition to their WEL, have a requirement to reduce exposure levels to ‘as low as reasonably practicable’. (It would be helpful if a commonly agreed name were to emerge for these substances with ‘more-than-just-a-WEL’.) The main groups of substances which fall into the low as reasonably practicable category are carcinogens and allergenic agents and they are flagged for special attention either by certain risk phrases (R42 etc) or by their presence in Schedule 1 of the COSHH Regulations which lists carcinogenic substances and processes.

Answer 11 An averaged hardwood concentration of 4 mg m^{-3} (WEL of hardwood = 5 mg m^{-3}) is not acceptable. There is a legal obligation to bring it as low as reasonably practicable.

Answer 12 No, it is not acceptable.

Answer 13 The 15 minute short-term limit (STEL) is intended to accommodate exposure levels which ‘peak’ from time to time in the day.

Answer 14/15 In the text we explained why it may not be necessary to analyse the contaminant - around a degreasing tank using solvent you will find solvent, in a woodwork shop you will find wood and so on. The nature of the airborne contaminant may be unknown in situations involving fires, explosions, illegal tipping and perhaps complex process plant; chemical analysis may be needed for identification purposes.

Answer 16 In addition to identifying unknown pollutants, air monitoring may be used to determine the concentrations of the contaminants, the variations throughout the workplace and variations during the shift / weekly work cycle.

Answer 17 Reasons for undertaking air monitoring include:

- assessing the exposure of personnel - individual and collective - to contaminants
- to assess compliance with hygiene standards, ie workplace exposure limits (WEL) or, in the case of substances without a WEL, to assess compliance with an internally derived standard
- to check the effectiveness of the control measures such as local exhaust ventilation which are in force
- selection of appropriate respiratory protective equipment which depends on the full identification of the contaminant
- emergency or alarm monitoring in, for example petrochemical plant, to ensure that leakages do not lead to explosive or toxic concentrations of gases; alarm monitors may be portable and carried by the worker or they may be in a fixed position, permanently ‘on guard’ whether or not the site is occupied

Answer 18 In outlining the similarities and differences between personal monitoring and area monitoring you should have pointed out that personal equipment must be ergonomically acceptable to the worker. If correctly chosen and operated, such portable equipment will be able to assess the level of the contaminant which is present in the worker's breathing zone as the worker pursues his/her normal pattern of work. For some gases and vapours, personal equipment may provide a 'real time' value for the concentration of the contaminant or the sample may be collected for subsequent analysis - particularly when the contaminant is a solid. Area equipment can be more sophisticated, providing a full read-out of the levels of one or more contaminants over the chosen time period.

Answer 19 General workplace dust ('nuisance dust') has an occupational exposure limit because such dust may cause irritation to the worker.

Answer 20 A colour detector tube (chemical indicator tube, stain detector tube, Dräger tube) operates by drawing a known amount of air through a chemical packed into the tube. The air may be drawn through in perhaps 10 'gulps' over a period of a few seconds or, if a long-term average concentration is required, over a period of several hours by a small battery-driven pump. The chemical in the tube will change in some way (colour, depth of stain, density of stain) and this will give a measure of the concentration of the contaminant in the air.

Answer 21 COSHH regulation 7:

> Every employer shall ensure that the exposure to substances hazardous to health is either prevented or, where this is not reasonably practicable, adequately controlled.

Answer 22 Hierarchy of control for substances; our text provides examples under each of the following:

- elimination of exposure (perhaps in conjunction with enclosure, when for example a welding process is automated)
- substitution: water-based degreasing agents for solvent-based
- modification of the process (engineering control)
- enclose the process, perhaps in conjunction with other controls such as automation or the introduction of LEV
- ventilation control
  - » local extract ventilation
  - » dilution ventilation for low levels of non-toxic pollutants
- personal protection
- ... at each and every level of the hierarchy ... administrative issues

Just why ppe, rpe (lower case) and LEV, AIDS ... (upper case) have become the usual way of showing abbreviations, we have no idea.

Answer 23 The limitations of ppe focus on the fact that, even when well-selected, fitted and used, they will only protect the person wearing it. In practice, ppe will often fail to achieve the full manufacturers level of protection because:

- it is inappropriately chosen
- ill-fitting (beards, spectacles)
- conflicts with other ppe (hearing protection and rpe are frequently badly combined)

... continued ...

