Northern Biological Safety Officers Meeting

Minutes of the meeting held on 4th December 2009
Newcastle University

Open session

1. Disinfection and fumigation of safety cabinets – a manufacturer/supplier perspective

Contained Air Solutions gave an overview of different methods of decontamination of microbiological safety cabinets. In their experience, the majority of users (65%) used formaldehyde, with approximately 10% using vaporised hydrogen peroxide and the remaining 25% relying on a physical clean with an appropriate disinfectant. It was noted that many of the cabinets installed in the University Sector were of the Class 2 type.

The use of recirculating cabinets presented its own problems as regards decontamination using formaldehyde with various methods for removal of the fumigant available including:

- The use of carbon filters – these could be installed within the cabinet or else mobile removal units used;
- Ducting the formaldehyde from the cabinet either through a fume cupboard or externally ducted safety cabinet; or
- Neutralising units (using ammonia).

The pros and cons of the different disinfection methods were outlined but it was noted that CAS did not recommend any particular system but were able to supply as required by the user.

Before carrying out any work on a cabinet, CAS required a "permit-to-work" from the user. This provided an assurance that the cabinet was clean and safe to work on; the means of disinfection used being appropriate to the work that had been carried out, with cabinets used in Containment Level 3 laboratories undergoing a full fumigation before any work was undertaken. CAS staff would also wear any personal protective equipment that may be required eg laboratory coat, gloves etc.

The use of UV light as a means of disinfection was also discussed. While this can be useful, it was noted that the efficacy of the bulbs decreased with time and they needed regular replacement to ensure maximum efficacy.

The issue of whether CAS would require a full room fumigation before working in a CL3 laboratory was raised. It was thought this would depend on the type of work to be carried out, for example, if a new cabinet was to be installed in an existing CL3 laboratory, then fumigation would probably be warranted.

The use of mobile carbon filter units to clear a room of fumigant was raised. It was thought that this may be difficult given the scale of even a small room as compared to a cabinet. There was also the issue of removal of residual fumigant, although this

may be made easier if the air within the room could be kept moving eg by using cabinet in recirculating mode.

The risk from exposure to residual formaldehyde on HEPA filters to service engineers was discussed as it was acknowledged that there was potential for repeated exposure especially when the cabinet was first switched on post fumigation. It was suggested that service engineers could use a portable sensor before starting work to check that levels were below the WEL.

2. Alternatives to formaldehyde fumigation: Efficacy, safety and ease of use

The Health and Safety Laboratories presented the findings of the HSE sponsored research comparing formaldehyde fumigation to other means of gaseous disinfection of CL3 laboratories. The disinfectants that were compared with formaldehyde included:

- 3 different systems using hydrogen peroxide
- Ozone
- Chlorine dioxide

The different systems were tested in both an exposure chamber and a functioning CL3 laboratoryto assess the usability and safety of each system – both contained basic items of laboratory furniture and equipment although the chamber did not contain a microbiological safety cabinet. Chlorine dioxide was not tested in the laboratory because of alterations that would have been required to deliver the gas.

A number of different test organisms (*Geobacillus sterothermophilus*, *Clostridium difficile*, *Myobacterium fortuitum* and Vaccina virus) were positioned around the chamber and the laboratory so as to assess the penetration efficiency of each of the test systems – this included a simulated liquid spill.

It was noted that 600ppm formaldehyde and chlorine dioxide consistently achieved the best results with 4-6 log reductions seen in across different locations/test organisms.

Other issues noted during the research included:

- Removal of fumigant – when cardboard was “planted” in the room, levels of 20ppm formaldehyde were measurable 24 hours after removal of fumigant. 15-50ppm H_2O_2 was measured 3-4 hours after aeration of the room;
- Ease of use – setting up formaldehyde fumigation was relatively straightforward once the relative concentrations of formalin and water have been calculated, and the chemicals were cheap and easy to purchase. The H_2O_2 systems were more expensive and the chemicals had a limited shelf life. In addition, where bespoke devices were used to deliver the fumigant, these machines all suffered technical problems and required careful set-up; in particular H_2O_2 systems needed regular use (weekly) otherwise there was an increased risk of breakdown.

The following issues were raised in discussion:

- Time taken to carry out a non-formaldehyde fumigation – although this should normally be carried out overnight, it was possible to re-enter a H_2O_2-fumigated room only 2-3 hours after aeration.
- Formaldehyde residue on surfaces – this was not detectable after a single cycle of fumigation.
- Whether increasing the concentration of formaldehyde above 600pmm would lead to a more reliable kill – given the log reduction already recorded, it was thought that increasing the concentration would not make that much difference.
- Publication of results – it was likely that the research would be published in Applied Biosafety and that HSE were likely to produce a concise guidance document based on the research. The manufacturers of the various devices tested had all been made aware of relevant findings.
- Future of formaldehyde as a gaseous disinfectant – advice from the HSE Biocides Unit was that there was no imminent "ban" likely.

