

SAFETY IN SCHOOL SCIENCE POLICY AND PROTOCOL IN THE WESTERN CAPE

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1. INTRODUCTION

The Western Cape Education Department (WCED) is responsible for ensuring that sound science teaching and learning can be achieved in public schools without compromising its commitment to a clean environment and the safety of its learners, educators and schools. The WCED recognises that school laboratories are potentially dangerous zones and that the storage and use of chemicals need to be strictly controlled. It is also aware that the misuse of chemicals stored in schools can endanger learners and the public.

The purpose of this Safety in School Science Policy and Protocol is to provide guidelines to public schools on laboratory safety. All public schools are thus obliged to take the necessary steps described in this policy to ensure safety in laboratories and to prevent the misuse of chemicals.

2. LEGAL FRAMEWORK

- 2.1 National Education Policy Act, 1996 (Act 27 of 1996)
- 2.2 South African Schools Act, 1996 (Act 84 of 1996)
- 2.3 Western Cape Provincial School Education Act, 1997 (Act 12 of 1997)
- 2.4 Curriculum and Assessment Policy Statement, 2011, (Government Gazette 34600 of 2011)
- 2.5 Occupational Health and Safety Act, 1993 (Act 85 of 1993)
- 2.6 National Environmental Management Act, 1998 (Act 107 of 1998)
- 2.7 National Environmental Waste Act, 2008 (Act 59 of 2008)

3. SAFETY FRAMEWORK

The School Science Safety Policy and Protocol framework provides that –

- 3.1 education district directors are responsible for monitoring the implementation of this policy and protocol and for the removal of chemical waste from each school;
- 3.2 school principals are responsible for implementing the policy and protocol;
- 3.3 each school appoints a school science safety officer from its staff;
- 3.4 each district director appoints an external science safety monitor to monitor safety practices in school science;

- 3.5 schools are supplied with the a Safety in School Science Laboratory Manual that is an integral part of the policy and protocol; and
- 3.6 schools must comply with the manual at all times; and the manual containing, amongst others:
- 3.6.1 the functions and responsibilities of the principal, school science safety officer, external science safety monitor, science educators and learners;
- 3.6.2 examples of hazardous chemicals and reactions;
- 3.6.3 restrictions on the use of hazardous chemicals and the creation of hazardous chemical reactions, and the use of makeshift apparatus;
- 3.6.4 instructions on ways in which chemicals should be stored; and
- 3.6.5 ways in which chemical waste can be rendered harmless and the procedure for the disposal of such chemicals.

4. APPOINTMENT OF SCHOOL SCIENCE SAFETY OFFICER

- 4.1 The principal of the school must appoint, in writing, the most experienced science educator as the responsible school science safety officer.
- 4.2 No school may conduct experiments or any tasks requiring the use of chemicals and science equipment without the appointment of a school science safety officer.
- 4.3 In the absence of an appointed school science safety officer, there must be an acting school science safety officer.

5. SAFETY IN SCHOOL SCIENCE LABORATORIES

5.1 Functions of the school science safety officer

The functions of the school science safety officer in a school are to -

- 5.1.1 develop a school policy on safety in science, in alignment with this policy and protocol and the manual;
- 5.1.2 store chemical waste in appropriate labelled containers in an appropriately demarcated area at the school where it will not be hazardous;
- 5.1.3 dispose of certain chemicals in accordance with the procedure set out in the manual;

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- 5.1.4 draw up a timetable for the use of the laboratory by educators and learners;
- 5.1.5 issue restricted chemicals and other chemicals to educators and keep a record of such chemicals;
- 5.1.6 ensure that chemicals are used, stored and arranged in the manner prescribed in the manual, which ensures safety;
- 5.1.7 conduct training and development of the school's science educators on matters relating to science safety;
- 5.1.8 ensure that the science laboratory is used, managed and kept in a condition that ensures safety, and inspect it weekly;
- 5.1.9 report immediately to the principal any matters which are hazardous or which may lead to a hazard;
- 5.1.10 keep an inventory of all restricted chemicals by name and quantity and update this quarterly;
- 5.1.11 ensure that safety signs are displayed in the laboratory and that hazardous chemicals are labelled;
- 5.1.12 order the chemicals that are required for science teaching; and
- 5.1.13 formulate the code of conduct required of science learners and educators to ensure safety.

