Guidance for school Science & Technology coming out of lockdown

Version 9 - 7th April 2022.

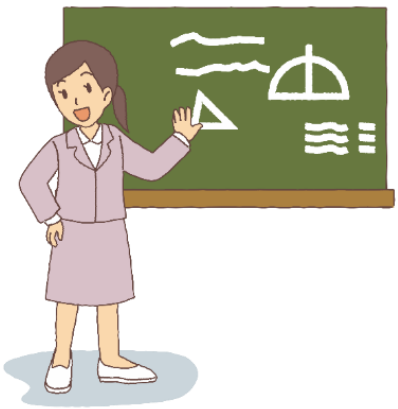
Introduction

This document focusses on the sciences and technologies. More detail, particularly about wider school issues can be found in the official Scottish Government advice which can be found here (https://www.gov.scot/publications/coronavirus-covid-19-guidance-on-reducing-the-risks-in-schools/) and for colleges here (https://www.gov.scot/publications/coronavirus-covid-19-guidance-for-colleges/)

We are currently at an interesting stage. The pandemic is definitely not over and infections are currently at very high levels. But we are also in the position where restrictions have been relaxed, if not entirely removed.

The situation will vary significantly across the country: learner rolls, numbers and location of teaching rooms, their dimensions and arrangements will all differ not just from Authority to Authority but from school to school. The advice in this document, therefore, is necessarily general in nature but SSERC will be happy to provide specific advice to schools and colleges if needed.

It is important to emphasise that the whole procedure for removal or imposition of restrictions should be led by risk assessment - this risk assessment should directly address any risks associated with coronavirus so that sensible measures can be put in place to minimise those risks for children, young people and staff.



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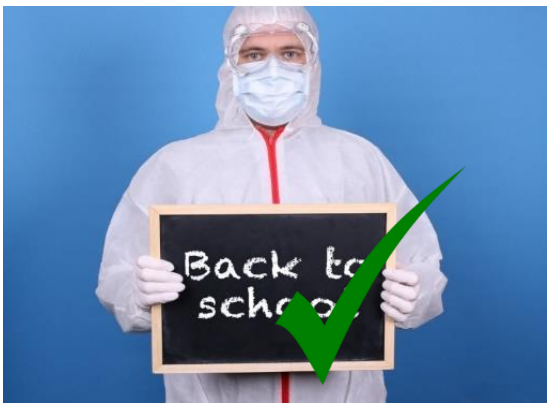

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Differences from previous versions

2.0 In consultation with the Scottish Government, sections offering more general advice for schools have been removed as these are dealt with by government publications. The document now focusses more narrowly on the sciences and technologies.

- Reformatting and branding.
- Some changes to phrasing in a few places to increase clarity.
- More guidance (in section on Hygiene) on the cleaning of equipment such as tools and computers.
- New short section with information on other help SSERC can provide.

3.0 In light of the revision of guidance regarding returning to school (30th July). Substantial changes in the sections regarding social distancing. Minor alterations elsewhere that reflect this. FAQ section now included.

> Further details, as they come, will mainly be addressed via a FAQ section which will be placed at the end of the document.
>
> Latest FAQ update – 12th April 2021

4.0 Changes in the section regarding sanitizing of equipment in light of revised government guidance.

5.0 For reopening in March 2021 there is a return to a 2m distancing between learners in the classroom as well as adults. Thus an emphasis on a blended learning approach.

6.0 Various relatively minor clarifications and . . .the 2m physical distancing between learners has been removed again. The section on Ventilation has been expanded (and pulled out to have its own heading). The section on outdoor learning has been expanded with more links.

7.0 No significant changes for the start of term – but there are proposed ones for a few weeks later. A minor change relating to physical distancing requirements along with a few clarifications.

8.0 Revised guidance in line with the new, more infectious, omicron variant.

9.0 Revised guidance in line with reduction of restrictions.
Changes shown in green

Contents

A holistic approach

The measures outlined in this and other documents are none of them exclusive of others: they are part of a whole.