3. VHP – personal experiences

Imperial College presented their experiences following the installation of various vaporised hydrogen peroxide systems at Imperial. The technique had been selected as a means of future proofing, ie in the event formaldehyde was no longer permitted to be used as a gaseous fumigant.

Its use was evaluated in four different areas with differing levels of success:

- To pre-treat materials entering an transgenic facility (via a chamber) – significant issues were identified including out-gassing from materials following treatment, long cycle times which required changes to be made to the ventilation system to decrease cycle time and limitations on the amount of absorbent material that could be treated;
- To decontaminate transgenic facilities and equipment contained in that facility (using mobile units) – it was claimed that the unit would be able to penetrate cages within the room, and while there was good kill within the room, the system could not penetrate cages in racks or filter units on the racks. Some damage to paintwork was also noted but this was an area that recently been re-painted and so highlighted that the finish had not been to the appropriate standard.
- To fumigate recirculating Class 2 safety cabinets in CL2 laboratories using mobile units – initial development of the appropriate cycle took some time. One of the reasons for choosing this technique was that there was potential for time savings because of the shorter fumigation cycle, but the cost of a single unit has meant that realistically only one unit was available to fumigate a number of cabinets and so it still takes some time to decontaminate cabinets ready for servicing etc. However, the use of one unit to fumigate up to three cabinets is currently being investigated

- As means of fumigating CL3 suites using a unit integrated into the suite – initial cycle development was lengthy and complex and installation of the system had meant a significant number of extra penetrations into the facility. It was found to be difficult to deliver a reliable and consistent cycle even in a small room with initial tests revealing problems if condensation occurred - damage to paintwork and metal on fridges, microscopes and cabinets (although this probably only revealed points of weakness eg poor/incomplete finish). However subsequent tests where condensation was not an issue did not lead to any damage. There were also an issue as regards absorption of hydrogen peroxide by the Trespa benching with levels of 1.6ppm being measured 72 hours after aeration.

The efficacy of the system was only assessed in the cabinets using simulated liquid spills of *Mycobacterium tuberculosis* and metal coupons coated with *Geobacillus sterothermophilus.* While a 6 log reduction was achieved with the latter, only a 3-4 log reduction was seen with the *M. tuberculosis.* Levels of hydrogen peroxide were also measured within a cabinet and it was evident that the fumigant did not reach effective levels consistently throughout the body of the cabinet.

4. Open discussion

The following issues were raised in discussion:

- Shelf life of hydrogen peroxide products – it was noted that certain products had a defined shelf life and that some of the systems would not use out-of-date products leading to the expense of disposing of unused chemicals
- It was reported that the chlorine dioxide system tested by HSL was a large system that needed to sit outside the room and so required holes in the doors of the room to deliver the gas. This could be designed into a new build but was perhaps less easy to retrofit. The gas is generated catalytically and removed the same way.

5. Update from Steering Group

- **Minutes of last meeting** – these were agreed and would be posted on the ISTR website
- **Steering Group Activities**
    - BSO/A survey - respondents were asked to consider how best to make use of the information gathered by the survey
    - Volunteers were sought for the steering group as current members had now served 18 months of their 2 year term. Ideally a fourth member could be identified to work alongside the current group before one of them stood down.
    - SRF – members noted that a HSE workshop had been attended by some of the group to discuss a draft of the Contained Use 2010 regulations and associated guide. A note of that meeting had been circulated to members.

- Fumigation survey – a limited number of responses had been received to date, but of those received all bar one used formaldehyde, with the other using hydrogen peroxide. Also noted was that most carried out their own in house validation of the process. It was suggested that the survey could be extended to animal houses as they also used fumigation as a means of room disinfection. Members discussed the pros and cons of carrying out fumigation on a routine basis as opposed to only in an emergency.

6. Next Meeting

The next meeting would take place at the University of Edinburgh. The steering group suggested that the agenda for the next meeting could be a continuation of the topic of decontamination, building on today's presentations and discussions. However, in light of the forthcoming consultation on the SRF, members were asked to consider whether the group should use the opportunity of the next meeting to review and discuss the draft regulations etc. It was agreed that this would be useful and that to ensure that individuals and the group had sufficient time to respond to HSE that the meeting should be held earlier than normal - towards the end of March.