Education Bureau Circular Memorandum No. 65/2007

From: Secretary for Education To: Heads of all secondary schools

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Date: 11 June 2007

Results of the Survey on School Laboratory Accidents (2005/06)

(Note: This circular memorandum should be read by all secondary school heads, teachers and laboratory technicians of the Science Education Key Learning Area.)

Summary

The purpose of this circular memorandum is to inform schools of the findings of the survey on school laboratory accidents for 2005/06 school year.

Details

2. As one of the ways to monitor the standard of safety in school science laboratories, surveys of laboratory accidents occurring at schools were conducted since 1995/96 school year. The survey for 2005/06 school year has been completed and its findings are summarized in the report at Annex. The report provides information on the nature and causes of common laboratory accidents in schools. It also recommends measures by which schools can minimise the occurrence of laboratory accidents. Heads of schools are requested to bring the contents of the report to the attention of their science teachers and laboratory technicians.

3. Findings of the survey and measures to promote laboratory safety will be discussed in a series of seminars that will be conducted on 18, 20-22 June 2007. Details of the seminars are posted on the Training Calendar of Education Bureau (Course ID: CDI020070367).

Enquiry

4. For enquiries, please contact the Science Education Section at 3698 3439.

Y T LAU
for Secretary for Education

c.c. Heads of Sections / Government Primary Schools – for information

Annex

Report of the Survey on Laboratory Accidents in Secondary Schools in 2005/06

I. Background

As one of the ways to monitor the standard of safety in school science laboratories, surveys of laboratory accidents occurring at schools have been conducted since the 1995/96 school year. From the 2002/03 school year onwards, the survey has been conducted on a triennial basis. The information obtained will be disseminated to all secondary schools to provide updated information on common laboratory accidents, so that appropriate preventive measures can be taken. This report presents findings of the survey for 2005/06 school year.

II. Results and Observations

The results of the survey for 2005/06 revealed that both the number of accident cases per school and the nature of the accidents were similar to those obtained in previous surveys. Out of the 464 secondary schools that responded to the survey, 296 schools (64%) reported that no laboratory accident of any kind occurred. A total of 554 accident cases were reported and the majority (91.7%) were due to carelessness of students. Altogether 500 students and 8 teachers and laboratory technicians suffered injuries. Most of the injuries were minor ones and schools had dealt with them at their own discretion.

Heat burns or scalds and cuts were the most common laboratory accidents and accounted for about 70% of the cases reported. A breakdown of the number of cases in different types of reported accidents is given in the **Appendix**. The nature of each type of accident is summarised below.

(a) **Cuts**: Most cases involved small cuts caused by broken glass apparatus (e.g. test tubes, glass tubing), tools (e.g. dissection instruments, cutters) or sharp edges. About 50% of the cases under this category occurred during junior secondary science lessons. Injuries were mostly found on fingers and palms.

(b) **Heat burns or scalds**: They were mainly caused by carelessness in handling hot objects (e.g. tripods, Bunsen burners, metal rods, glassware or combustion spoons), hot liquids, Bunsen flame or lighted matches. About 69% of the cases under this category occurred during junior secondary science lessons. Slight heat burns on hands were most common.

(c) **Chemicals on skin**: Many cases involved spillage of chemicals during transfer or heating of chemical liquids. Concentrated sulphuric acid, phenol and dilute acids were the most common chemicals involved. Slight burns or irritations were resulted.

(d) **Eye accidents**: Most cases involved chemical liquids splashing onto the eyes, giving rise to slight irritation or discomfort. The chemicals commonly involved were copper(II) sulphate solution and dilute acids. In a few cases, students unintentionally rubbed their eyes with hands contaminated with chemicals. One case involved heating of a solution containing concentrated nitric acid in a test tube and the student did not wear any safety spectacles. The solution boiled and splashed onto the student's eye.