Good hand hygiene in your school does not mean that there is no need to maintain spacing. A reduction in interactions does not mean that you can neglect the cleaning of surfaces.

We all of us need to implement as many of these measures as far as we possibly can. It is the combination of approaches that will help us in our fight to keep the coronavirus under control.

Additionally, even while coronavirus cases are decreasing, the measures in place will also reduce transmission of various other diseases such as Flu and Norovirus. Reducing these as we go into winter will further help reduce the load on the NHS.

Prior to Returning

This is unlikely to be relevant now as schools have been open at least partially for a while now. It is retained for the sake of completeness and also as a list of things that might need re-checking after the summer break

When returning to school there are some important things to consider before 'normal' activities begin again. Most though not all of these are activities for technicians:

- **Taps and Sinks**: - The HSE has recently issued guidance regarding Legionella in workplaces that have been in lockdown. The school/Local Authority should have procedures in place for managing this risk. Consult them before using any water supplies. If they are content that all appropriate measures have been taken, then run the water for 5 to 10 minutes through the system to ensure it is working. This will refill any drain traps which have evaporated. (https://www.hse.gov.uk/coronavirus/legionella-risks-during-coronavirus-outbreak.htm)
- **Chemical Store: -** Check that the store is secure and has not been tampered with in any way. Chemicals that exist on the latest stocklist are all present and accounted for. There may be specific chemicals that required attention due to shelf life, such as potassium. Look for any distortions in bottles that may indicate pressure build up. If there are any signs of leakage, or any unusual smells, seek guidance immediately. If there is no one on site who can help, contact SSERC.
- **Radioactive Store**: - Check that the store is secure, and all radioactive sources are present and accounted for. Check that the sources are still within their leak test period. If there are any overdue tests or checks, these should be carried out **before** practical work resumes with sources.
- **Electrical Safety**: - It may be that some electrical items are outwith their PAT test period. Check all electrical equipment before use and label and remove any items that fall into this category to be tested. If the testing is done inhouse, then items can be tested on a rolling basis as they need to be used. If it is done externally, contact the company as soon as possible to arrange a test before the start of term – if possible. If testing cannot be done in time, make sure the teachers know so they can plan their lessons accordingly.
- **Equipment yearly checks**: - Fume cupboards, autoclaves, extraction systems, steam engines, and other bits of equipment may be out of their yearly test period. If so, they must be fully tested and comply with all relevant regulations before being used. As with PAT testing, if it is not being done inhouse then contact the testing company as soon as possible to ensure it can be done before the start of term. Again, if there is a delay, let the teachers know to inform their planning.
- **Gas Supply: -** Check all rooms with a gas supply for full functionality. It may have been switched off at the building's main gas valve. Immediately report any gas smells as this may indicate a leak.
- **Electrical systems: -** If any of the rooms have an emergency shut down system, check that it is still fully operational, and all buttons function correctly. Report any faults immediately.
- **Eyewash: -** If you have eyewash bottles in labs/workshops, check they are not out of date. If, as is better, you have an eyewash station, ensure the tubing is sterilised and replaced above the tap. (A plumbed in station will only need to be cleaned and run for a while – once Legionella tests have been carried out.
- **Fridges and Freezers: -** Check that these have not been tampered with or switched off. If they have, they will need to be emptied and cleared out – this should be done carefully particularly if there was organic material inside that might have rotted.
- **Microbiology –** Dispose of all sub-cultures and plates. Check the master culture is still in date. Disinfect "Clean Room" surfaces and all storage fridges. While Virkon is a common 'go to'

disinfectant, any surfactant disinfectant, including a dilute solution of bleach, is suitable. If microbiology work is being undertaken, new cultures might need to be obtained.

