



2010

New and expectant mothers in school science departments

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Introduction

Risk assessments are needed for the activities of all employees and then control measures have to be put in place to remove or to minimise any risks to health and safety shown up by those assessments.

For particular individuals, work activities which are normally considered to be acceptable may no longer be so and special risk assessments are required. One important such case is that of women who are pregnant or breastfeeding.

The Management of Health and Safety at Work Regulations point specifically to expectant and new mothers and to women of child-bearing age.

The two requirements are:

- 1) All existing generic risk assessments should be checked to see if any activity would give rise to an additional risk to an expectant mother and her unborn child and to a new mother and her baby. This would include female pupils.
- 2) Once an employer has been informed by a teacher, a technician or a student that she is pregnant an individual risk assessment specific to that person's work has to be made.

Expectant and new mothers working in a school science department will experience a wide range of factors which might affect their health or that of their babies. It is considered that the generic risk assessments provided by SSERC in SafetyNet on the SSERC website [1] or SafetyNet DVD would provide adequate protection in virtually all situations. Where a substance or activity is not listed in those sources, e.g. one used for a project, or where special information or advice is needed, contact SSERC [2].

Those substances or activities which are of particular concern are listed in the Appendix. There are many other useful general sources, e.g. New and Expectant Mothers at Work - a guide for health professionals (HSE) [3].



One factor which causes harm is stress. If an expectant member of staff is concerned about an activity or substance, even when the risk is known to be extremely low, e.g. when the actual dose received from using a particular substance is an extremely small fraction of that generally permitted, then the wise course is to arrange for someone else to do that task.

The most vulnerable time for pregnant women is the first two or three weeks of pregnancy. Thus it is sensible for women who are intending to become pregnant to take precautions when handling any chemicals or biological materials known to be harmful to mothers or their yet unborn child. Several different types of hazards can cause harm to a mother or her child.

[1] <http://www.sserc.org.uk>

[2] Tel: 01383 626070 or sts@sserc.org.uk

[3] <http://www.hse.gov.uk/pubns/indg373.pdf>

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Hazards and Control Measures

A) Manual Handling and Workplace Environment

This includes postural problems associated with expectant or new mothers, namely carrying heavy loads, standing or sitting for long periods and excessive bending. Lone working, and working at heights should be avoided.

It is important for floor surfaces to be clear and free of obstacles and to be dry and non-slippery. Because of the effects of hormonal changes on ligaments, expectant mothers are particularly at risk from manual handling injuries and existing risk assessments need to be reviewed. Generally any load carried should be reduced to half of that previously carried.

B) Hazardous Chemicals

Exposure of the expectant or nursing mother to certain chemicals can damage the foetus via the umbilical cord or the newly born through the milk. Many of these chemicals can be identified by having certain R-numbers (generally called risk phrase; this is a misnomer and the term “hazard phrase” would be a more accurate description). R-numbers can be found in the *Hazardous Chemicals* part of *SafetyNet* (on the SSERC website or the SafetyNet 2010 DVD) or in suppliers’ catalogues.

Some of the chemicals concerned are listed in the table below. For a more complete list see *Appendix 1 - Risk phrases & Combination of particular risks*.