5.2 Duties and responsibilities of the educators using the laboratory and chemicals

The duties and responsibilities of educators using the laboratory and chemicals are, amongst others, the following:

- 5.2.1 Co-operate with the school science safety officer.
- 5.2.2 Know and apply this policy and protocol, together with the manual.
- 5.2.3 Ensure that learners using the laboratory follow appropriate codes of conduct that ensure safety.
- 5.2.4 Ensure that learners are not left in the laboratory without supervision.
- 5.2.5 Turn off the gas supply at the end of a lesson.
- 5.2.6 Lock all chemicals away and ensure that there are no chemicals left lying around in the laboratory.
- 5.2.7 Lock the laboratory door during school breaks and when it is not in use.
- 5.2.8 Keep hazardous chemicals locked away when they are not in use.

- 5.2.9 Instruct learners about the dangers involved and the precautions that must be taken before they handle hazardous chemicals and/or create hazardous chemical reactions.
- 5.2.10 Ensure that learners do not perform those reactions which, according to the Curriculum and Assessment Policy Statement (CAPS), must be demonstrated by the educator.
- 5.2.11 Ensure that chemicals are not taken out of the laboratory without the approval of the school science safety officer.
- 5.2.12 Use chemicals only for the purposes prescribed in the CAPS.
- 5.2.13 Use only those chemicals approved by the school science safety officer.
- 5.2.14 Return chemicals, after use, to their correct storage positions in the storeroom.
- 5.2.15 Handle hazardous chemicals and hazardous chemical reactions safely.
- 5.2.16 Report any hazardous or potentially hazardous matters to the school science safety officer.
- 5.2.17 Allow learners to smell, taste and touch chemicals only under supervision.
- 5.2.18 Ensure that the science laboratory is used, managed and kept in a condition that ensures safety, and inspect it daily.

5.3 Responsibilities of learners using the science laboratory

In order for the school science safety officer to execute his or her functions, cooperation from learners is essential. The duties and responsibilities of learners using the science laboratory are as follows:

Learners must –

- 5.3.1 know and adhere to the policy and protocol, and to the manual;
- 5.3.2 co-operate with the educator on duty and with the school science safety officer to ensure safety at all times; and
- 5.3.3 conform to the code of conduct laid down by the school science safety officer.

6. NOMINATION OF EXTERNAL SCIENCE SAFETY MONITOR

- 6.1 Each district director must appoint, in writing, the district official most experienced in the teaching of science as the external science safety monitor.
- 6.2 In the absence of an appointed external science safety monitor, there must be an acting external science safety monitor.

6.3 No school may conduct experiments or any tasks requiring the use of chemicals and equipment without the appointment of an external science safety monitor.

7. FUNCTIONS OF THE EXTERNAL SCIENCE SAFETY MONITOR

The external science safety monitor must -

- 7.1 ensure that each school offering science in the district is practising safety in accordance with this policy and protocol and the manual, before their laboratories can be declared safe;
- 7.2 report regularly to the district director concerned, via the Head: Curriculum Coordination and Advice, on the status of science laboratory safety in the district's schools; and
- 7.3 train school science safety officers in safety matters.

8. RESTRICTED CHEMICALS

- 8.1 A list of hazardous chemicals supplied to schools appears in **Appendix A**.
- 8.2 The use of these chemicals is restricted, as prescribed in the CAPS.
- 8.3 When restricted chemicals are used, additional precautions must be taken to ensure safety.
- 8.4 Unless otherwise stated in the CAPS, learners must not personally handle restricted chemicals and only educators may demonstrate them and their reactions to learners.
- 8.5 Educators wanting to use restricted chemicals, must inform the school science safety officer in advance, who will issue such chemicals.
- 8.6 The process referred to in 8.5 must be well planned so that it does not impede on teaching and learning.
- 8.7 All hazardous chemicals must have visible labels and appropriate warning symbols.

9. RESTRICTIONS ON DEMONSTRATIONS OF CHEMICAL REACTIONS

- 9.1 A list of chemicals which are supplied to schools and which produce hazardous products when heated or when they react with other substances, is provided in Appendix B.
- 9.2 The demonstration of these reactions is restricted to what is prescribed in the CAPS.

- 9.3 When these demonstrations are performed, additional precautions must be taken to ensure safety.
- 9.4 Unless otherwise stated in the CAPS, learners may not do these reactions themselves and only educators may demonstrate them to learners.

10. STORAGE OF CHEMICALS

10.1 Chemicals not listed in the Curriculum and Assessment Policy Statement or not supplied by the WCED to public schools

- 10.1.1 The school science safety officer must make a list of all such chemicals, either in stock or recently purchased, and their intended use.
- 10.1.2 This list must be submitted quarterly to the external science safety monitor.
- 10.1.3 The external science safety monitor will prohibit the storage and/or use of any chemicals deemed to be inconsistent with the policy and protocol, and the manual.