- **Machinery –** If there is machinery in technology (or other areas) that needs regular checks, these should be carried out before any use of the machinery.
- **Ventilation: -** It is a good idea to open all windows and let rooms ventilate for at least 5 minutes.
- **PPE: -** It should be noted that advice from Health Protection Scotland and the Scottish Government is that there is no need for any PPE to be used other than for the Health and Safety purposes that existed previously as a result of risk assessment.
- Any PPE should be checked by a competent employee that it is fully functional and has no damage **before** use.

  N.B. It may be that your school has donated some of their PPE as a result of COVID-19. If this is the case, no activities that require the use of this PPE should take place until it has been restocked. Each member of staff should have personal eye protection and should be provided with suitable antiviral wipes for cleaning through the day.
- **Social Distancing –** The latest government guidance is that there is no requirement for social distancing among learners in school. Distance should, however, be encouraged where possible and close interactions minimised as far as possible.

  However, the current distance guidance for adults says “at least 1m” but 2m should be adhered to where possible between adults and between adults and learners who are not family members.
- **Equipment and ordering –** Although practical work **can** be carried out by groups now, individual work is still preferable where possible. In this case some readjustment will be needed. This may also make a case for purchasing extra equipment, where this is feasible.
- **Setting out and clearing up** - The best option remains for equipment to be set out for each learner (or small group) in trays as this will reduce interactions while they collect their own. More trays may be needed.

  In addition, the setting out and clearing up of practical classes may take longer than before so technicians should be consulted about feasibility when any new timetabling arrangements are drawn up. The time taken and the practicalities of cleaning and sterilising equipment between uses will also need to be considered.

Consultation

As mentioned in a couple of places above, there are likely to be all sorts of changes needed to how teaching in general and practical sciences and technologies in particular are managed. Extended time needed for setting up and clearing away may affect timetabling. Changes may be needed to experiments. Some equipment will need to be disinfected on a regular basis. More individual kits may be needed which may have purchasing as well as preparation implications etc.

It is important that technicians are consulted fully before these changes are implemented to avoid the risk of measures being put in place that turn out to be impractical.

Positioning learners in labs/workshops:

Revised government guidance means that there is now no absolute **requirement** for permanent physical distancing among learners and teachers or other adults in laboratories or workshops. So, there is no need for measuring out for repositioning learner workspaces.

However, the virus **is** still here and it is highly infectious so it would be sensible and responsible to try to maximise distances between people as far as is reasonably possible.

Where possible arrange that learners are not seated across from each other but side by side. An option might be, where possible, to use any side benches for some student seating – this would also help with further distancing.

In colleges, the guidance says to "consider where some physical distancing might still be helpful in managing transmission risks." So the above advice is applicable here as well.

Research suggests that transmission by droplets and particularly aerosols is the main route of infection. An important measure for mitigating this is distance. Schools and colleges should still be trying to ensure that where possible a significant distance is maintained between learners and between them and adults.

Permanent groupings

There is no requirement for groupings ('bubbles')

That said, given the high rates of infection and the disruptive effect on schools from the absence of pupils and teachers, where it is possible to maintain semi-separate groups to reduce mixing – even if this is only year groups – this would seem a sensible approach.

