2018

New and expectant mothers

in school science departments

Contents

1 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 on the SSERC website[1] 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].

[1] https://www.sserc.org.uk

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

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

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.

2 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 umbilical cord or the newly born through the milk. Many of these chemicals can be identified by having certain H-numbers (Hazard Statements). H-numbers for chemicals can be found in the Hazardous Chemicals Database part of the SSERC website, in suppliers' catalogues or on the chemicals' containers

Some of the chemicals concerned are listed in the table below. For a more complete list see **Appendix 1 : Substances of particular concern to New and Expectant Mothers.**

Health Hazards (listed in the table below) are classified in Categories. Categories 1A, 1B and 2 are generally determined by the standard of evidence. By and large, for 1A there is evidence from human epidemiological studies, 1B from animal or cell culture studies and 2 could be from either but the evidence is less clear cut.

The H numbers in bold refer to the more serious category 1

Hazard Number	Hazard Class	Hazard	Comments
H340, H341	Mutagens	May cause genetic defects	Evidence from heritable germ cell mutations from human studies
H350, H351	Carcinogens	May cause cancer	An 'I' postscript means the effect is via inhalation only.
H360, H361, H362	Reproductive Toxins	Known human reproductive toxin	A 'D' postscript means it affects foetal development. An 'f' postscript means it affects fertility. H362 refers to toxicity via lactation
H370, H371, H372, **H373**	Specific Target Organ Toxins	May cause damage to organs	H370 and 371 refer to organ damage due to a single exposure to a substance, while H372 and 373 to damage done my repeated or prolonged exposure.
H300, H301 **H310**, H311 **H330**, H331	Acute toxins, Categories 1, 2 & 3.		Acute toxins (by ingestion, inhalation or skin contact) do not cause long-term damage. As long as the effect is sub-lethal the victim will recover.

Acute toxins and Specific Target Organ Toxins do not specifically affect the unborn child but any chemical that gets into the bloodstream and can cause distant or systemic effects has the potential to cross the placental barrier and affect the embryo/ foetus.

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 fi ne 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

A list of chemicals of concern can be found in Appendix A but common substances to be wary of while pregnant would include:

- Amines and amides (especially aromatic ones)
- Azo dyes (eg crystal violet)
- Benzene diols and triols
- Boron compounds (eg borax)
- Bromates
- Carbon monoxide
- Chlorinated hydrocarbons
- Cobalt compounds
- Methanal (formaldehyde)
- Phenols and nitrophenols
- Hexane
- Lead and compounds
- Mercury and compounds
- Methanal
- Petroleum ethers
- Phenolphthalein

Where the list above includes a group, not all members of that group are problematic (for instance only benzene-I ,4-diol of the diols is carcinogenic) but further information should be sought.

[4] Topics in Safety, Topic 12, 3rd edition, ASE 20017 (see p21)

[5] Control of Substances Hazardous to Health (COSHH) ACOP (6th edition) Schedule 3 http://www.hse.gov.uk/pubns/indg136.pdf

C) Biological Materials

Risk assessments are carried out for biological materials in exactly the same way as for chemicals. Microorganisms recommended for practical work in schools belong to a hazard category described as 'being unlikely to cause human disease [6]. In addition the control measures and good practice in the SSERC Code of Practice Safety in Microbiology [7] will reduce the chances of infection to a minimum. In a similar way the SSERC Code of Practice Materials of Living Origin [8] describes control measures and good practice when working with plants, animals and materials derived from them. By following these Codes of Practice there is no additional risk to an expectant mother and her child or to a new mother and her baby.

There is a low risk of infections that could harm the health of expectant mothers and their babies outside the laboratory. To avoid the small risk of toxoplasmosis, expectant mothers should avoid cat litter or wear disposable rubber gloves when emptying cat litter trays and empty them every day washing your hands thoroughly afterwards. Wash your hands thoroughly after handling cats and avoid sick cats [9]. To avoid the small risk of chlamydiosis, expectant mothers should avoid close contact with sheep during the lambing season [10]. Care should be exercised when handling soil that may have been in contact with cat faeces and when embarking on farm visits [11].