R number	R phrase	Examples
R39	Danger of serious irreversible effects	Ethanal, ethanamide.
R40	Limited evidence of carcinogenic effects	Phenylchloromethane, phenylbromomethane, some Cd salts, 1,2-diaminobenzene, dichloromethane, 1,4-dihydroxybenzene, N,N'-dimethylphenylamine, 1,4-dioxane, many epoxy compounds, Fast Green F, furan, iodomethane, lead ethanoate (basic), Methyl Violet, methanal, naphthalene, nickel(II) salts, nitrobenzene, phenolphthalein, phenylamine, Rhodamine, safrole, tetrachloroethene, tetrachloromethane, thermochromic liquid, thiocarbamide, trichloromethane, Universal Indicator.
R45	May cause cancer	Arsenic, arsenic(VI) oxide, benzidine based azo dyes, cadmium salts, Chromium(VI) compounds, 1,2-dibromoethane, 1,2-dibromoethane, several epoxy compounds, hydrazine and salts, phenylchloromethane, phenylhydrazine, potassium bromate(V), thioethanamide.
R46	May cause heritable damage	Several cadmium salts, diethyl sulphate.
R49	May cause cancer by inhalation	Cobalt salts, dichromate(VI) and chromate(VI) salts, chromium(VI) oxide.
R61	May cause harm to an unborn child	Carbon monoxide, cycloheximide, dimethylethanamide, formamide, several lead(II) salts and oxides.
R63	Possible risk of harm to an unborn child	Cadmium sulphide, thiocarbamide, methylbenzene.
R64	May cause harm to breast-fed babies	Some heavily halogenated hydrocarbons are so labelled*
R68	Possible risk of irreversible effects	Cadmium salts, 1,2-diaminobenzene, 1,4-dihydroxybenzene, ethanedial (glyoxal), ethidium bromide, furan, phenolphthalein solution, phenylhydrazine, phenylamine, 1,2,3-trihydroxybenzene (pyrogallol).

* There are many other substances including several heavy metal salts and widely used solvents such as propanone, cyclohexane, butanone (MEK) and hexane which have not been assigned any of the above R numbers and which are likely to cause harm. Exposure to solvents and to heavy metals in general should be avoided since even though they might not have reproductive or teratogenic effects, large exposures to amounts of most substances place an increased burden on the mother’s liver and kidneys.

Some dyestuffs and stains are carcinogenic or mutagenic. Note that most dyes are not carcinogenic. Further advice on carcinogenic risks, particularly of dyes, can be obtained in Topics in Safety (ASE). [4]

The exposures resulting from handling crystalline solids or their aqueous solutions properly are virtually nil. On the other hand dusty solids and fine powders, unless handled very carefully, can produce an aerosol which is readily inhaled. However, once in solution, they are extremely unlikely to be inhaled. Volatile solvents readily produce much vapour which can be inhaled. It is best to avoid use of these materials, but many of them could be safely handled if the quantities are very small and good containment methods used. If another person weighed out and made up the solution the residual risk will be very small. Examples of activities to be avoided are the electrolysis of molten lead(II) bromide, the reduction of lead oxides on a charcoal block and the drying of solvent off paper chromatograms. The smaller scale thin layer chromatography uses much less solvent. An efficient fume cupboard would capture these fumes and vapours.

The use and handling of carcinogens, teratogens, mutagens and cytostatics should be avoided and if that is not reasonably practicable, exposure should be reduced to the minimum by using only small amounts and in dilute solution with good engineering controls.

C) Biological Materials

Risk assessments are carried out for biological materials in exactly the same way as for chemicals. See COSHH Approved Code of Practice (L5). The HSE's Advisory Committee on Dangerous Pathogens classified agents into Hazard Categories [5] 1 to 4 and describes levels of containment needed for each. Hazard Category 1 is described as being "unlikely to cause human disease". Many biological agents in Categories 2, 3 and 4 can affect the foetus if the mother is infected during pregnancy.

None of the organisms used in schools [6] are from the Dangerous Pathogens Hazard Category 2, 3 or 4. Those used in schools are not considered to be infectious to humans. In any case the control measures taken and the good laboratory practice [7] used will reduce the risks of infection to a minimum. There is a bigger risk of being infected from the community outside the laboratory. Field trips on farms at lambing time must be avoided as there is the possibility of picking up *Chlamydia psittaci* which can cause abortions.