(e) **Chemical spillage**: Most cases involved small-scale spillage of chemicals during transfer. A number of cases were due to breakage of mercury thermometers. In one case, a wall cabinet filled with glass jars containing specimens and formalin collapsed. Fortunately, no injury was reported in this case.

(f) **Substances catching fire**: Most of the cases were caused by accidental ignition of flammable liquids (e.g. ethanol, propan-1-ol). One case involved a student inappropriately adding extra hexane with a dropper to an evaporating dish containing burning hexane. The hexane in the dropper caught fire. The student suffered a minor burn as a result.

(g) **Discomfort arising from inhalation of gases**: There were six reported cases. Students felt discomfort after inhaling a small amount of chemical vapour (e.g. chlorine, hydrogen sulphide) from reaction mixture. In one case, a brown gas was released when chemical wastes were mixed at the end of an experiment. Students felt discomfort after inhaling the unknown gas. Some students were sent to hospital for medical examination. Another case was due to the reaction between concentrated hydrochloric acid and iron(II) sulphide solid wastes left in the drainpipe, leading to the release of hydrogen sulphide gas.

(h) **Bites by animals**: No case under this category was reported.

(i) **Others**: Some students tasted solid or liquid chemicals in laboratories out of curiosity. In one case, a student put a burning splint into a gas jar filled with hydrogen gas and covered the jar with a glass plate. This led to an increase in pressure inside the jar causing the glass plate to burst. No injury was reported.

To better understand the conditions in which accidents occurred, information on the usage of science laboratories in schools was also collected in this survey.

(a) **Accident rate per 1,000 students**: The schools reported that a total of 353,184 students (S1-7) studied science courses in the 2005/06 school year. This corresponded to an accident rate of 1.57 cases per 1,000 students studying science courses.

(b) **Accident rate per 10,000 practical periods**: The schools reported that during the 2005/06 school year a total of about 1,334,688 practical periods were conducted (with practical activities e.g. student experiments, teacher demonstrations, preparation for experiments, project work and science club). This corresponded to an accident rate of 4.15 cases per 10,000 practical periods.

III. Recommendations

Although accidents resulting in serious injuries rarely occur in school science laboratories, schools should continue to be on the alert and take active measures to minimize the occurrence of laboratory accidents.

(a) Promoting laboratory safety

To help students develop positive attitudes towards safety and acquire habits of assessing hazards and risks is one of the essential parts of science education. Teachers are recommended to emphasise the importance of safety consideration by devoting substantial lesson time to this area. Learning packages, such as *Learning and Teaching Resources on Safety in Science Laboratories* (*http://cd1.edb.hkedcity.net/cd/science/laboratory/SAFETY/safety_exemplars_e.pdf*), and *Safety in Exploring Science* (*http://resources.edb.gov.hk /~ses/*), can be adopted by teachers to plan and conduct lessons on laboratory safety. Other laboratory safety resources such as the handbook *Safety in Science Laboratories* (*http://cd1.edb.hkedcity.net/cd/science/laboratory/safety/SHB_2002e.pdf*), laboratory safety posters, hazard warning labels and warning signs have been distributed to schools. Schools that are newly established or have not collected the resources may complete and submit the collection form at *http://cd1.edb.hkedcity.net/cd/science/laboratory /safety/form.pdf*.

(b) Risk assessment

A risk assessment is needed for any activities to be carried out in a laboratory, which include preparation of experiments, teacher demonstrations, student experiments, inquiry-based experiments and open-ended investigations. Students should be taught to take more responsibility for the safe conduct of their practical work in science, especially when they are required to carry out scientific investigations. They should be able to recognise hazards, assess consequent risks and take steps to control the risks to themselves and others. Safety information about chemicals such as the material safety data sheet (MSDS) is useful for risk assessment and can be obtained easily from the Internet and various sources. For example, *http://cd1.edb.hkedcity.net/cd/science/laboratory/safety/msds_ss_2000.pdf* is one good source for accessing MSDS.