- not maintained, stored and cleaned
- not worn for 100% of the time that it should be worn; as we have explained, failure to wear (say) hearing protection for only short periods can greatly increase exposure levels

Not really a limitation of ppe as such, but certainly worth mentioning in your answer is the fact that ppe can be used as a cover for poor practice in the workplace, an alternative to undertaking the control measures that should be undertaken - engineering control, LEV etc.

Answer 24 Administrative control will encompass:

- training workers in the correct use (including cleaning, maintenance and emergency procedures) of the equipment they encounter and use in the workplace
- training in the selection, storage, maintenance, use of any personal protective equipment that is required for the protection of the worker
- reduce the number of employees exposed to hazardous activities and their time of exposure
- ensure good housekeeping: cleaning schedules, control of eating, drinking and smoking
- control of hazardous substances throughout their life-cycle: receipt, storage, use, disposal
- provision of facilities for washing, changing, storage of clothes
- record keeping

As we've said before, you can't go wrong with 'record keeping' - it has almost universal relevance in health and safety. Clearly your answer will be better if you give some examples of the records that should be kept - in this case you could mention records of the purchase, supply and use of ppe, COSHH records, training records, data sheets for the substances which are used, and so on.

Answer 25 General ventilation may be appropriate in the control of substances of low hazard and/or in providing thermal comfort and a supply of fresh air. Local ventilation may be portable (for example, extraction systems which can be wheeled to the place were welding is taking place) or fixed around the site of the pollutant (you should be able to provide a handful of examples here, check the text if necessary). The main components of a local exhaust system must include:

- device for gathering contaminated air (hood)
- ductwork to take the contaminated air from the hood to ...
- collection device (cleaning the air and disposal of waste)
- air-moving device (fan)

Answer 26 A safety data sheet must encompass all the necesary information to enable the substance in question to be stored safely and used and disposed of safely; the data sheet must also encompass actions which are required in the event of spillage and other accidents. Your answer should, as so often, refer to the relevant legislation, in this case CHIP and also worth a mention are the HSE leaflets which form part of your study, in particular:

- Why do I need a safety data sheet? INDG 353
- Read the label INDG 352

Answer 27 Health surveillance is particularly important for substances which cause allergic reactions, when the worker has become sensitised.

For the answers to questions 28–31, we refer you back to section 9 of NGC2/7

Answer 32 Environments in which workers might come into contact with biological hazards include:

- agriculture, food production, work associated with animals
- » animal husbandry and transport, slaughterhouses
- » contact with spores: mushroom growing, grain storage, etc
- » veterinary work, bird handling, laboratory animals, pet shops and garden centres
- building / demolition / repair work: birds droppings etc
- health care workers: TB, AIDS, hepatitis
- sewerage and drainage system work
- textile work: animal hair, cotton dust etc

These are just some examples of 'occupational' hazards, although of course, non-occupational members of the public will not be immune to these hazards. In addition you might have mentioned hazards such as humidifier fever and legionnaires' disease which are associated with micro-organisms in air conditioning systems. These are found throughout the built environment - commerce, entertainment, recreational.

Answer 33 Routes of entry for biological agents:

- ingestion: food poisoning, for example salmonella, brucellosis
- inhalation: legionnaires' disease and tuberculosis
- skin entry: either through a wound (eg tetanus, Weil's disease) or a bite by an insect (malaria) or an animal (rabies) or via contaminated body fluids (AIDS, hepatitis B)

Answer 34 Some methods of control for microbiological agents; there are many examples from which to choose, including:

- control of rodents and insects
- personal protective equipment: full length boots for sewer workers (Weil's disease), rpe for workers who are liable to be exposed to bird-carried diseases
- health surveillance to show if a worker is becoming sensitised to a particular allergen; immediate appropriate action is then required
- good housekeeping including the collection and appropriate disposal of all contaminated clothes, animal bedding and waste; protect broken skin
- adequate ventilation
- disinfection - equipment, animal stalls
- scrupulous personal hygiene - changing clothes
- control (enclosure, ventilation) of the aerosols produced by equipment such as laboratory centrifuges and dryers
- proper design, commissioning and maintenance of engineering controls in water cooling and ventilation systems