D) Ionising Radiation

It is permissible to use the standard school sealed sources, or carry out the demonstrations of half-life using either the Cs-137/Ba-137m isotope generator or the Cooknell ionisation chamber with a thoron generator. The dose received by anyone carrying out the procedures laid down in the guidance on radioactivity will be many orders of magnitude below that recommended by Health Protection Agency (HPA, successors to the NRPB) and well below that for pregnant women and nursing mothers. [8]

Open sources including geological specimens and artefacts with radioluminescent paint, e.g. clocks and watches, and uranium and thorium salts should not be used as there is a small possibility on inhaling some of the dust.

See Appendix 2 - Radioactive Materials for further details.

E) Display Screen Equipment

Computer monitors and TVs emit negligible radiation that is harmful. The main risk to health is from musculoskeletal disorders which generally result from poor posture and sitting too long. It is important to ensure the work station is well adjusted and also to take frequent breaks.

See Appendix 3 - Using Computers Safely for more details.

[4] Topics in Safety, chapter 12, 3rd edition, ASE 2001 ISBN 0 86357 316 9

[5] Control of Substances Hazardous to Health (COSHH) ACOP (5th edition) Schedule 3

[6] Materials of living Origin http://www.sserc.org.uk/members/SafetyNet/Biology/MOLO/Main_Menu.HTM

[7] http://www.sserc.org.uk/members/SafetyNet/Microbio2/Main_Menu.HTM

[8] http://www.sserc.org.uk/members/SafetyNet/Radioactivity/Seal_source_risk_assessments_Amersham.doc

[9] http://www.sserc.org.uk/members/SafetyNet/Display_Screen_Safety/START.HTM






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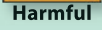




Appendix 1 - Risk phrases and Combination of particular risks

Number	Risk phrases
1	Explosive when dry
2	Risk of explosion by shock, friction, fire or other sources of ignition
3	Extreme risk of explosion by shock, friction, fire or other sources of ignition
4	Forms very sensitive explosive metallic compounds
5	Heating may cause an explosion
6	Explosive with or without contact with air
7	May cause fire
8	Contact with combustible material may cause fire
9	Explosive when mixed with combustible material
10	Flammable
11	Highly flammable
12	Extremely flammable
14	Reacts violently with water
15	Contact with water liberates extremely flammable gasses
16	Explosive when mixed with oxidising substances
17	Spontaneously flammable in air
18	In use may form flammable/ explosive vapour-air mixture
19	May form explosive peroxides
20	Harmful by inhalation
21	Harmful in contact with skin
22	Harmful if swallowed
23	Toxic by inhalation
24	Toxic in contact with skin
25	Toxic if swallowed
26	Very toxic by inhalation
27	Very toxic in contact with skin
28	Very toxic if swallowed
29	Contact with water liberates toxic gas
30	Can become highly flammable in use
31	Contact with acids liberates toxic gas
32	Contact with acids liberates very toxic gas
33	Danger of cumulative effects
34	Causes burns

Number	Risk phrases
35	Causes severe burns
36	Irritating to the eyes
37	Irritating to the respiratory system
38	Irritating to the skin
39	Danger of very serious irreversible effects
40	Limited evidence of carcinogenic effect
41	Risk of serious damage to eyes
42	May cause sensitisation by inhalation
43	May cause sensitisation by skin contact
44	Risk of explosion if heated under confinement
45	May cause cancer
46	May cause heritable genetic damage
48	Danger of serious damage to health by prolonged exposure
49	May cause cancer by inhalation
50	Very toxic to aquatic organisms
51	Toxic to aquatic organisms
52	Harmful to aquatic organisms
53	May cause long term adverse effects in the aquatic environment
54	Toxic to flora
55	Toxic to fauna
56	Toxic to soil organisms
57	Toxic to bees
58	May cause long term adverse effects in the environment
59	Dangerous for the ozone layer
60	May impair fertility
61	May cause harm to the unborn child
62	Possible risk of impaired fertility
63	Possible risk of harm to the unborn child
64	May cause harm to breastfed babies
65	Harmful: may cause lung damage if swallowed
66	Repeated exposure may cause skin dryness or cracking
67	Vapours may cause drowsiness or dizziness
68	Possible risk of irreversible effects