10.2 Incompatible chemicals

- 10.2.1 Incompatible chemicals are chemicals that can react with one another and create hazards.
- 10.2.2 Incompatible chemicals must be stored in ways that make them easy to find and that do not create hazards.
- 10.2.3 Incompatible chemicals should not be stored as vertical or horizontal neighbours on shelves. A list of these incompatible materials and chemicals is provided in **Appendixes C and D**.



X marks the positions where incompatible chemicals should not be placed.

- 10.2.4 Chemicals should be kept in a separate room and not in the same room as the physics apparatus.
- 10.2.5 Large containers containing chemicals should be stored on the floor.
- 10.2.6 There must be no hazardous vapours in either the physics or chemistry storeroom.

11. DISPOSAL OF CHEMICAL WASTE

Each education district is responsible for the removal and disposal of chemical waste at schools. A school's safety in science policy must make provision for –

- 11.1 the procedure to be followed for the disposal of chemical waste;
- 11.2 segregation of chemicals in order to ensure that chemical wastes from each specific process are stored separately;
- 11.3 the storage of wastes in containers made of a compatible material; and
- 11.4 the disposal of chemical waste only at sites approved by local government.

12. EMERGENCIES PROCEDURES

12.1 Theft

- 12.1.1 All cases of theft must be brought to the immediate attention of the school science safety officer, who must inform the principal. The principal must inform the education district office concerned, through the external science safety monitor.
- 12.1.2 The school science safety officer must write a report on the theft and submit copies of the report to the principal and the external science safety monitor.
- 12.1.3 The principal must report the matter to the local police, and open a case for investigation.
- 12.1.4 If necessary, the external science safety monitor will conduct an on-site assessment of the theft and report the findings of this assessment to the Head: Curriculum Coordination and Advice at the district office.
- 12.1.5 In all theft cases, the school and the district office concerned must file reports and keep the relevant curriculum directorate at Head Office informed.

12.2 Injuries and accidents in the laboratory

- 12.2.1 Injuries must be brought to the immediate attention of the principal through the school science safety officer.
- 12.2.2 The principal must immediately inform the parents of the learners concerned and/or the spouse or family of the educator concerned.
- 12.2.3 Once the cause of the injury is identified, the educator on duty must render first aid in accordance with the instructions in the manual for the treatment of that injury.
- 12.2.4 In severe cases, the injured person must be taken to hospital.
- 12.2.5 In the case of a serious hazard, such as uncontrollable fires, the laboratory must be evacuated and the local authority concerned alerted so as to bring the situation under control.
- 12.2.6 The school science safety officer must submit a written report on the incident to the external science safety monitor.
- 12.2.7 The school and the education district office concerned must keep a copy of this report on file.
- 12.2.8 Each laboratory must be equipped with a first aid kit, a fire extinguisher and other safety equipment, in accordance with the requirements in the manual.
- 12.2.9 The school and district concerned must file reports in all cases of injuries and accidents and should keep the relevant curriculum directorate at Head Office informed.

13. TRAINING IN SAFETY IN SCHOOL SCIENCE

- 13.1 The school science safety officers must train science educators in school science safety.
- 13.2 The education district's external science safety monitor must train newly appointed school science safety officers within one month of the latter assuming duty.
- 13.3 The external science safety monitor must train school science safety officers in schools where science has recently been introduced into the curriculum.

14. SAFETY IN SCHOOL SCIENCE LABORATORY MANUAL

- 14.1 The WCED has sent the Safety In School Science Laboratory Manual to all schools, together with Curriculum Development Minute No. 0057/2007.
- 14.2 The manual must be permanently available in the physical sciences or natural sciences laboratory, in a place where it can be easily accessed.
- 14.3 Copies of the manual can be obtained from Edumedia.

15. **PROHIBITED PRACTICES**

- 15.1 The use of makeshift apparatus is strictly prohibited.
- 15.2 Schools are not allowed to store any chemicals which are not listed in this Safety in School Science Policy and Protocol document.