D) Ionising Radiation

It is permissible to use the standard school sealed sources, or to carry out the demonstrations of half-life using either the Cs-137/Ba-137m isotope generator, protactinium generator or the Cooknell ionisation chamber with a thoron generator.

The dose received by anyone carrying out the procedures laid down in SSERC's guidance on radioactivity* will be well below the dose limits specified in the Ionising Radiation Regulations for pregnant women and nursing mothers. It would be necessary to carry out several thousand standard experiments to come anywhere near to these limits.

Geological specimens should not be used as there is a small possibility of inhaling dust or ingesting a radioactive fragment.

See **Appendix 2—Radioactive Materials** for more detailed guidance

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

[6] Biological agents: Managing the risks in laboratories and healthcare premises, Advisory Committee on Dangerous Pathogens http://www.hse.gov.uk/biosafety/biologagents.pdf
[7] Safety in Microbiology: A code of practice for Scottish schools and colleges, https://www.sserc.org.uk/wp-content/uploads/2018/06/SSERC-Safety_in_Microbiology_Code_of_Practice.pdf
[8] Materials of Living Origin – Educational Uses: A code of practice for Scottish schools and colleges, SSERC http://www.sserc.org.uk/images/Publications/Biology/SSERC-Materials_of_Living_Origin_Code_of_Practice.pdf
[9] What are the risks of toxoplasmosis during pregnancy? NHS Choices, https://www.nhs.uk/chq/pages/1107.aspx?CategoryID=54
[10] Why should pregnant women avoid sheep during the lambing season? NHS Choices, https://www.nhs.uk/chq/Pages/934.aspx?CategoryID=54&SubCategoryID=131
[11] Visit my Farm: Industry Code of Practice http://www.visitmyfarm.org/component/k2/339-industry-code-of-practice

3 Appendix 1: Substances of particular concern for New and Expectant Mothers

	Name	Mutagen	Carcinogen	Reproductive Toxin	Specific Target Organ Toxin
	Acridine orange	1A			
	Algal mountant[4]	2			
	Amann's medium[4]	2			
4-	Aminophenol	2			
	Ammonium dichromate[1]	1A	1B	1B	RE1
	Ammonium metavanadate	2			
	Aniline blue		2		
	Aniline blue lactophenol[4]		2		
	Aniline blue sulphate		2		
	Arsenic compounds (B)		1A		
	Azo dyes		*		
	Barium chromate[1]		1B		
	Benzene (B)	1B	1A		
	Benzene-1,2,3-triol	2			
	Benzene-1,2-diamine	2	2		
	Benzene-1,3,5-triol	2		2	
	Benzene-1,3-diamine	2			
	Benzene-1,4-diol	2	2		
	Benzidine (B)		1A		
	Beryllium & compounds		1B		RE1
	Bis(4-isocyanatophenyl)methane		2		RE2
	Boric acid (above 5.5%)			1B	
	Bouin's fixative[2] (NR)	2	1B		
	Bromates (K, Na)		1B		
	Bromoethane		2		
	Cadmium and compounds	2	1B	1B	RE1
	Cajal's fixative[2]	2	1B		
	Carbon disulphide (B)			2	RE1
	Carbon monoxide			1A	RE1
	Carnoy's fluid[2] NR	2	1B		

	Name	Mutagen	Carcinogen	Reproductive Toxin	Specific Target Organ Toxin
	Direct brown 95		1B		
L-	Dopa (L-3,4-dihydroxyphenylalanine)			2	
	DPX mountant			1B	RE2
	Ethanal[2]		2		
	Ethanamide		2		
	Ethidium bromide (B)				
2-	Ethoxyethanol (Cellosolve, Ethex)			1B	
	Ethyl ureate (carbamate) (NR)		1B		
	Fast green	2	2		
	Flemming's fluid[1] (NR)		1A		
	Fuchsin (basic)		1B		
	Fuchsine, new		2		
	Gatenby's fluid[1] (NR)		1A		
	Gilson's fixative[3]	2		2	RE2
	Green algae preservative [2] (NR)		2		
n-	Hexane			2	RE2
	Hydroxylamine (hydrochloride and sulphate)			2	RE2
	Jefferey's macerating fluid[1] (NR)		1B		
	Kaiserling's preservative[2]	2	1B		
	Kinetin	2			
	La Cour's fixatives[2] (NR)				
	Lactofuchsin		1B		
	Lactophenol[4]	2			
	Lead chromate[1]		1B	1A	RE2
	Lead metal & compounds			1A	RE2

