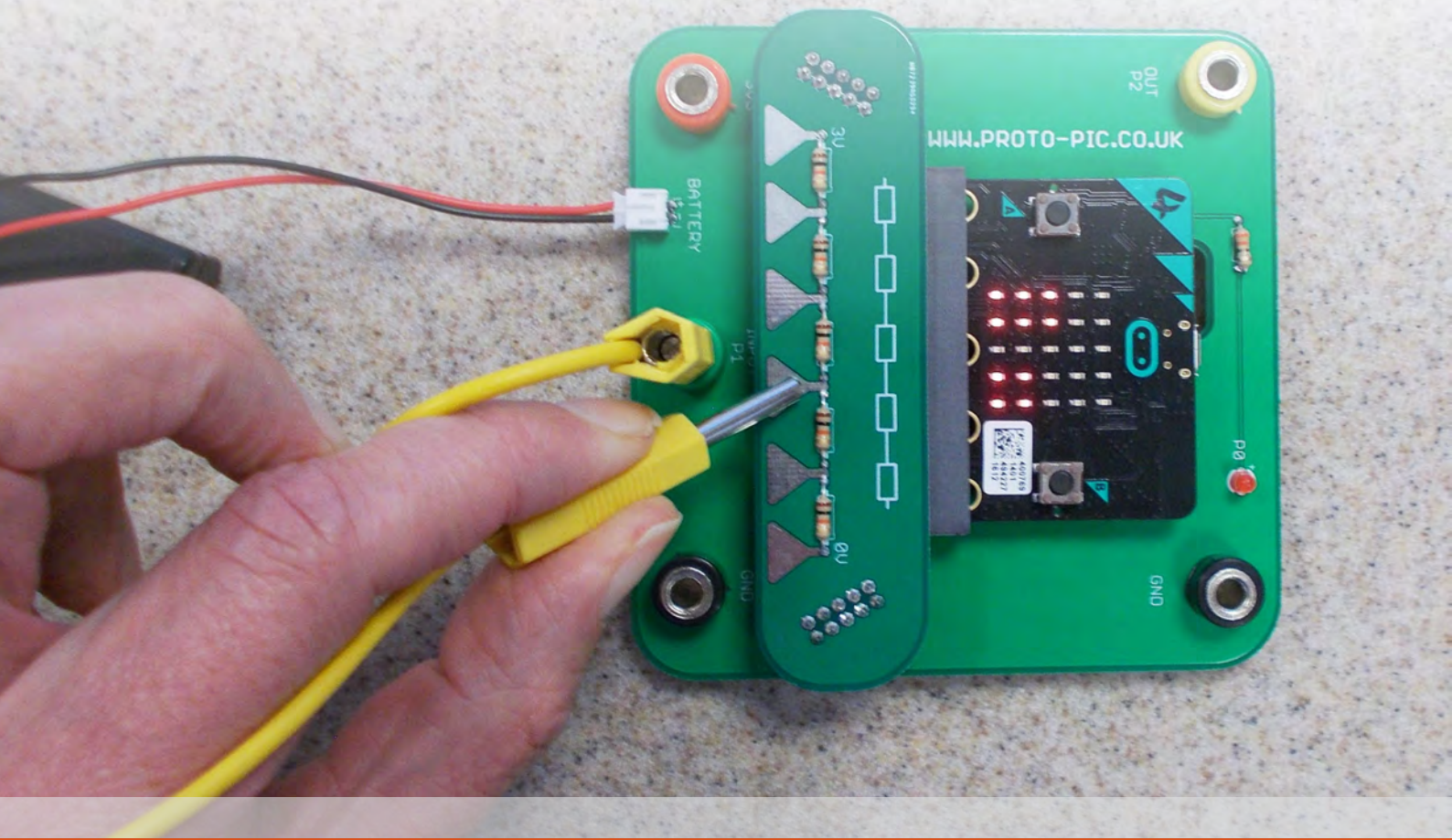
sserc

scottish schools education research centre

STEM bulletin

supporting STEM for all Local Authorities through advice, ideas and inspiration



©SSERC 2018 - ISSN 1759-1082

NO. 265 - AUTUMN 2018

Catalase activity in immobilised yeast - effect of inhibitors

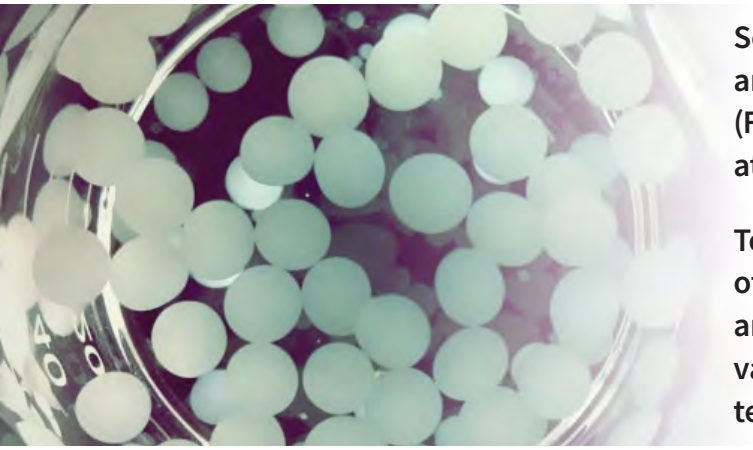


Figure 1 - Immobilised yeast (see [1] for preparation method).

Several schools have indicated to us that they are using catalase activity in immobilised yeast (Figure 1) as the basis for student investigations at both National 5 and Higher.

Teachers and technicians tell us that the simplicity of the experimental system, the low costs involved and the inherent scope for changing a number of variables (principally substrate concentration, temperature and pH) all allow for flexibility.

We have previously published protocols which describe the basic techniques involved in the preparation of immobilised yeast [1, 2]; our protocols are based on the work of Bryer [3].

In order to extend the variety and complexity of the immobilised yeast/catalase system we have been turning our attention to inhibitors that might be used. We were encouraged by a piece on the National Centre for Biotechnology Education website [4]:

Fungal catalase is (noncompetitively) inhibited by ethanol - so ethanol can be used to demonstrate enzyme inhibition (you need roughly 15% ethanol to inhibit the catalase).