(c) Disposal of chemical waste

A few accidents were found to be due to improper disposal of chemical waste in the laboratory. For handling of chemical waste, schools are strongly recommended to follow *the Guide on the Segregation, Packaging, Labelling and Storage of Laboratory Chemical Wastes for Schools* prepared by Environmental Protection Department (*http://cd1.edb.hkedcity.net/cd/science/laboratory/waste/apx2_e.pdf*). Schools should note that the chemical waste handling procedures for secondary school science laboratory have been revised in 2006. The corresponding information is available on the website *http://cd1.edb.hkedcity.net/cd/science/laboratory/waste/cw_e.htm*.

IV. Concluding Remarks

Safety is everyone's responsibility. We need a constant and a concerted effort to maintain the standard of laboratory safety in schools. In order to have an effective safety management system, all secondary schools are advised to set up a standing committee on laboratory safety (SCLS). The SCLS can help promote laboratory safety through closer coordination in reviewing the effectiveness of safety measures to raise the standard of laboratories, and better equip schools to deal with emergency situations. It is therefore important that the SCLS (or relevant safety management committees) of schools could meet regularly and carry out duties to meet these ends.

In view of over three hundred thousand students and laboratory staff involved in over one million practical periods in a school year, the statistics of this survey show that schools have maintained a high standard of laboratory safety. However, schools should continue to take a proactive role in monitoring the standard of laboratory safety in their schools. Based upon the fact that over 90% of accident cases are due to carelessness of students, their attitudes towards, and knowledge of, safe practice in laboratories should be enhanced. Laboratory safety should not be only mentioned at the beginning of each school year, but also be treated as one of the essential parts of each practical activity and scientific investigation. Risk assessments should be made in advance and suitable personal protective equipment should be worn when conducting experiments. For more guidelines and resource materials on laboratory safety, please refer to the website of Science Education – Laboratory Safety and Management at *http://www.edb.gov.hk/index.aspx?nodeID=3376&langno=1*.

Science Education Section
Education Bureau
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Appendix

Statistics of Surveys on
Laboratory Accidents in Secondary Schools (2005/06)

Number of Accidents Reported

Number of schools responded	464
Number (percentage) of schools reported laboratory accidents	168 (36%)
Number of accident cases	554
Number of accident cases per school	1.19
Number of students injured*	500
Total no. of injured teachers/lab technicians	8
Accident rate per 1,000 students studying science courses[#]	1.57
Accident rate per 10,000 practical periods	4.15