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Numbers	Combination of particular risk - very toxic...	 Very Toxic
26/27 26/27/28 26/28 27/28 50/53	by inhalation and in contact with skin by inhalation, in contact with skin and if swallowed by inhalation and if swallowed in contact with skin and if swallowed to aquatic organisms and may cause long-term adverse effects in the aquatic environment	
Numbers	Combination of particular risk - very toxic: danger of very serious irreversible effects...	 Very Toxic
39/26 39/26/27 39/26/27/28 39/26/28 39/27 39/27/28 39/28	through inhalation through inhalation and in contact with skin through inhalation, in contact with skin and if swallowed through inhalation and if swallowed in contact with skin in contact with skin and if swallowed if swallowed	
Numbers	Combination of particular risk - toxic...	 Toxic
23/25 24/25 23/24 23/24/25 51/53	by inhalation and if swallowed in contact with skin and if swallowed by inhalation and in contact with skin by inhalation, in contact with skin, and if swallowed to aquatic organisms, may cause long-term adverse effects in the aquatic environment	
Numbers	Combination of particular risk - toxic: danger of very serious irreversible effects...	 Toxic
39/23 39/23/24 39/23/24/25 39/23/25 39/24 39/24/25 39/25	through inhalation through inhalation and in contact with skin through inhalation, in contact with skin and if swallowed through inhalation and if swallowed in contact with skin in contact with skin and if swallowed if swallowed	
Numbers	Combination of particular risk - toxic: danger of serious damage to health by prolonged exposure...	 Toxic
48/23 48/23/24 48/23/24/25 48/23/25 48/24 48/24/25 48/25 48/23	through inhalation through inhalation and in contact with skin through inhalation, in contact with skin and if swallowed through inhalation and if swallowed in contact with skin in contact with skin and if swallowed if swallowed through inhalation	

Numbers	Combination of particular risk - harmful: possible risk of irreversible effects...	
68/20	through inhalation	 Harmful
68/20/21	through inhalation and in contact with skin	
68/20/21/22	through inhalation, in contact with skin and if swallowed	
68/20/22	through inhalation and if swallowed	
68/21	in contact with skin	
68/21/22	in contact with skin and if swallowed	
68/22	if swallowed	
Numbers	Combination of particular risk - harmful: danger of serious damage to health by prolonged exposure...	
48/20	through inhalation	 Harmful
48/20/21	through inhalation and in contact with skin	
48/20/21/22	through inhalation, in contact with skin and if swallowed	
48/20/22	through inhalation and if swallowed	
48/21	in contact with skin	
48/21/22	in contact with skin and if swallowed	
48/22	if swallowed	
Numbers	Combination of particular risk - harmful...	
20/21	by inhalation and in contact with skin	 Harmful
20/21/22	by inhalation, in contact with skin and if swallowed	
20/22	by inhalation and if swallowed	
21/22	in contact with skin and if swallowed	
52/53	to aquatic organisms, may cause long-term adverse effects	
Numbers	Combination of particular risk - irritating to...	
36/37	eyes and respiratory system	 Irritant
36/37/38	eyes, respiratory system and skin	
36/38	eyes and skin	
37/38	respiratory system and skin	
Numbers	Combination of particular risk - extremely flammable...	
14/15	reacts violently with water, liberating Extremely Flammable gases	
15/29	contact with water liberates toxic, Extremely Flammable gas	
42/43	may cause sensitisation by inhalation and by skin contact	

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Appendix 2 - Radioactive Materials

This guidance is based on the requirements of the Ionising Radiations Regulations 1999 (IRR99), which takes on board up-to-date international guidance and EU directives together with recent changes to the Management of Health and Safety at Work Regulations (MHSWR) under The Health and Safety at Work Act 1974.