	Name	Mutagen	Carcinogen	Reproductive Toxin	Specific Target Organ Toxin
	Lithium carbonate			1B	RE1
	Lithium fluoride			1A	
	Lithium hydroxide			1A	
	Mercury				RE1
	Mercury II chloride	2		2	RE2
	Mercury - other compounds			2	RE2
	Merkel's Fluid[1]		1B		
	Methanal[2]	2	1B		
	Methanol				SE1
2-	Methoxyethanol			1B	
	Methyl yellow				RE2
	Methylated spirits				RE2
	Methylbenzene				RE2
	Millon's reagent[3] (NR)				RE2
	Mineral wool		2		
	Manganese ethanoate & nitrate				RE2
	Molybdenum			2	
	Molybdenum trioxide		2		
	Murexide (ammonium purpurate)	2			
	Naphthalene		2i		
	Nashavin's fluid[123] (NR)				
	Nessler's reagent[3] (NR)				RE2
	Nickel compounds	2	1A	1B	RE1
	Nitrobenzene		2	2	
4-	Nitrophenol				RE2
	Pampel's fluid[2]	2	1B		
	Pararosaniline		1B		
	Petroleum ethers	1B	1B		

	Name	Mutagen	Carcinogen	Reproductive Toxin	Specific Target Organ Toxin
	Phenol[4]	1B			RE2
	Phenolphthalein (>1%)	2	2		RE2
	Phenylamine	2	2		RE2
	Phenylammonium chloride	2	2		SE1
	Phenylhydrazine	2	1B		RE1
	Phosphorus trichloride / pentachloride				RE2
	Potassium chromate[1]	1B	1B		
	Prop-2-enamide (NR)	1B	1B	2	RE1
	Quinoline	2	1B		
	Refactory ceramic fibre		1B		
	Rossman's fluid[2]	2	1B		
	Schaudin's fixative[3]	2		2	RE2
	Selenium				RE2
	Smith's fixative[12] (NR)	2	1B		
	Sodium & potassium dichromate[1]	1B	1B	1B	RE1
	Sodium chromate[1]	1B	1B		
	Sodium hexanitricobaltate		C		
	Sodium tetraborate (above 8.5%)			1B	
	Sudan Black	2			
	Sudan Red G		1B		
	Sudan I	2	2		
	Sudan IV		2		
	Susa fixative[23] (NR)	2	1B	2	RE2
	Tetrachloroethene		2		
	Tetrahydrofuran		2		
	Thiocarbamide (Thiourea)		2	2	
	Thiourea		2	2	

	Name	Mutagen	Carcinogen	Reproductive Toxin	Specific Target Organ Toxin
	Thyroxine			2	
	Trichloroethene	2	1B		
	Trichloromethane		2		RE2
	Trioxygen	2			RE2
	Vanadium pentoxide	2		2	RE1
	Zinc chromate[1]		1A		
	Zirkle's fluid[1]	1B	1B		

[1] Contain chromium VI

[2] Contain methanal

[3] Contain mercury compounds

[4] Contain phenol

4 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 etc. 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 -

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 in relation to an employee who is breastfeeding, 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 [12]

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 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. Opensource 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 [13].

[12] http://www.hse.gov.uk/pubns/indg373.pdf

[13] https://www.sserc.org.uk/health-safety/physics-health-safety/ionising-radiation/

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 [14] 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. Cs137/ 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.

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

7) Other sources of useful guidance are given below:

Working safely with ionizing radiation. Guidelines for expectant or breastfeeding mothers: INDG334 HSE Books, 2001. [15]

[14] https://www.sserc.org.uk/wp-content/uploads/2018/11/half_life_demonstrations.pdf

[15] http://www.hse.gov.uk/pubns/indg334.pdf.

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Appendix 3: Using Computers Safely

Guidance on setting up computer workstations and on how to prevent computer-related injuries they can cause, particularly lower back pain.