However, we tried a series of protocols in which we added both ethanol and/or methanol to see if we could detect any inhibition but the results from our studies proved to be inconclusive. Searches of the wider literature indicated that several metal ions, in particular copper, might be inhibitors of catalase.

For our first attempts at demonstrating copper inhibition of catalase we prepared immobilised yeast balls in the standard way [1] and then added copper sulfate to the measuring cylinder to provide a range of different concentrations. We saw no difference in the time taken even at relatively high copper concentrations. It should be noted also that at concentrations of copper sulfate > 0.5 mol dm^{-3} the addition of copper leads to observable breakdown of the hydrogen peroxide in the absence of added yeast balls. At concentrations of copper sulfate lower than 0.5 mol dm^{-3} the peroxide appears to be relatively stable but a pupil contemplating such an experiment as part of an >>

	Time taken (/s)				
Copper sulfate concentration (/mol dm^{-3})	Run 1	Run 2	Run 3	Run 4	Mean of Runs 1-4
0.00	16	16	16	16	16
0.001	16	16	15	15	16
0.005	58	47	58	60	56
0.010	125	120	110	119	119
0.025	192	186	190	196	191

Table 1 - Time taken for immobilised balls of yeast to fall and rise in solutions of hydrogen peroxide (1 vol). Approximately 20 immobilised yeast balls were allowed to stand for 16 hours in solutions (50 cm^3) of copper sulfate at the concentrations shown. Fresh peroxide solution was used when a change in copper sulfate concentration was made.

assignment might wish to think about appropriate controls.

We decided to 'incubate' immobilised yeast balls with copper sulfate and then measure the time taken for balls to fall and rise in solutions of hydrogen peroxide. The data is presented in Table 1 and plotted graphically in Figure 2. What can be seen is that increasing copper sulfate concentration does indeed lead to catalase inhibition. Such observations open up the possibility of a range of other experiments which pupils might undertake. For example, we see little inhibition when using zinc sulfate in place of copper sulfate and comparisons might form the basis of an interesting investigation.

Once immobilised yeast balls have been left overnight in the presence of copper they have a distinct blue/green colour. Much of the copper can be removed by gently agitating the balls in distilled water; after a few changes of water the inhibition seen in the presence of copper is reversed.

Please send any feedback on this article to biology@sserc.scot. <<

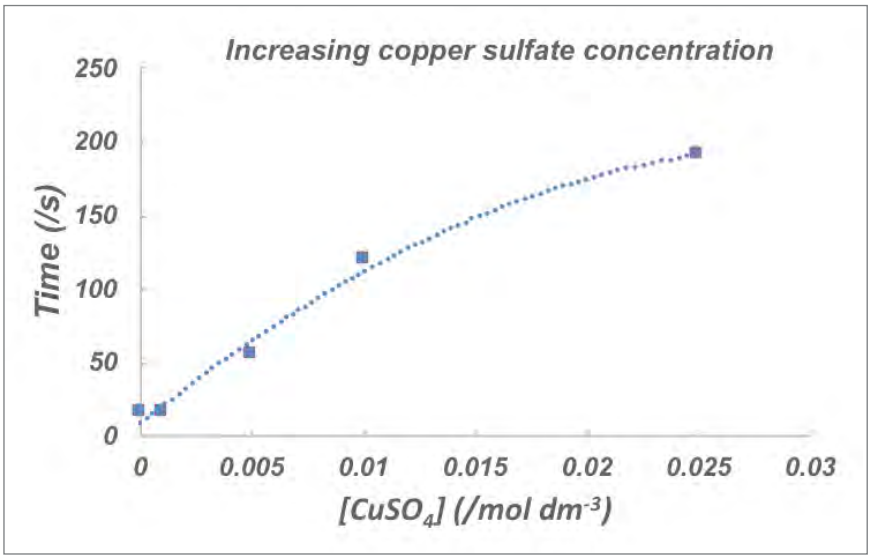


Figure 2 - Data from Table 1.

References

[1] SSERC (2017), Hydrogen peroxide and immobilised yeast, SSERC Bulletin, **258**, 10-13. Available at http://info.sserc.org.uk/images/Bulletins/258/SSERC_S258p10_13.pdf (accessed 14th September 2018).

[2] SSERC (2018), Catalase activity in immobilised yeast – an update, SSERC Bulletin, **264**, 9. Available at https://www.sserc.org.uk/wp-content/uploads/Publications/Bulletins/264/SSERC-bulletin-264webp9.pdf (accessed 14th September 2018).

[3] Bryer. P. (2016), A twist on measuring catalase, *Science Teacher*, **83**, 69-73.

[4] NCBE (2018), Enzymes for Education: Catalase. Available at http://www.ncbe.reading.ac.uk/MATERIALS/Enzymes/catazyme.html (accessed 14th September 2018).

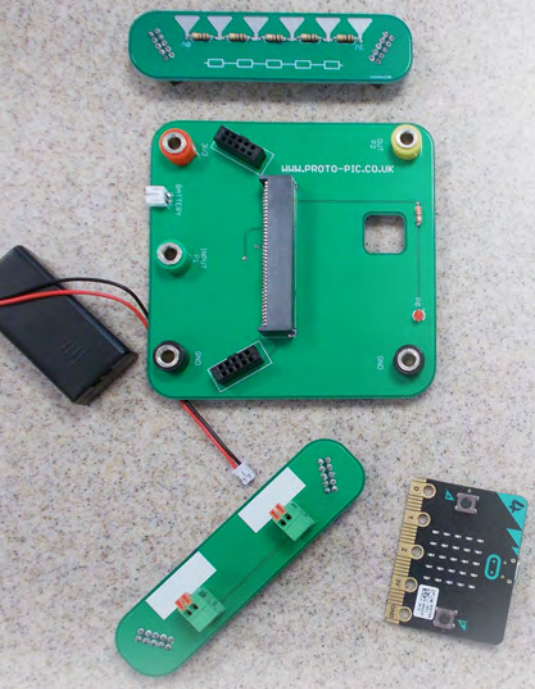


Figure 1 - Proto-Pic board, accessories and BBC micro:bit.

Proto-Pic board for the BBC micro:bit

In Bulletin 262, we suggested that you could use BBC micro:bits as an aid to teaching potential dividers and switching circuits. We directed you to some programs we had written and showed how you could wire up "choc block" connectors to use the devices with electronic components such as LDRs and LEDs. We had some very interesting, rather contradictory feedback. Some teachers reported that their students loved wiring up the block connectors. Others found the approach too fiddly. If you fall into the latter camp, you may be interested in the Proto-Pic board and accessories (Figure 1).