APPENDIX A

LIST OF RESTRICTED CHEMICALS

Key:

- **E** = Explosive [has tendency to explode]
- **F** = Flammable [can be set on fire]
- T = Toxic [poisonous]
- **M** = Mutagen [causes mutation in an organism]
- **O** = Oxidant [promotes oxidation or burning]
- **C** = Corrosive [eats away by chemical reaction]
- I = Irritant [causes irritation to skin or eyes, etc.]
- **HC** = Human carcinogen [causes cancer in humans]
- **PHC** = Probable human carcinogen [probably causes human cancer]

CHEMICALS	E x p I o s i v e	O x d a n t	F I a m a b I e	Corrosive	T o x i c	l r l t a n t	M u t g e n	C a r c i n g e n
Acetic acid				С				
Aluminium chloride				С				
Aluminium powder	E				Т			
Ammonia					Т	I		
Ammonium dichromate	E			С	Т	I	М	
Ammonium nitrate	E							
Ammonium thiocyanate					Т			
Barium chloride					Т			
Barium hydroxide					Т			
Benzene			F		Т			HC
Bromine				С		I		
Butanol			F		Т			
Carbon (graphite)						Ι		

Carbon disulphide	E		F					
Carbon tetrachloride					Т	I		PHC
Charcoal			F					
Chlorine				С	Т	I		
Chloroform					Т			PHC
Copper carbonate						I		
Copper carbonate						I		
Copper chloride						I		
Copper nitrate	E				Т	I		
Copper oxide						I		
Copper sulphate						I		
Cyclohexane			F			I		
Cyclohexene			F			I		
Decanedioyl dichloride					Т			
Ethanoic acid			F			I		
Ethanol			F					
Ether		E	F					
Ether (diethyl ether)			F					
Ethyl ethanoate			F					
Hydrochloric acid				С	Т	I		
Hydrogen gas		E	F					
Hydrogen peroxide (30%)				С		I		
Hydrogen sulphide			F		Т	I		
Indigo carmine							М	
lodine vapour				С		I		
lodine crystals				С		I		
Iron (III) chloride						I		
Lead (II) oxide					Т			
Lead acetate					Т			
Lead bromide					Т			
Lead carbonate					Т	I		
Lead nitrate					Т			
Lead sulphide					Т			
Liquid petroleum gas		E	F					

Lithium		E		С				
Lithium chloride				С				
Lithium hydroxide				С				
Magnesium			F					
Mercuric oxide					T			
Mercury					T			
Mercury nitrate					T			
Methanol			F		T			
Methylated spirits			F					
Methanoic acid (formic acid)			F			I		
Methanal (formalin)			F			I		
Naphthalene			F			I		
Nickel								PHC
Nitric acid		0				I		
Oxalic acid				С				
Oxygen gas		0						
Phenolphthalein						I		
Phosphorous (white)				С	T			
Phosphorous pentoxide				С	T			
Phosphorous red			F					
Phosphorous yellow			F	С				
Potassium	E			С				
Potassium carbonate								
Potassium chlorate		0			Т	I		
Potassium dichromate				С				HC
Potassium hydroxide				С		I		
Potassium permanganate	E					I	М	
Propanone (acetone)			F		Т	I		
Silver nitrate				С			м	
Soda lime				С				
Sodium				С				
Sodium hydroxide				С		I		
Sodium hypochlorite				С		I		
Sodium nitrate							м	

Sodium nitrite	E	0					М	
Sodium peroxide					Т			
Sodium sulphide						I		
Sulphur			F					
Sulphuric acid				С				
Turpentine			F			I		

APPENDIX B

RESTRICTED CHEMICAL REACTIONS

CHEMICALS	DESCRIPTION OF THE REACTION AND HAZARD
Acids	They produce heat and hydrogen gas that can explode when
	they react with metals. They produce heat when water is added.
	Violent reactions take place when acid is added to water and
	hot acid is released.
Alkali metals (Group I)and alkaline	They react vigorously with water to release much heat and
earth metals (Group II)	hydrogen gas, which can explode. Most of these metals burn in
	oxygen or air.
Ammonium nitrate	It forms hazardous mixtures with acids, chlorates, flammable
	liquids and finely divided materials.
Ammonium thiocyanate	When heated above 170 °C, it can release fumes containing
	cyanides
Bleaching powder	It emits poisonous chlorine gas when it is dissolved in water. It
	explodes when heated above 100 °C. It emits toxic and possibly
	explosive fumes if acid is added to it.
Calcium metal	Fumes emitted from burning calcium are
Calcium carbide	It forms ethyne (acetylene) when it is mixed with water.
Calcium oxide	It produces much heat when it reacts with water, steam, acids or
	acid fumes.
Carbon (graphite)	If burnt, it can explode.
Carbon disulphide	Like most flammable gases, it forms an explosive mixture with air.
Ethyne (acetylene)	When ignited in the presence of oxygen, it forms an explosive
	reaction, releasing much heat.
Potassium chlorate	It can explode violently if carbon or organic compounds are
	added, or when other impurities, such as dust, are present when
	it is heated.
Potassium hydroxide	It produces heat when it is added to water.
Silver nitrate	It forms an explosive mixture with magnesium powder.
Sodium hypochlorite	It reacts with acids to form poisonous chlorine gas. It also releases
	chlorine gas when it is heated.
Sodium hydroxide	It produces heat when it is added to water.