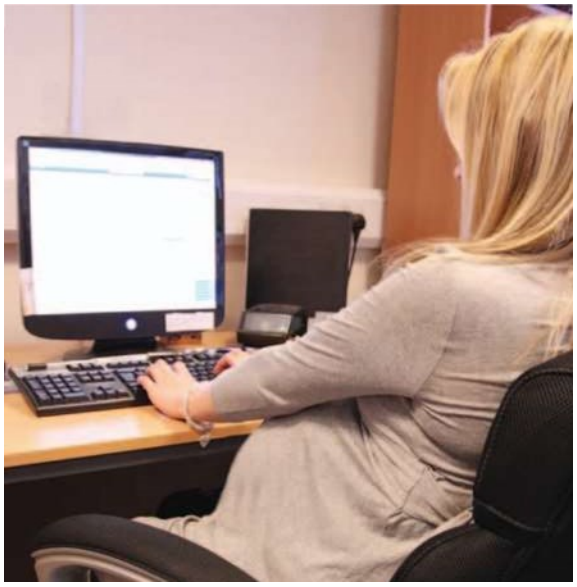
What are the big causes of injury?

- 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.

Further information can be found on the SSERC website— https://www.sserc.org.uk/health-safety/other-legislation-guidance/

Watch Out for Bad habits	
Bad Practice	**Remedies**
Extending the upper arm to use the keyboard **Twisting the torso to use the keyboard**	Sit directly in front of and near to keyboard
Twisting the neck to view the screen **Twisting the torso to view the screen**	Sit directly in front of the screen
Elbow not at keyboard height	Adjust the seat height.
Elbow extended/not making contact with trunk	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	Sit upright in seat, or tilt the spine back by no more than 5 0 allowing the small of he 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	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	Use a document holder positioned next to the screen.
Looking at the keyboard to find the keys	Learn to touch type
Extending the arm to use the mouse	Position the mouse close to the side of the keyboard and at the front of the desk. Use keyboard short-cuts instead of using the mouse.
Peering into the screen	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	Take a break of at least 10 minutes every hour. Take some exercise. Gaze outdoors, focusing on something distant.
Continual heavy use	Discuss options with your employer.

Sources of Information

HSE

New and Expectant Mothers at Work - a guide for health professionals: http://www.hse.gov.uk/pubns/indg373.pdf

Control of Substances Hazardous to Health (COSHH) http://www.hse.gov.uk/pubns/indg136.pdf

Biological agents: Managing the risks in laboratories and healthcare premises, Advisory Committee on Dangerous Pathogens http://www.hse.gov.uk/biosafety/biologagents.pdf

Working safely with Ionising Radiation - http://www.hse.gov.uk/pubns/indg334.pdf.

SSERC

Safety in Microbiology: A code of practice for Scottish schools and colleges, https://www.sserc.org.uk/wp-content/uploads/2018/06/SSERC-Safety_in_Microbiology_Code_of_Practice.pdf

Materials of Living Origin – Educational Uses: A code of practice for Scottish schools and colleges, SSERC http://www.sserc.org.uk/images/Publications/Biology/SSERC-Materials_of_Living_Origin_Code_of_Practice.pdf

Chemical Health Hazards - https://www.sserc.org.uk/health-safety/chemistry-health-safety/chemistry-hs-background/health-hazards/

Ionising Radiation - https://www.sserc.org.uk/health-safety/physics-health-safety/ionising-radiation/

Display Screen Equipment - https://www.sserc.org.uk/health-safety/other-legislation-guidance/

ASE

Topics in Safety, Topic 12 - Carcinogens, 3rd edition, ASE 2017 (*The 3rd edition is now no longer available from the ASE bookshop. The 4th edition has been produced as a series of separate PDF documents that can be downloaded free by ASE members. As yet no arrangement has been made for non-member access*).

NHS

What are the risks of toxoplasmosis during pregnancy? NHS Choices, https://www.nhs.uk/chq/pages/1107.aspx?CategoryID=54

Why should pregnant women avoid sheep during the lambing season? NHS Choices, https://www.nhs.uk/chq/Pages/934.aspx?CategoryID=54&SubCategoryID=131

Other

Visit my Farm: Industry Code of Practice http://www.visitmyfarm.org/component/k2/339-industry-code-of-practice

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