Proto-Pic[1] are based in Kirkcaldy. When the company heard that SSERC was promoting the use of the micro:bit in physics lessons, they asked if we felt there was a need for additional hardware. From the discussions that followed, a board was born. It has a connector for the micro:bit (which is not supplied with the board), plus input and output sockets. There are also accessory boards. Figure 2 shows a set of five resistors connected in series. The micro:bit is running SSERC's bar voltmeter program. A lead plugged into the board can be touched on pads between the resistors, creating a potential divider. As described in Bulletin 262, the two columns on the micro:bit display represent the voltages across each arm.

There is also a component holder board (Figure 3). Resistors, capacitors, LDRs and so forth can be fitted into spring-loaded holders. Our program is designed to switch on an output when the voltage across the lower arm is 3 bars (about 2.1 V). Two versions of the program exist. One uses an onboard LED as the output. The other allows you to connect an external output device across the black and yellow sockets at the right of the board.

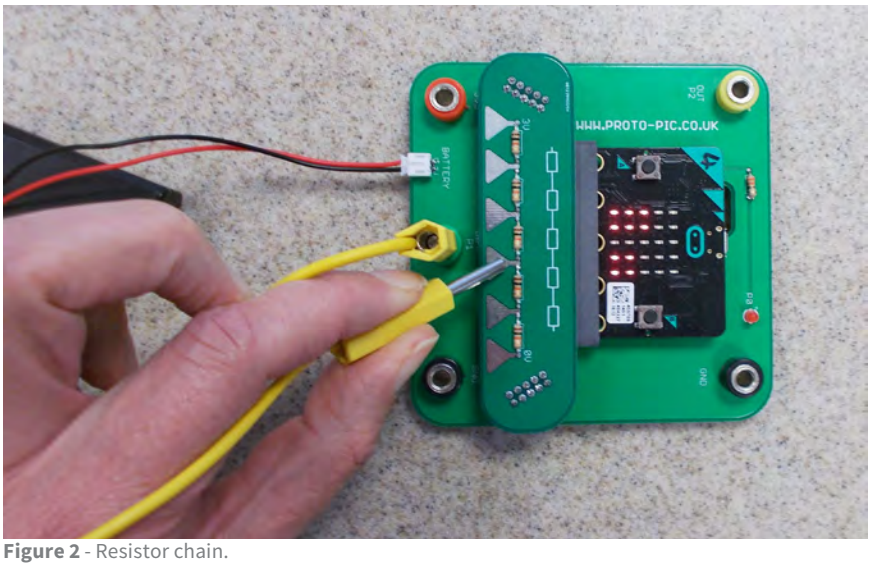


Figure 2 - Resistor chain.

These programs use a digital output - connected devices are either on or off. Documentation mentioned an analogue output. We decided to make use of this in another pair of programs. Sure enough, we could make the brightness of an LED increase as a capacitor charged or an LDR was covered. However, the range of brightness possible from the LED puzzled us. It was greater than we expected. We attached an oscilloscope across the output. Figure 4 shows what we found.

Is the output truly analogue? It appears to be either zero or 3.3 V. All that changes are the times for which the pulsed output remains high or low. Set the analogue output to a small value and the signal is zero for much longer than it is at 3.3 V. Make it higher and the time for which the output is at 3.3 V increases, with a corresponding decrease per cycle in the time that it is at zero volts. This type of output is called Pulse Width Modulation (PWM). You may be interested to know that electric cars use PWM to control motor speeds. >>

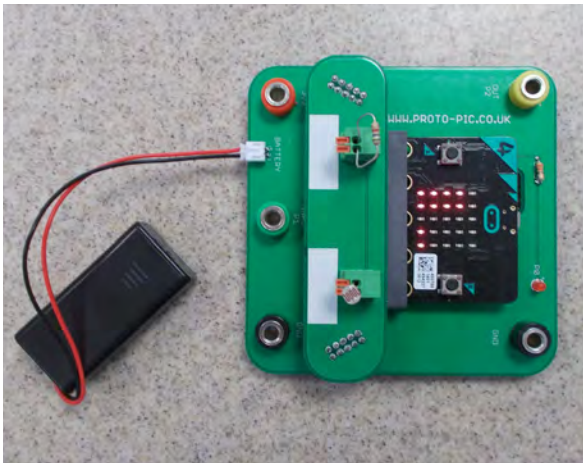


Figure 3 - Component holder board with LDR and fixed resistor.

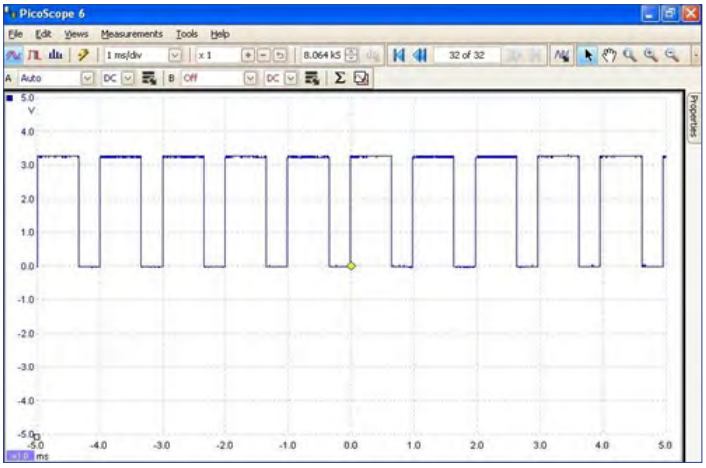


Figure 4 - "Analogue" output from the micro:bit.

Interestingly, some delegates at a two part course who had been unsure of using the micro:bit with their pupils having been introduced to the "fiddly" approach in Part 1 pronounced themselves to be converts after having been introduced to the boards.

Pricing depends on the number of boards ordered, but Proto-Pic, as part of their design brief, set the goal of making them comparable in cost to the micro:bit itself. We have asked them if they can supply resistor boards separately without the components soldered in place.

We think this could be a useful activity for Practical Electronics students. As ever, we are eager to hear your own ideas. <<

Reference

[1] www.proto-pic.co.uk.