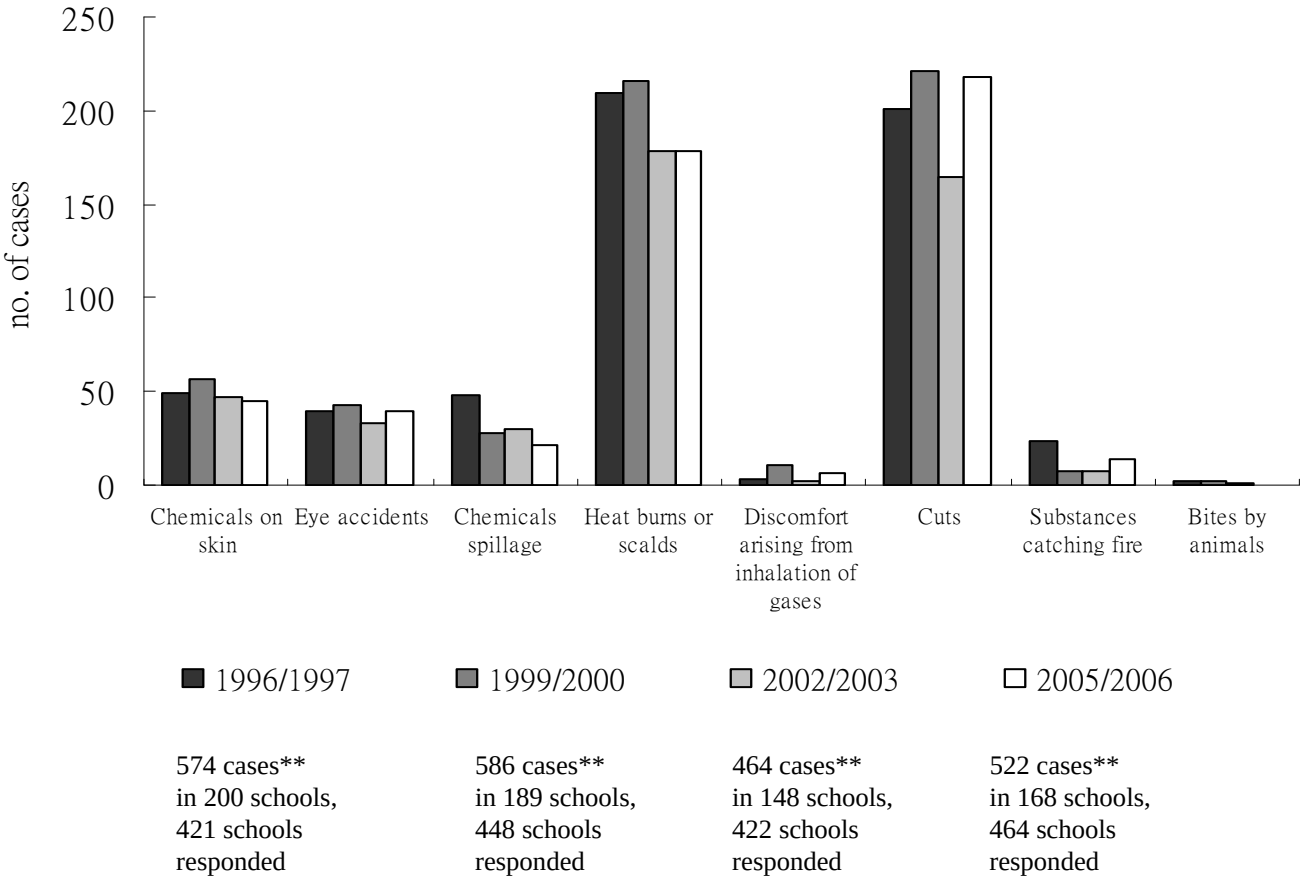
**Most of the injuries were very minor ones, e.g. minor cuts or scalds on hands.*

[#]In 2005, the traffic accident rate in Hong Kong was 2.2 cases per 1,000 population. The industrial accident rate in all industries was 30.6 cases per 1,000 workers.

Type of accident	**Number of cases**	**Percentage**
Cuts	218	39.4%
Heat burns or scalds	178	32.1%
Chemicals on skin	45	8.1%
Eye accidents	40	7.2%
Chemicals spillage	21	3.8%
Substances catching fire	14	2.5%
Discomfort arising from inhalation of gases	6	1.1%
Bites by animals	0	0%
Others	32	5.8%
Total	554	

Subject	**Number of cases**	**Percentage**
Physics	18	3%
Chemistry	134	24%
Biology / Human Biology	92	17%
Science (S1-3)	309	56%
Science & Technology / Engineering Science	1	~0%

Surveys on Laboratory Accidents in Secondary Schools
1996/1997 – 2005/2006



1996/1997	1999/2000	2002/2003	2005/2006
574 cases** in 200 schools, 421 schools responded	586 cases** in 189 schools, 448 schools responded	464 cases** in 148 schools, 422 schools responded	522 cases** in 168 schools, 464 schools responded

*** The cases in "Others" are neglected because in the surveys for 1996/1997 and 1999/2000, more than 280 cases were reported in this category for each survey in which over 90% of the cases were mere accidental breakage of glassware or damage of equipment which did not involve any injury.*