Entry and Exit

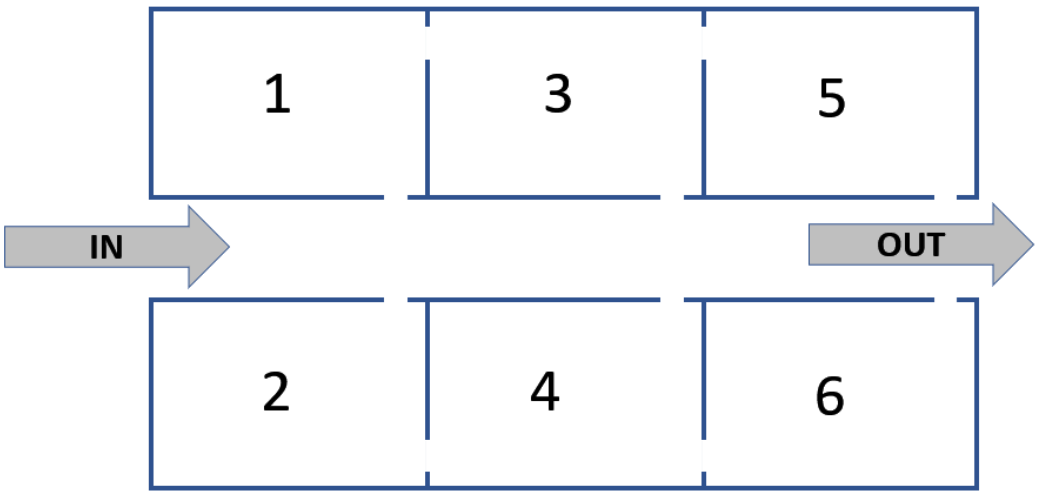
Into the school

Advice on this is more general and thus outwith the scope of this document. Guidance has been provided by the Scottish government and can be downloaded from here (https://www.gov.scot/publications/coronavirus-covid-19-guidance-on-reducing-the-risks-in-schools/).

Entering/leaving the Lab/Workshop

Given the relaxation of rules, there is clearly no requirement for setting up any sort of a one-way system – however, if it is still in place in your school/college, it would seem sensible to retain it – for a while at least.
The details below are unlikely to be relevant but are retai9ned for the sake of completeness.
While brief interactions such as might happen while entering/leaving are generally an insignificant risk, every little helps. If it is feasible to arrange a one-way system, or to control entry and exit to minimise interactions then you should do so.

e.g.



- If doors are not fire doors, then leaving them open will aid ventilation and more importantly reduce touching of them. However, **fire doors must not be left propped open**. Check before having any open doors. (see section on ventilation).

Managing practical activities

There is now no requirement for physical distancing between learners and between adults (or between adults and learners). However, proximity remains a risk. Wherever possible, distance should be maximised between learners as well as adults.

The latest guidance from March 2022 removes any comments about the need for disinfecting/quarantining equipment.That said, **where possible,** it is still preferable to have learners working on their own and not sharing equipment.

The risk of infection from the equipment itself does indeed seem to be very low but learners working together are inevitably going to be working in quite close proximity and it remains the case that distance between learners should be maximised where it is not problematic to do so.

As with other sections of this guidance

Ways to reduce sharing of equipment

Where there is equipment that needs to be shared – eg microscopes, workshop machinery – there is no need to put complicated arrangements in place to avoid sharing. Any transmission from the devices themselves is likely to be minimal but it would be wise, as in other cases, to maximise distance while learners are waiting for their turn.

- Practical lessons may still take longer than normal to complete; this is likely to be a particular problem if your school has short lessons. The Head of Department (in consultation with the technician team and senior management) should ensure that the timetable is changed in such a manner as to make the preparation and clearing away of any practical equipment feasible.
- As with other subjects, having longer lessons, having very long blocks of individual subjects, might be a good way to minimise movement of groups around the school. In the sciences and technologies this may well have implications for preparation and clearing away of practical work.
- Teachers (in discussion with technicians) will have to plan and take into account requirements for each practical (e.g. available equipment) and decide whether it can be safely managed as a class activity (can learners work individually not in groups?) or needs to become a teacher demonstration.
- There is no need to worry now about longer, more complicated practical work though anything that means there is less need for close proximity between teacher and learner is sensible.
    - An option might be in some cases to adapt the 'integrated instruction sheets' as developed by many educators. See this RSC article for more information: https://edu.rsc.org/feature/improving-practical-work-with-integrated-instructions/3009798.article
    - An extension of this is to use PowerPoint to animate the steps in the integrated instructions – an example can be found **here.**
- It is still advisable for learners to work individually wherever possible rather than in pairs or groups. But only if this is not disruptive to the learning process. For instance, there should be no need for simple chemistry experiment using test tubes to be carried out in pairs or groups. (microscale

chemistry can be a useful alternative in some cases) But this does not preclude group work though. For instance, different individuals could investigate different factors affecting the rate of reaction and then share their results (electronically).