Changes to National 5 Biology Coursework Assessment Task

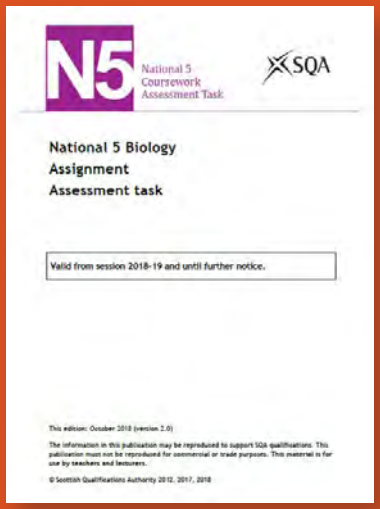
SQA have recently published some revisions to the documentation related to the National 5 Coursework Assessment Task [1].

As a result of these changes we have made some 'minor tweaks' to the Student Guides related to our exemplar resources packs (*Limiting Factors in Photosynthesis and Fertiliser and the Growth of Algae*) which are available on the SSERC website [2].

Please send any feedback on this article to biology@sserc.scot. <<

References

[1] https://www.sqa.org.uk/files_ccc/BiologyN5CAT.pdf.
[2] http://info.sserc.org.uk/biology/biology-national-4/4239-test.



Annual Conference 2019

UNMISSABLE CPD FOR ALL SCIENCE EDUCATORS

Wednesday 9 January – Saturday 12 January at the University of Birmingham

Europe's Largest Science Education Conference

Thursday Twilight from **£25**

4 days. 450 sessions. 432 speakers. All in one place. A unique CPD opportunity across all subjects and phases.

Exhibition-only ticket **FREE**

"Inspirational, brilliant. Cannot wait to use all the resources back in school."

"After two days of being back to normal, still on a high after inspirational #ASEconf."

2018 Conference Delegates

The Association for Science Education

www.ase.org.uk/annual-conference

The Association for Science Education, College Lane, Hatfield, Herts AL10 9AA T: 01707 283000 F: 01707 266532 E: info@ase.org.uk W: www.ase.org.uk
VAT number: GB 230 3753 93 I Royal Charter: ROC 000805 I Patron: HRH The Duke of Edinburgh I Registered Charity: 313123/SC042473

SSERC website explained

Most of you will have been aware of the transfer of content that took place over the summer. We are now at a position where most of what was on the old site is now on the new one so this seems like an apposite time for some brief guidance.

Access

Access is as before, all our experimental information is open access. The Health & Safety advice, however, and the recent bulletins, will remain members only.

On that point, you may or may not have noticed that you have not been prompted to log in to any pages. We decided that during the transition period, dealing with any possible access problems would be a step too far so until now all our pages have been open access.

However, we are now reverting to the old system as outlined above. However, as we have moved our website to a new platform there are a few differences that should make things easier for you.

Registration

When you are prompted to register, or if you click on the 'register' button at the bottom of any page (Figure 1), you will be taken to a page to enter your information. Your entry will then go to a 'holding' area where we will check that you are entitled to access before clicking the button to confirm. It will speed the process considerably if you use your work email to register with. If you use a personal one, we will need to contact you to see if you are entitled to access.

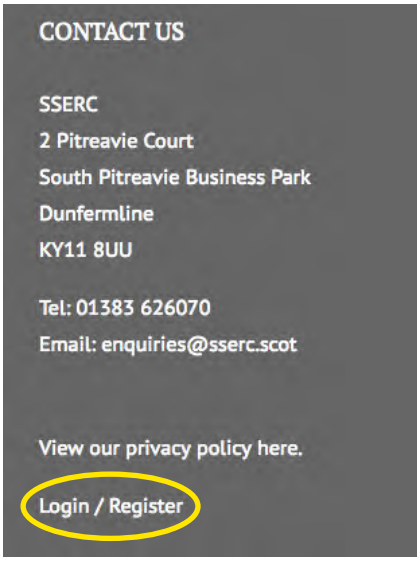


Figure 1 - The 'register' button you will find at the bottom of each page.

Passwords

In the past if you forgot your password, it needed to be reset at our end. That is no longer the case: you will be able to change or reset your password whenever you choose.

Existing accounts - we have transferred over many of the existing users but this process did not allow for the retention of passwords so you will still need to reset them. In addition, to trim down our data retention in light of GDPR we have deleted all accounts that have not been used in the past year or longer.

Student access - There is no problem getting access for your students. You can register in exactly the same way as above. It may be difficult to set up another school/ authority/Glow email so using a Gmail, Hotmail etc. account is fine, but please email us to let us know so we can approve it without having to contact you about it.

Content

The content is structured in a very similar fashion to before though there are fewer menus to deal with. The main menu is across the top of all the pages (Figure 2).

The main menu tabs

- **Subject Areas** - where you will find all our educational materials
- **Health & Safety** - what it says
- **Technicians** - the homepage for school technicians with links to resources relevant to them
- **Wider Engagement** - Information on STEM Ambassadors and STEM Insight.
- **CLPL** - where you can find and register for any of our professional learning courses.

>>

Figure 2 - SSERC website main menu.