Relevant parts of IRR99 all fall within Regulation 8 (Restriction of exposure):

- 8(1) Every radiation employer shall, in relation to any work with ionising radiation that he undertakes, take all necessary steps to restrict so far as is reasonably practicable the extent to which his employees and other persons are exposed to ionising radiation.
- 8(5) Without prejudice to paragraph (1), a radiation employer shall ensure that -
- a) in relation to an employee who is pregnant, the conditions of exposure are such that, after her employer has been notified of the pregnancy, the equivalent dose to the foetus is unlikely to exceed 1 mSv during the remainder of the pregnancy; and
 - b) in relation to an employee who is breast-feeding, the conditions of exposure are restricted so as to prevent significant bodily contamination of that employee.

The HSE has published guidance for expectant or breastfeeding mothers [10]

Commenting on Regulation 8 (5) (a) in IRR99, the dose limit permitted for the foetus is 1 mSv from exposure from work activity. It is inconceivable that an expectant-mother might get a dose of around 1 mSv from a series of normal school demonstrations with radioactive sources, recalling that the typical dose to the demonstrator from working with beta or gamma sources is 100 nSv, which is 10^4 below the proposed limit. Recalling also that the average annual dose to UK residents from natural background radiation is 2.2 mSv, the dose to the expectant-mother from laboratory demonstrations is negligible.

Regulation 8 (5) (b) in IRR99 requires a little more discussion. To comply with this regulation, the expectant mother should take care that she does not work with an open source of a type that could present her with a significant risk. Most types of school sources are sealed rather than open, which is to say that because of their construction they are normally incapable of causing contamination. Thus in the normal course of events there is no chance of either the ingestion or inhalation of radioactive substances when working with sealed sources.

Regulation 8 (5) (b) does not ban open source work. The regulation is proportionate in its wording. Open-source work is permissible provided that the risks are insignificant.

Examples of such work where the risks are insignificant are the two new half-life sources, the Cs-137/Ba-137m Isotope Generator and the Cooknell ionisation chamber with thoron generator. In the event of a spillage of the eluate (the radioactive liquor extracted from the Isotope Generator), the worst-case dose that can result is of the order of a few hundred nanosieverts [10].



Interpreting 8 (5) (b) for work activities to which you may be exposed, the following is recommended:

- 1) Normal demonstrations with sealed sources are permissible.
- 2) Leak testing sealed sources is permissible, unless you have reason to expect that a source is leaking, such as knowing that it had suffered a violent impact.



- 3) The half-life demonstration [11] with a Cs-137/Ba-137m Isotope Generator is permissible even although this source is an open source. The risk of harm that could result from the spillage of the eluate is trivial. Personal protective equipment to be worn during this demonstration are gloves and labcoat.

Prior risk assessment: Use of the Isotrak Cs-137/Ba-137m Isotope Generator in half-life experiments, SSERC, 2003.

- 4) The half-life demonstration with a Cooknell ionisation chamber with thoron generator is permissible because the risk of harm is trivial.

- 5) Geological specimens should not be worked with because of the very remote chance that dust might be inhaled or fragments ingested. Unlike the Isotope Generator, the risk is unquantifiable. It is possible (although improbable) that highly active fragments might be released from the lumps of rock.

- 6) No other open sources should be worked with. These include clocks, watches or dials with radioluminescent paint, and uranium or thorium compounds. (Open sources of the kind listed should have been disposed of from every school during 2007).

- 7) Other sources of useful guidance are given below:

Working safely with ionizing radiation. Guidelines for expectant or breastfeeding mothers: INDG334 HSE Books, 2001. [12]

[10] http://www.sserc.org.uk/members/SafetyNet/Radioactivity/Main_Menu.htm

[11] http://www.sserc.org.uk/members/SafetyNet/bulls/218/Half_life_demos.htm

[12] <http://www.hse.gov.uk/pubns/indg334.pdf> and <http://www.sserc.org.uk/members/SafetyNet/Radioactivity>

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Appendix 3 - Using Computers Safely