- Where learners are still working individually, some practicals may take longer to complete, but time can be saved by
    - Having reagents pre-weighed or measured.
    - Using a 'flipped classroom' approach so that learners familiarise themselves with the experiment before coming into class to carry it out.
    - Learners can also share their data after the practical if required.
- Time must be allocated at the start and end of lesson for setting up/clearing up. This will need to be allowed for in the timetable.
- Once the practical has finished, learners should tidy up their equipment, wash / sanitise their hands then leave the room in an orderly fashion similar to their entry. (See later section on hygiene).
- If teacher demonstrations are being carried out, it is important there is still at least a 1m distance between the teacher/demonstrator and any learners (ideally more). (This should be the case for most hazardous chemistry demonstrations anyway. However, the nature of a demonstration means that learners will inevitably be crowding quite close together in order to see; so, using AV equipment to project the demonstration is a good way to prevent this and should be the preferred approach.

  An important part of many demonstrations, particularly chemistry ones, is their multisensory nature. It is better for the demonstration to be carried out live in class rather than just watched on video – that way the learners will experience the sounds and smells as well.
- There is now no requirement for teachers to keep a specific distance when observing the learners as they work through the practical activity (or carry out any other work). This mitigates any of the H&S concerns about pupils working partially unsupervised: there are no problems with teachers being at any distance to ensure safe and effective work.
- Where possible, it might be helpful to have learners able to carry out **some** practical work at home. This could either be a part of catching up with missed work due to self-isolation (or conceivably if there is a rise in cases causing schools to be closed again at some point in the future).

  If it is simple, then kits can be sent out and learners can have a 'cook-along' approach or work autonomously. It will help break up the routine of home working for learners as well. Details of some possible activities (particularly for chemistry) can be found on the SSERC Home Learning pages.

Problematic Activities

There are certain procedures that are commonly carried out in science lessons that are problematic in varying degrees in relation to Covid-19.

We now think that, once again, most of these can still be carried out in a relatively normal manner.

Cheek cells

Looking at cheek cells under the microscope is low hazard. Normal practice would be that students swab their own cheeks and the slides are placed in a container of disinfectant at the end.

If you are concerned, though, then SSERC has an alternative using liver cells that you can find on the website.

Digestion of starch by salivary amylase

Similar to the above. The activity itself is of very low risk but there is a slight risk from the removal of masks to collect the saliva.

Alternatively, plant sources of amylase could be used.

Blowing through limewater/indicator solution

Again, this is fairly low hazard, particularly if the straw is pushed through a bung of cotton wool to act as an extra filter. Any aerosols produced will remain close to the individual rather than being projected across the room.

As an alternative, you can chemically produce a bit of CO_2 (with an acid and carbonate for instance) and use a Pasteur pipette to bubble it through.

Peak Flow meters

The problem with these is that they result in the propelling of a plume of exhaled, and potentially contaminated, air across the laboratory.

Given that learners are no longer required to wear face coverings, although blowing through peak flow meters is an extra risk, it is unlikely to be large.

It would still be preferable to use them outside (or perhaps to arrange that the airstream goes directly into a fume cupboard) or leave this activity for a later date but if this is difficult then there is no reason why the activity absolutely cannot go ahead.

Tidal volume and Vital capacity

As with the peak flow meter activity above, any activity that involves working on exhaled human breath is possibly still avoided for the time being but there is no absolute reason not to carry it out if you wish.

Pulse rate

As with most other physiological studies, there is no significant problem with this.

Hygiene

While the mention of distancing in the guidance has been reduced to “it is safer to keep a distance from other people” and learners are no longer **required** to wear face coverings in class, there is still mention of washing hands and cleaning surfaces.

Although evidence now suggests the impact of this on Covid is likely to be slight, it will certainly have an effect in reduction of Flu, Norovirus and various other illnesses as these definitely **are** transmitted from surfaces. This will further reduce pressure on the NHS at a time when Covid cases are increasing.

