

## The protactinium generator and its rivals



Figure 1 - latest incarnation of the protactinium generator.

In Bulletin 218, we last wrote about half life sources [1]. At that time, the protactinium generator was no longer in use in Scottish schools and a direct replacement had not been put on the market. A couple of years ago, the protactinium generator re-entered, blinking, into the sunlight (Figure 1).

Comparable in price to the Cooknell ionisation chamber kit and substantially cheaper than the barium eluting source, it is seen by some schools as a good way to demonstrate half life. We have risk assessed the new incarnation of the protactinium generator and have authorised its use. Though we will continue to do so, there are some things about this source that you should know.

- The protactinium generator has a recommended working life of eight years. At the end of the eight years, it will have to be disposed of. This will incur a cost which could be comparable to the initial purchase price. For some locations in Scotland, it could be considerably greater. If you are buying this source on account of its price this may well be a false economy if you take a long-term view.
- Our CLEAPSS colleagues have had reports of two leaking protactinium generators. One was found to be leaking on delivery. The other had been incorrectly stored on its side.

At this point, it is worth remembering that all half life sources have their good and bad points. The table below summarises the pros and cons of the ones approved by SSERC for use in schools.

Remember, you can't buy the barium eluting source or the protactinium generator without a letter of approval from the Scottish Government. We will help you with this.

Have a look at the Physics area of the CPD section of our website too. We run two courses on using radioactive sources. The fact that these are always well-attended, coupled with the enquiries we receive from people out to buy new sources, makes us very happy indeed.

### Rubbish legislation

Of all the sources that you are allowed to have in schools, only the protactinium generator should require a contractor for disposal. This is due to the chemical toxicity of the heavy metal, uranium, rather than a radiological hazard. Well, that's the theory and indeed the intention of the Exemption Order 2011 legislation. Excepting the protactinium generator, it should be possible to put end-of-life sources in the dustbin and dispose of to landfill. Unfortunately, we are in the faintly ludicrous situation whereby most sources are considered too active, according to another piece of legislation, to be taken from bin to coup in a refuse truck. This is despite the fact that it is legal for a lorry carrying 500 smoke alarms, ten of which would be as active as the most active school source, to wend its way around the country. Needless to say, we are working hard to have this situation resolved. ◀

### Reference

[1] [www.tinyurl.com/sserc-hl](http://www.tinyurl.com/sserc-hl).

Half life source	Advantages	Disadvantages
Barium eluting source	It is hard to argue against this being the best method, educationally speaking. The elution yields a radioactive liquid that is quite separate from the main source. The liquid's activity thereafter decays rapidly.	Relatively high initial purchase price. Extra cost of eluent. The elution has to be practised. Requires an annual "bleed-through" test, though this can be incorporated into a standard demonstration.
Protactinium generator	Relatively inexpensive to purchase. Older teachers are familiar with its use.	The only one of the three with the potential to cause serious harm in the event of a mishap, though the chance is small. Small number of reported leakages. High end-of-life costs. Hard-to-understand method of operation (some children think it becomes radioactive only when shaken).
Cooknell ionisation chamber with gas mantles.	Relatively inexpensive. Does not need a GM tube - a voltmeter or datalogger with voltage probe will suffice. No permission required to buy.	A bit of a "black box" (well, a blue box) whose internal workings need to be explained to pupils.