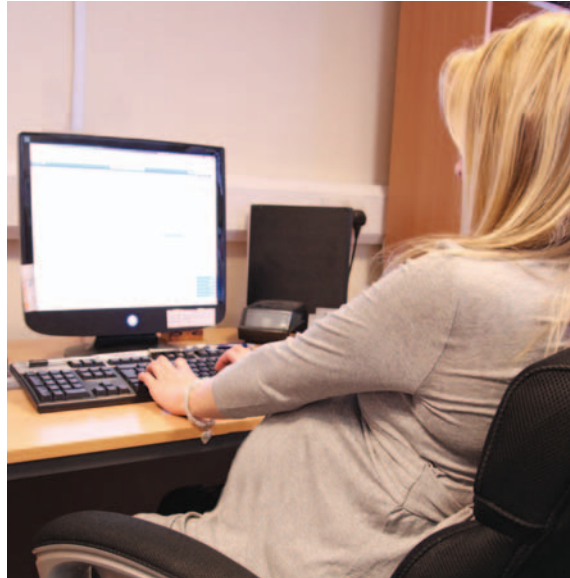
Guidance on setting up workstations and on how to prevent computer-related injuries

What are the big causes of injury?

- Habitual bad posture and technique.
- Working for long periods of time without a break.
- Working too often.

Main causes of bad posture

- Sitting at the wrong height.
- Slouching; not maintaining the proper curvature of the spine.
- Twisting the back or neck.
- Muscles in shoulder, arm, wrist, hand or neck under continuous strain, not in a neutral posture.
- Stretching the arm.
- Bending the wrist.
- Much use of the mouse.
- Looking upwards at a screen.
- Bending the trunk or neck when the screen display is too near or too far away.
- Craning the neck when the screen display detail is difficult to see.
- Twisting the head, neck or trunk to look at documents.



Recommendations

- Each workstation should be risk assessed and supervised.
- Individuals should be trained in how to set up workstations.
- Individuals should learn to be responsible for their own safety and that of others.

WATCH OUT FOR BAD HABITS	
Bad practice	Remedies
Extending the upper arm to use the keyboard Twisting the torso to use the keyboard	<ul style="list-style-type: none"> • Sit directly in front of and near to keyboard.
Twisting the neck to view the screen Twisting the torso to view the screen	<ul style="list-style-type: none"> • Sit directly in front of the screen.
Elbow not at keyboard height	<ul style="list-style-type: none"> • Adjust the seat height.
Elbow extended/not making contact with trunk	<ul style="list-style-type: none"> • The elbow should sit below the shoulder, tucked into the side of the trunk. Adjust the seat height so that the elbows are level with the keyboard.
Slouched back or hunched forward	<ul style="list-style-type: none"> • Sit upright in seat, or tilt the spine back by no more than 5° allowing the small of the back to be supported by the back rest of the chair. Try to maintain the curvature of the spine. Let the backrest take some of your weight.
Head bent upwards	<ul style="list-style-type: none"> • Lower the display screen so that the top of the display screen lies just below the level of your eyes.
Twisting the neck to read off a paper document	<ul style="list-style-type: none"> • Use a document holder positioned next to the screen.
Looking at the keyboard to find the keys	<ul style="list-style-type: none"> • Learn to touch type.
Extending the arm to use the mouse	<ul style="list-style-type: none"> • Position the mouse close to the side of the keyboard and at the front of the desk. • Use keyboard short-cuts instead of mousing.
Peering into the screen	<ul style="list-style-type: none"> • Swivel or tilt the screen to remove glare. • Close a blind to block out the sun or sky. • Clean the screen. • Magnify the image. • Use a larger font size. • Adjust the screen brightness or contrast. • If problems persist, get an eyesight test.
Working without a break	<ul style="list-style-type: none"> • Take a break of at least 10 minutes every hour. • Take some exercise. • Gaze outdoors, focusing on something distant.
Continual heavy use	<ul style="list-style-type: none"> • Change your lifestyle.



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