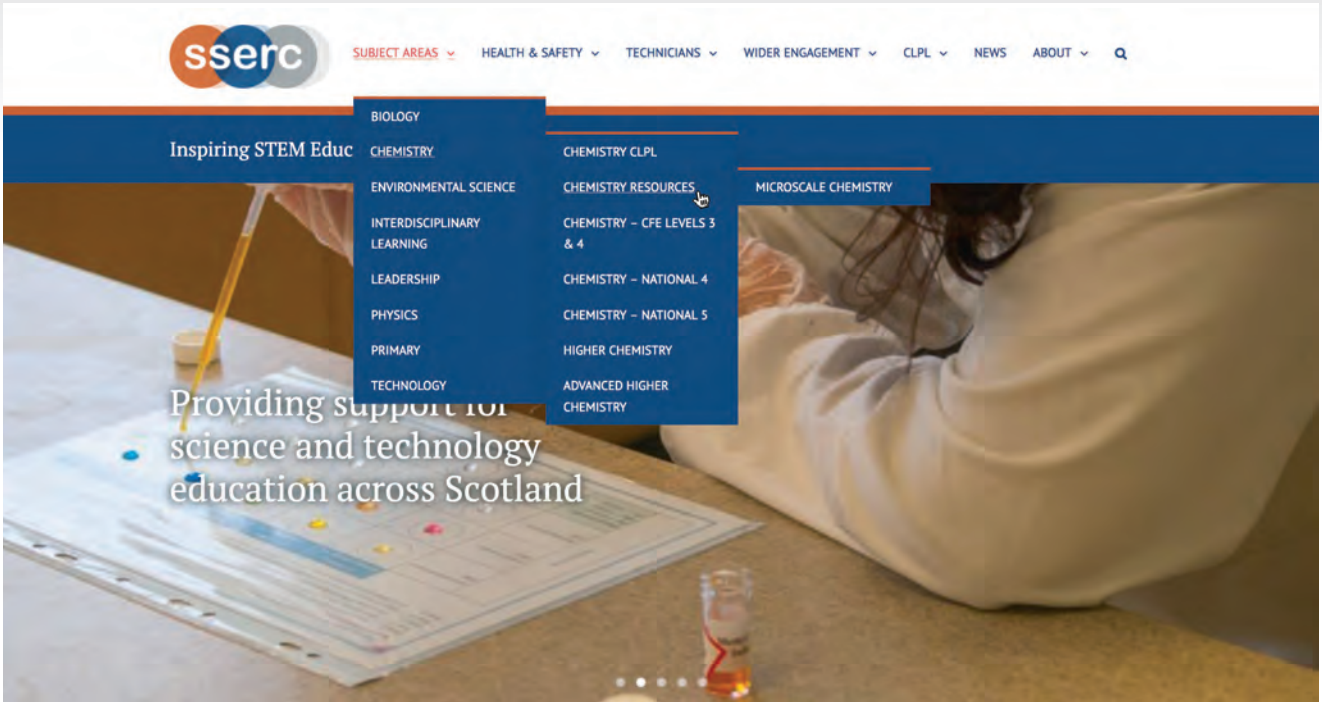


Figure 3 - Example of submenus: Subject Areas –> Chemistry –> Chemistry Resoures –> Microscale Chemistry.

Each of these has a submenu and often sub-submenus. For instance: *Subject Areas* has subcategories for *Biology, Chemistry, Physics etc. Chemistry* has subcategories for *Resources list, N4, N5, Higher etc.* (Figure 3).

There is not a menu item for every page. A decision we took to prevent you having to dive through too many layers of menus. When you reach the 'bottom' page of a menu trail, pages attached to that can be found as icons at the bottom (Figure 4).

Search - The search facility has been enhanced and can be found at the top right of the menu bar. If you are not sure where an item is, this is probably the quickest way to find it.

Mobile access

The website is now much more mobile friendly though not perfect: some tables, for instance the chemical index, don't fit the page so a small amount of sideways as well as vertical scrolling might be required.

Finally, please feed back to us if you find aspects of it that are not working. With the best will in the world with this amount of data, mistakes will be made. Even SSERC employees are (mainly) human. <<

Figure 4 - Submenus icons you can find at the bottom of the page.

SSERC professional learning courses

Our professional development courses range from twilight events, day-courses through to residential meetings lasting up to 6 days in total. Our curriculum coverage spans both primary and secondary sectors and we offer events for teachers as part of their career long professional learning, newly qualified teachers and technicians. Many of our events receive funding from the ENTHUSE awards scheme or the Scottish Government.

Courses available for online booking include:

COURSE NAME	RESIDENTIAL?	DATES	CLOSING DATE	SECTOR
Health & Safety Update	No	20 November 2018	29 October 2018	Secondary
STEM Day for Early Level	No	23 November 2018	31 October 2018	Primary
SSERC Conference	No	30 November 2018	31 October 2018	Primary & Secondary
Safe Use of Fixed Workshop Machinery	No	5-6 December 2018	19 November 2018	Secondary (Technology)
Science for Secondary Probationers (2-part)	Yes	5-6 February 2019 4-5 June 2019	30 November 2018	Secondary
Risk Assessment	No	14 January 2019		Secondary
Maintenance of Fixed Workshop Machinery	No	15-17 January 2019	3 December 2018	Secondary (Technician)
Safe Use of Fixed Workshop Machinery (Refresher)	No	23 January 2019	10 December 2018	Secondary (Technology)
Technology Makerspace	Yes	28-29 January 2019	14 December 2018	Secondary (Technology)
Introductory Physics	No	29-30 January 2019	11 January 2019	Secondary (Technician)
Safe Use of Fixed Workshop Machinery	No	6-7 February 2019	14 January 2019	Secondary (Technology)
Electrical Safety and PAT	No	12-13 February 2019	21 January 2019	Secondary (Technician)
Fabrication Skills	Yes	19-20 February 2019	25 January 2019	Secondary (Technology)
Chemical Handling	No	19-20 February 2019	29 January 2019	Secondary (Technician)
SSERC_Meet: Getting to Grips with Friction	No	27 February 2019	1 February 2019	Primary
SSERC_Meet: Microbes for Minors	No	6 March 2019	8 February 2019	Primary
Safe Use of Fixed Workshop Machinery (Refresher)	No	13 March 2019	18 February 2019	Secondary (Technology)
Intermediate Physics	No	19-20 March 2019	19 February 2019	Secondary (Technician)

Please check our website pages at **https://www.sserc.org.uk/professional-learning/calendar/** for the most up-to-date details on our career long professional learning calendar.

Working safely with micro-organisms in Laboratory Science: Practical Skills (National 5)

Laboratory Science: Practical Skills **(National 5) is a mandatory unit within the *National 5 Laboratory Science Skills for Work Course* [1]. Outcome 1 of the unit requires learners to demonstrate competence in some basic laboratory microbiological techniques, namely pouring media plates, subculturing of micro-organisms, preparing slides for microscopy and an awareness of appropriate safe disposal of microbiological waste. This involves learners in developing aseptic technique together with an awareness of the health and safety aspects of working with micro-organisms.**

At SSERC we believe in the considerable educational value of carrying out school practical work involving micro-organisms which, as the Safety in Microbiology Code of Practice says,

> *'... lends itself to investigative work in science and to the discipline of developing competence in practical skills. Microbiological skills are key components in the field of biotechnology and in the medical industries and services. The applications of microbiology are relevant to the everyday concerns of citizens in relation to food production, hygiene, health and waste management. It also allows for the evaluation and control of risk, a valuable life skill, as well as providing an insight into an area of science in which Scotland is a major global contributor in research and industrial production. In the 21st century responsible citizens will need to evaluate scientific issues related to microbiology and to develop informed views on the use and applications of micro-organisms.' [2]*

We are pleased that there is a growing interest amongst school science departments in offering the *National 5 Laboratory Science Skills for Work Course* to young people interested in developing their practical laboratory skills. Of course, microbiology is not the only practical component of the course; learners measure radioactivity, use various types of laboratory instruments and perform titrations [1]. However, the interdisciplinary nature of the course is generating questions to SSERC from interested science departments about the training requirements for both teaching and technical support staff, especially the requirements for the microbiology component.