Hand washing & personal hygiene

By far the best way of ensuring clean hands is washing with soap and water. Obviously, there will be issues with access to sinks for a class of learners (even a small class) but there are other possibilities.

- If soap and water is not available, a suitable hand-sanitiser is the next best option.
- Ideally, each learner should be provided with a personal bottle of hand sanitiser by the school, which they can use to clean their hands before and after practical work. If this is not possible, hand

sanitiser should be provided at least in each laboratory/workshop, particularly where there is equipment that may need to be shared.

- There should be a supply of tissues in each laboratory (in addition to supplies for individuals). Used tissues should be placed in bins that are emptied regularly.

Hand Sanitisers

These are less effective than soap and water but better than nothing.

They do tend to be less effective where hands are dirty or greasy – which may be problematic in some school situations.

Alcohol-free sanitisers are less effective. Aim for ones containing at least 60% alcohol. **Some** alcohol-free sanitisers may work but check carefully before ordering them.

N.B. If alcohol-based hand sanitisers are used, the bottles should be kept well away from any sources of ignition and no naked flames should be used for several minutes to avoid possible ignition and burns.

PPE

As mentioned earlier in this document, this is guidance specifically for the use of PPE in standard activities In the sciences and technologies. There is no need for PPE to be worn more generally (but see 'Face-coverings').

For detailed advice on this sort of PPE and Covid-19 see the Health Protection Scotland and Scottish Government websites.

- We know many schools have donated all of their PPE to the NHS. You can expect demand for PPE to be very high, so it will take time and money to restock supplies.

Face-coverings

There has been no change in the specification of face coverings. 'Normal' cloth or disposable coverings are acceptable – subject to appropriate cleaning/replacement.

At the time of writing, while face coverings are no longer required by learners in class, they are still required in communal areas, by teachers and other staff and in some other circumstances such as sitting exams.

However, there is some lack of clarity here. Earlier in the Schools document it says

> *The general guidance for safety in the workplace should be adhered to. This includes consideration of both:*
>
> - *physical distancing*
> - *the use of face coverings by all staff and young people in secondary schools, and by all staff in primary schools, in indoor communal areas and when moving around the school building*

While in the document for colleges, it says *"consider encouraging continued use of face coverings, even when not mandatory, in settings where risk of transmission might be considered higher".*

It seems likely that the suggestion being made is that if the risk assessment requires it then distancing and face coverings can be required in any establishment.

- As long as they are still being worn, schools should raise awareness amongst children, young people, and staff about the correct way to remove and store face coverings. This can be done well in biology lessons. It could be helpful to adapt some common microbiology experiments so that they highlight potential transmission from face coverings such as SSERC's 'Beat Those Bugs' or 'Toilet-tissue Challenge'.

- **Eye protection**

  More extensive details about the use and cleaning of eye equipment can be found in a separate document here (https://www.sserc.org.uk/wp-content/uploads/2020/09/Eye-Protection-and-Practical-Work.docx).

  SSERC's view, in light of the low transmissibility from surfaces, is that the cleaning/sanitising of eye protection (or other equipment) is now less important than before. The latest guidance for schools makes no mention of sanitising or quarantining of equipment of any sort so it seems unnecessary to apply it to science/technology equipment.

  Learners should still be reminded to wash their hands before putting on eye protection.

  As in many other cases, although there is no requirement to do this it would seem sensible to carry out such cleaning/sanitising from time to time if possible – perhaps on a weekly basis.

  Given this relaxation, there seems no need to continue to include detail of cleaning methods in this document –

  More detail can be found in the document **Eye Protection and Practical Work**

- **Gloves** – Gloves are rarely required by learners doing practical work. However, where we advise the use of gloves then the correct type should be worn.
- **Lab coats** –as these are not PPE they are not **required** for most practical work (microbiology being a notable exception). There is no need now to impose restrictions on the sharing of Lab coats. Staff clothing, including lab coats should be washed as normal.
- **Staff:** It is still sensible, for a variety of reasons, for staff to have their own PPE.