Sodium nitrite	It explodes when heated in the vicinity of 500 °C. It can form
	explosive mixtures with ammonium salts and thiosulphates.
Sodium peroxide	It reacts violently with water.
Sulphur	It produces toxic sulphur dioxide when it is heated in oxygen. It
	forms explosive mixtures with zinc and magnesium powder, and
	with chlorates and other oxidants.
Zinc powder	It is explosive. It forms an explosive mixture with sulphur.

APPENDIX C

INCOMPATIBLE CHEMICALS [General]

The pairs below are general examples of incompatible materials:

Oxidising agents	and	flammables
Oxidising agents	and	reducing agents
Acids	and	bases
Acids	and	sulphides
Acids	and	flammables
Acids	and	chlorine compounds
Acids	and	alcohols
Acids	and	elemental metals
Water	and	Groups I and II elements
Water or air reactives	and	anything
Organic peroxides	and	anything

APPENDIX D

INCOMPATIBLE CHEMICALS [Specific]

Specific examples of incompatible chemicals are given in the table below. (Adapted from *Safety in Academic Chemistry Laboratories:* American Chemical Society)

CHEMICAL	INCOMPATIBLE WITH
Acetic acid	Nitric acid, hydroxyl compounds,
	peroxides, permanganates
Acetylene	Chlorine, bromine, copper, fluorine, silver,
	mercury
Acetone	Concentrated nitric acid and sulphuric
	acid mixtures
Alkali and alkaline earth metals (Groups I	Water, carbon tetrachloride or other
and II elements] e.g. potassium, lithium,	chlorinated hydrocarbons, carbon dioxide,
sodium, calcium, magnesium and	halogens
aluminium powder	
Ammonia (anhydrous)	Mercury, chlorine, calcium hypochlorite,
	iodine, bromine, anhydrous hydrofluoric
	acid
Ammonium nitrate	Acids, powdered metals, flammable
	liquids, chlorates, nitrites, sulphur, finely
	divided organic combustible materials
Bromine	Ammonia, acetylene, butadiene, butane,
	methane, propane (or other petroleum
	gases), hydrogen, sodium carbide,
	benzene, metals, turpentine
Calcium oxide	Water
Carbon (activated)	Calcium hypochlorite, all oxidising agents
Carbon tetrachloride	Sodium
Chlorates	Ammonium salts, acids, powdered metals,
	sulphur, finely divided organic or
	combustible materials
Chlorine	Ammonia, acetylene, butadiene, butane,

	methane, propane (or other petroleum
	gases), hydrogen, sodium carbide,
	benzene, finely divided metals, turpentine
Copper	Acetylene, hydrogen peroxide
Flammable liquids	Ammonium nitrate, hydrogen peroxide,
	nitric acid, sodium peroxide, halogens
Fluorine	All other chemicals
Hydrocarbons, e.g. butane, propane,	Fluorine, chlorine, bromine, sodium
benzene	peroxide
Hydrofluoric acid (anhydrous)	Ammonia (aqueous or anhydrous)
Hydrogen peroxide	Copper, iron, most metals or their salts,
	alcohols, acetone, organic materials,
	combustible materials
Hydrogen sulphide	Fuming nitric acid, oxidising gases
Hypochlorites	Acids, activated carbon
lodine	Acetylene, ammonia (aqueous or
	anhydrous), hydrogen
Mercury	Acetylene, ammonia
Nitrates	Sulphuric acid
Nitric acid (concentrated)	Acetic acid, hydrogen sulphide,
	flammable liquids and gases, copper,
	brass, any heavy metals
Nitrites	Acids
Oxalic acid	Silver, mercury
Oxygen	Oils, grease, hydrogen, flammable liquids,
	solids or gases
Phosphorous (white)	Air, oxygen, alkalis, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide,
	water
Potassium chlorate	Sulphuric and other acids
Silver	Acetylene, oxalic acid, tartaric acid,
	ammonium compounds
Sodium	Carbon tetrachloride, carbon dioxide,
	water

Sodium nitrite	Ammonium nitrate and other ammonium
	salts
Sodium peroxide	Ethanol or methanol, glacial acetic acid,
	carbon disulphide, glycerine, methyl or
	ethyl acetate
Sulphides	Acids
Sulphuric acid	Potassium chlorate, potassium
	permanganate (similar compounds of light
	metals, such as sodium, lithium)