Laboratory Science: Practical Skills **(National 5)**

Outcome 1 - Performance evidence [1]

Learners will work safely with micro-organisms in a laboratory setting
Learners will be required to demonstrate by practical activity that they are able to:

- Pour agar plates using aseptic technique to a satisfactory standard
- Subculture micro-organisms (bacteria, yeast **and** mould) using aseptic technique without contamination. Learners must subculture **each** micro-organism type using **one** of the following subculture techniques:
  - Liquid to solid
  - Liquid to liquid
  - Solid to liquid
  - Solid to solid
- Prepare wet and dry mounts to satisfactory standard. The preparation is in accordance with given instructions and the mounted material is clearly visible when viewed using a microscope.
- Work safely throughout.

Figure 1

This article aims to address the issues of training requirements and the levels of work appropriate to learners and their teachers working safely with micro-organisms to achieve the *Laboratory Science: Practical Skills* (National 5) outcomes and performance criteria (see Figure 1).

Risk assessment and the Code of Practice

Activities involving micro-organisms are controlled by the Control of Substances Hazardous to Health (COSHH) Regulations and teachers and technicians have a duty under the Health and Safety at Work Act to comply with any safety instructions given by their employers. These include using model risk assessments. In Scotland all 32 local authorities and SSERC member schools and >>

colleges have adopted the Code of Practice - *Safety in Microbiology for Scottish Schools and Colleges*, SSERC, 2018 [2] and Figure 2.

The process of risk assessing work involving microbiology should be to identify the risks in any activity and to consider adopting the Code of Practice as being suitable and sufficient to control these risks. By following the Code of Practice in this way, a risk assessment is being carried out. If an activity falls outwith the guidance in the Code of Practice, then an individual risk assessment for that activity must be carried out. **If an employer has provided additional guidance on assessing and recording risk, that guidance must be followed.**

Teacher/technician training and levels of work

Central to the Code of Practice is the concept of levels of work. Three levels of work are determined by a combination of risk factors including choice of micro-organism, teacher training, age of learners and availability of trained technicians [2]. For level 1 work with learners (primary or early secondary), teachers do not require specialist microbiological training beyond normal good school science laboratory practice. For level 2 work with learners (early secondary to senior phase), science teachers may require training and some supervision which can be provided by a knowledgeable teacher (most often a biologist) or technician or by a short in-school training session. The SSERC instruction sheets and short films Microbiological Techniques [3] should be a useful resource in such training as will reference to and familiarity with the Code of Practice [2]. Most school microbiological laboratory work carried out by learners will be at levels 1 and 2, although students in the senior phase may carry out particular level 3 tasks under the supervision of a teacher, or technician trained to level 3.

In order to support level 2 microbiological laboratory work in schools and to supervise students who carry out level 3 tasks, staff trained to level 3 are required. For level 3 work teachers and technicians should be thoroughly trained and skilled in aseptic technique (see Figure 3).

See also a more detailed SSERC statement on training requirements [4].

Level 3 tasks required to support microbiological work in schools:

a) order, receipt, labelling and storage of cultures;
b) preparation of sterile media and sterile equipment;
c) preparing sub cultures for class use;
d) sampling from bioreactors;
e) sterilisation and disposal of cultures;
f) sterilisation of used equipment;
g) management of incidents of spillage;
h) staining of incubated plates (e.g. starch agar).

Figure 3

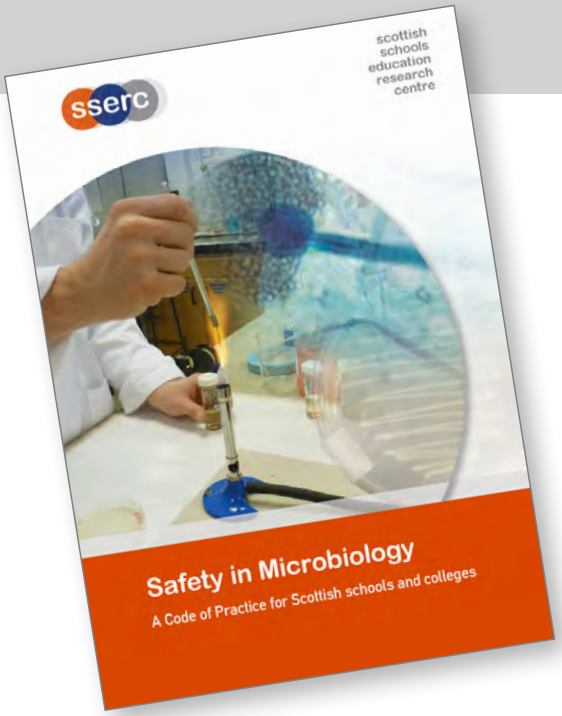


Figure 2 - *Safety in Microbiology - A Code of Practice for Scottish Schools and Colleges* [2].

How do these levels apply to *Laboratory Science: Practical Skills* (National 5)?

It is possible to meet the Outcome 1 performance criteria by carrying out only work at level 2. Done in this way, no specialist training is required for teachers beyond an in-school training session delivered by someone themselves trained to level 3. In order to carry out tasks to support the delivery of the course the expertise of someone (usually a technician) trained to level 3 is required (see Figure 3).