Laboratories/Workshops

- **Ventilation**: see separate section below.
- **Benches** will need cleaning as per the guidelines for all classrooms in the rest of your school. Door handles and plates in particular (as well as any other frequently touched items) should be cleaned down on a regular basis.
- Appropriate cleaning supplies should be in each laboratory to enable learners to wipe down their own desk/chair/surfaces before leaving and, especially, on entering the room.

Ventilation

As the pandemic has developed, it has become clear that the main route of infection, for Covid-19 is by inhalation of particles which can sometimes spread relatively large distances.

The main problem comes from bioaerosols, droplets or particles smaller than 5 micrometers. The particular problem with these is that they can remain suspended in the air for extended periods and move with air currents.

Larger particles are less concerning as they tend to sink to the ground and remain there.

We are being told, quite sensibly, that ventilation is important and that we should open windows or find other ways to increase ventilation.

How do I know if I need to increase the ventilation?

By now, most schools and colleges should have access to some sort of CO_2 monitors. These can act as a proxy for ventilation rate.

In order to get a reasonable figure from your monitor:

- Place it at head height
- Keep it away from windows
- Keep it away from doors
- Keep it away from air supply openings
- Position the monitor over 50cm away from people as their exhaled breath contains CO_2. If your monitor is too close it may give a misleadingly high reading.

CO_2 levels vary within an indoor space so try out several locations to find the most representative position for the monitor in the space.

Levels

A consistent CO_2 value below 800ppm is likely to indicate that an indoor space is well ventilated.

CO_2 levels consistently higher than 1500ppm in an occupied room indicate poor ventilation and you should take action.

CO_2 levels below 800ppm are recommended for areas with continuous talking, singing or high levels of physical activity such as sport or dancing

Remember other factors

Aside from anything else, the opening of windows to reduce build-up of viruses needs to be considered in conjunction with other factors such as room temperature that could be deleterious to health and welfare of students and teachers.

Ventilation

It seems important, therefore, that we should be able to make the most of any ventilation we already have.

Mechanical Ventilation

Science laboratories have an advantage in that they should be designed and built with ventilation in mind, particularly chemistry labs. This is in order to remove airborne contaminants such as CO2 from Bunsen burners, fumes from solvents etc. If this ventilation is working well, it should be equally effective at removing airborne Covid-19 containing aerosols.

Air conditioning?

If the air conditioning is taking in air from outside there is little problem. If it is a self-contained system that is simply recirculating air within the same room then it does create a marginally higher risk but there will still be a significant level of dilution. For airborne infection proximity seems to be the most important factor.

HSE guidance says that the risk of air conditioning spreading coronavirus (COVID-19) in the workplace is extremely low.

However, they do suggest that *'. . . if you use a centralised ventilations system that removes and circulates air to different rooms it is recommended that you turn off recirculation and use a fresh air supply.'*

So you should check (or get someone else to check) the way the ventilation system works for your laboratories and classrooms – If the air is being drawn in from other rooms that have people in, it should be turned off.

Passive Ventilation

This is the ventilation you get from opening doors and windows. But it is more complicated than you might think.

The HSE suggests various measures:

- Partially opening windows and doors can still provide adequate ventilation
- Make sure trickle vents (small vents usually on the top of a window) or grilles are open and not blocked. Air which flows in from these vents will mix with warm room air as it enters, which helps keep the room a comfortable temperature.
- Open higher-level windows to create fewer draughts (rather than at the level of students)
- If the area is cold, relax dress codes so people can wear extra layers and warmer clothing
- You could set the heating to maintain a comfortable temperature even when windows and doors are open
- Consider providing additional sources of heating if required. Only use fan convector heaters if the area is well ventilated
- You can also regularly air the space in rooms that rely on natural ventilation, by opening windows and doors as fully as possible.