Subculture work can be carried out by learners using known micro-organisms deemed to be safe for use in schools. These are listed in appendices 1, 2, 3 and 4 of the Code of Practice [2] and should be sourced from recognised suppliers. However, confining work to level 2 for teachers and learners requires cognisance of some subtleties in the Code of Practice. The issue is the techniques which require transfer of an organism from a liquid culture. Transfer from liquid cultures increases the risk of spillage, or the formation of aerosols (invisible 'mists' of small droplets of moisture which might contain microbes that could be inhaled). Done using Appendix 2 organisms (Figure 4), these liquid transfers are level 3 tasks and would, therefore, require learners to be trained and supervised by someone trained to level 3. The easiest way to minimise risk and restrict liquid transfers to level 2 work is to use *Saccharomyces cerevisiae* (yeast) which is listed in Appendix 1 (Figure 5). By using *Saccharomyces cerevisiae* (yeast) for liquid to solid, and liquid to liquid transfers the learning outcomes for *Laboratory Science: Practical Skills* (National 5) can be met by learners and teachers working at level 2.

>>

APPENDIX 2

Selected organisms for work at levels 2 and 3

All micro-organisms listed in Appendix 1 and the following organisms:

Fungi
Agaricus bisporus
Armillaria mellea
Aspergillus oryzae
Botrytis cinerea
Botrytis fabae
Chaetomium globosum
Coprinus lagopus
Fusarium graminearum
Fusarium solani
Fusarium oxysporum
Helminthosporium avenae
Kluveromyces lactis
Lindnera jadinii (also called *Candida utilis*)
Monilinia fructigenea (also called *Sclerotinia fructigena*)
Mucor hiemalis
Mucor mucedo
Myrothecium verrucaria
Neurospora crassa
Penicillium expansum
Penicillium roquefortii
Phaffia rhodozyma (e.g. coloured organism)
Physalospora obtusata
Phycomyces blakesleanus
Phytophthora infestans
Plasmodiophora brassicae
Pleurotus ostearus
Pythium de baryanum
Rhizopus oligosporus
Rhizopus sexualis
Rhizopus stolonifer
Rhytisma acerinum
Saccharomyces cerevisiae
Saccharomyces diastaticus
Saccharomyces ellipsoides
Saprolegnia litoralis
Schizosaccharomyces pombe
Sordaria fimicola
Sporobolomyces species
Trichoderma reesei

Bacteria
Acetobacter aceti
Agrobacterium tumefaciens
Azotobacter species
Alcaligenes eutrophus
Bacillus megaterium
Bacillus stearothermophilus
Bacillus subtilis
Cellulomonas species
Chromatium species
Janthinobacterium lividum (also called *Chromobacterium lividum*)
Escherichia coli (strain B or strain K12)
Gluconobacter oxydans
Lactobacillus species
Micrococcus luteus (also called *Sarcina lutea*)
Micrococcus roseus
Methylophilus methylotrophus
Pectobacterium carotovorum (also called *Erwinia carotovora*)
Photobacterium phosphoreum
Pseudomonas fluorescens
Rhizobium species
Rhodopseudomonas palustris
Spirillum serpens
Staphylococcus epidermidis
Streptococcus lactis
Streptococcus thermophilus
Vibrio natriegens (also called *Beneckea natriegens*)

Viruses
Cucumber Mosaic Virus
Potato Virus X
Potato Virus Y (not the virulent strain)
Tobacco Mosaic Virus
Turnip Mosaic Virus

Figure 4 - *Safety in Microbiology - A Code of Practice* Appendix 2.

>>

APPENDIX 1

Selected organisms for work at level 1

- Bread making or brewer's yeast (*Saccharomyces cerevisiae*)
- Dried yoghurt cultures (bacteria used to make yoghurt)
- Blue-green algae
- Green algae
- Free living protozoa
- Lichens
- Slime moulds

Figure 5 - *Safety in Microbiology - A Code of Practice* Appendix 1.

Our recommendations for organisms to be used to carry out the required microbiological techniques for *Laboratory Science: Practical Skills* (National 5) course while working at level 2 are shown in Figure 6.

These recommendations make it possible to perform the appropriate techniques using the required range of organisms for *Laboratory Science: Practical Skills* (National 5) without level 3 training for teachers or learners. It is worth re-emphasising that it is still necessary to have someone within the school trained to Level 3 in order to carry out the relevant technical support tasks described in Figure 3.

It should be noted that SSERC has recently revised *Safety in Microbiology - A Code of Practice for Scottish Schools and Colleges*. All references in this article are to the revised version which is available on our website [2]. <<

Technique	Organism	Code of Practice reference	Type
Solid to solid	*E. coli* or *M. luteus* or *B. subtilis*	Appendix 2	Bacterium
Liquid to solid	*S. cerevisiae* (yeast)	Appendix 1	Fungus
Solid to liquid	*E. coli* or *M. luteus* or *B. subtilis*	Appendix 2	Bacterium
Liquid to liquid	*S. cerevisiae* (yeast)	Appendix 1	Fungus
Solid to solid	*Mucor hiemalis*	Appendix 2	Mould

Figure 6

References

[1] *Laboratory Science: Practical Skills* (National 5) Skills for Work Unit Specification June 2017 link to SQA website https://www.sqa.org.uk/sqa/38267.html.

[2] *Safety in Microbiology - A Code of Practice for Scottish Schools and Colleges*, SSERC, 2018 available at https://www.sserc.org.uk/health-safety/biology-health-safety/codes-of-practice/.

[3] SSERC Microbiological techniques. Available at https://www.sserc.org.uk/health-safety/biology-health-safety/microbiological-techniques/.

[4] Advice on Training Requirements. Available at https://www.sserc.org.uk/health-safety/biology-health-safety/updates-on-health-and-safety-practice/.

Further reading and useful websites

- SSERC Microbiological techniques. This is a series of both cards and films which will be a useful source of training for teachers and learners, available at https://www.sserc.org.uk/health-safety/biology-health-safety/microbiological-techniques/.
- Topics in Safety, Topic 15: Microbiology, Association for Science Education, 2018.
- Basic Practical Microbiology: A Manual, Microbiology Society, 2016.
- Microbiology Online. This is the education resource website of the Microbiology Society, available at https://microbiologyonline.org/.

‘Gauzegate’

There will, hopefully, be few if any science departments across the country that have not come across this issue. And by the time you read this it is likely that the situation will have been resolved without too much drama. But at the risk of boring you, a brief recap.

A few weeks ago it was discovered that a few samples of ceramic-centred Bunsen gauzes from two suppliers had come back with a positive test for a very low level of contamination with asbestos. HSE issued advice on what to do, mirrored by ourselves and CLEAPSS.

Perhaps the key point from this is that HSE described the risk from these gauzes as **‘extremely low’**. In fact, when discussing dust and particles that tend to rub off these gauzes in storage, they said **‘these particles and fragments do not represent an airborne risk’**.

All the suppliers then rushed to get testing done on their current stock by approved laboratories and can all now assure potential customers that any new gauzes they buy will be entirely asbestos-free.

They have been unable, however, to offer reassurance for stock purchased prior to this event. Either testing was not done or it was done overseas, in good faith, but not matching the UKAS standards required to certify them as asbestos-free.

As a result, it looks like all ceramic-centred gauzes will have to be disposed of as asbestos-containing waste. This may seem an over-reaction but the Asbestos Regulations reverse the burden of proof in this context. Once there is suspicion, then material must be assumed to contain asbestos unless it can be proven not to. In this case that is not possible and so it needs to be disposed of.

The disposal process is quite simple, is not dangerous and does not, unlike most asbestos work, require special training or equipment.

Any gauzes should be carefully double-bagged and kept for disposal by a licensed asbestos contractor. HSE say that any other gauzes in the same tray/cupboard, even if they are plain metal, should also be disposed of.

Figure 1 - Bunsen gauze (Image by NagayaS (CC BY-SA 4.0)).

Apart from these, **there is no need to dispose of any other equipment stored with the gauzes**. Tripods, Bunsens and the like should simply be wiped down with a damp cloth and the cloth disposed of along with the gauzes.

We have come across cases where contractors have been sent in by the Local Authorities and have turned up in full ‘hazmat’ suits and removed everything - in one case even the cupboard. They have clearly not read the HSE’s guidance. If this happens, refer them to the guidance here [1].

At the time of writing, early October 2018, we are aware of no more than three schools that have found contaminated gauzes. We are unable to name the suppliers: HSE have asked us not to as there may yet be criminal prosecutions and early publicity could endanger their case.

For the future, the suppliers have all had their current stock tested appropriately and will, presumably continue to do so. In order to reassure yourself when purchasing stock in the future, ask to see a copy of the test certificate. This should be from a certified UKAS accredited laboratory and will contain some variant of this symbol. <<

UKAS TESTING

Reference

[1] http://www.hse.gov.uk/asbestos/wire-gauzes.htm (3rd paragraph of the ‘What do I need to do?’ section).

Changes to Radioactivity Legislation

This article is of particular importance to schools that own radioactive sources with activities greater than 200 kBq, for example a 370 kBq caesium-137 sealed source.

It doesn't seem that long ago (because it wasn't) that SSERC was getting in touch with all local authorities and independent schools to help them with the registration process that the HSE's new Ionising Radiation Regulations 2017 (IRR17) requires. Now there is another change in the law but this time it is environmental rather than health and safety legislation that is affected. Confusingly, both sets of rules use the same terms to mean different things.

The Legal Background

The new rules are called the Environmental Authorisations (Scotland) Regulations 2018 (EASR2018). These replaced the Radioactive Substance Exemption Order (Scotland) 2011 on September 1st of this year. Under the 2011 legislation, all school sources were either classed as out of scope or exempt. The term "exempt" could be confusing. Exempt sources were not "exempt" from any legal restrictions. Rather, you were exempt from telling SEPA, the Scottish Environment Protection Agency, that you had them.

Under EASR2018, most school sources are covered by General Binding Rules. There is only one significant change in procedure that we will come to shortly. One source that schools are currently permitted to hold comes into a new category called Notification. The term "Notification" is also used in IRR17 and was used in previous HSE legislation. In all cases, it has a different meaning. If this seems tortuous, do not worry.

What you must do

- If you have a 370 kBq caesium-137 sealed source, inform SSERC via rpa@sserc.scot;
- SSERC will then notify SEPA.

The source will almost certainly be similar to the one shown in Figure 1. There is a small chance that you own one of the Frederiksen 370 kBq caesium sources with a clear acrylic handle (Figure 2). We must know about these too [1]. The new law applies to any sources with an activity greater than 200 kBq. The caesium sources are the only ones that should be in schools. If you have others, please get in touch.

Figure 1 - Most Cs-137 370 kBq sources will be similar to this one.

Notification is done school-by-school rather than on a local authority basis, but kudos to SEPA for allowing it to be carried out by an external agency. This can therefore be done by SSERC as part of your RPA service.

When you must do it

Please tell us as soon as possible. Notification must take place by March 2019 and will be required every 3 years. Again, SSERC will handle this. We will know of any disposals or transfers of sources to new sites that take place between notifications because these are things that you are obliged to tell us.

Changes to disposal practices

The only other change, the one we alluded to when General Binding Rules were mentioned above, concerns disposal of sealed sources. Under the previous environmental legislation, all sealed sources permitted in Scottish schools except for the Cs-137 370 kBq source could be disposed of to dustbin (note that a protactinium generator does not qualify as a sealed source). EASR2018 is slightly different. To avoid sealed sources being recycled along with scrap metal, disposal to dustbin can only take place if you know that the source will end up in landfill. >>

We do not publish guidance online about disposal other than to ask that you get in touch with us. It is fairly rare that someone wants to get rid of an expensive-to-replace item that enhances a fascinating part of the curriculum, but it does happen. If you have made a disposal before, you will find that we will now ask you to take the following additional steps:

- Check that waste that cannot be recycled will go to landfill;
- Embed your waste source in mortar before disposal.

By grouting your waste source, even if rubbish is sorted by hand for recycling, your source will not end up being identified as scrap metal. Full instructions will be given by SSERC should you have to make a disposal.

We do not feel that these changes will cause significant problems for schools. As ever, if you have a query regarding the keeping or use of radioactive materials or would like to buy a source, email rpa@sserc.scot. <<

Reference

[1] Note that your RPA no longer permits this type of Frederiksen sources to be bought by member schools but if you have any, keep using them subject to their passing an annual leak test.

Figure 2 - Three Frederiksen sources.

The SSERC Bulletin is published by SSERC 2 Pitreavie Court South Pitreavie Business Park Dunfermline KY11 8UU
Managing Editor: Alastair MacGregor Telephone 01383 626070 enquiries@sserc.scot www.sserc.scot