  For example, you can do this when people leave for a break. Even 10 minutes an hour can help reduce the risk from virus in the air, depending on the size of the room.

Purging (airing) rooms

Airing rooms as frequently as you can improves air quality. Opening all the doors and windows maximises ventilation in a room. It is better to do this when the room is unoccupied to avoid discomfort.

Research shows that being in a room with fresh air can reduce your risk of infection from particles by over 70%, as fresh air dilutes the particles[1].

As we spend more time indoors, experts are recommending that people either:

- open windows for short, sharp bursts of 10 to 15 minutes regularly throughout the day
- leave windows open a small amount continuously

"Opening windows for short periods of time (10 minutes every hour or two hour) may be effective at reducing risks without significantly compromising temperature."– Dr Louise Smith, King's IoPPN[2]

Interestingly, in Germany, airing of rooms, including classrooms, has been taken much more seriously.

The practice of stosslüften, opening a window in the morning and evening for at least five minutes to allow air circulation is of long standing. Even more effective is querlüften or cross-ventilation, which involves opening all windows.[3]

A recent gathering of the ministers of education for Germany's 16 states was dedicated to how to air a classroom. The Experts reinforced the importance of airing a room every 15 to 20 minutes, for five minutes in spring and autumn, and three minutes in winter.[4]

The decision about how often this purging should happen and for how long should be taken by the school or college

Ongoing ventilation

If your school does not have windows that open, this this is going to be problematic, to say the least. But for anyone who does have opening windows, there is a number of questions:

- How long should the windows be open for?
- Which windows should be open? Should doors be opened as well?
- How should they be opened?
- What if there is no wind?

How long?

It is clear that ventilation should be maximised. So windows should be open for as long as possible. But we are not talking about the wide open 'purge' ventilation discussed above but rather a constant 'trickle' ventilation. In this case, the level should be set such that the ventilation is as great as possible without causing discomfort to students and teachers.

[1] https://www.gov.uk/government/news/new-film-shows-importance-of-ventilation-to-reduce-spread-of-covid-19

[2] https://www.kcl.ac.uk/news/opening-windows-for-short-periods-of-time-could-help-prevent-covid-19-transmission

[3] https://www.theguardian.com/world/2020/sep/30/germans-embrace-fresh-air-to-ward-off-coronavirus

[4] https://www.kmk.org/presse/pressearchiv/mitteilung/kmk-expertengespraech-lueften-in-schulraeumen-richtiges-und-regelmaessiges-lueften-bleibt-a-und-o-bunde.html

Which windows?

The best method is having a breeze enter one window and exit directly from another one placed opposite the first (or possibly a door). Don't worry too much about them being precisely opposite, the air will find a way to the open areas even if windows are situated at 90 degrees from the inlet window so as long as they are on different walls, it will help.

Opening doors can be problematic as far as noise goes. It would be a good idea, then, to have the door open only slightly. There will still be significant ventilation through it. Fire doors should not be propped open but while there are people in the laboratory, having them open is not problematic. If the room needs to be evacuated the door will be opened anyway and as long as it is closed after exiting then fire breaking abilities of the door will not be impaired.

How to open them?

Where there are sash windows – or tilting ones that open top and bottom - to getting the best flow of air slide the sashes so the window is open equally at the top and bottom. (Tilting windows do this automatically). The warm air inside the room passes out through the top opening and the cooler air from the outside comes in through the lower opening.

Effect of the wind

Clearly the wind will have an effect on airflow. In general, it is probably preferable to have windows facing the wind open less than the ones on the opposite side. Ventilation will still take place but there will be less of a draft.

When there is no wind, the air change rate will be lower. You can increase it simply by using a fan. (or a fan heater set to cold). Counterintuitively, you should point the fan out of the window, this will drag air out from the room which will be replaced by cleaner air from the opposite window or door. If the fan is blowing into the room then there is the increased possibility of contaminated air being blown from an infected individual to someone else.

A more complex picture.

Most work has been assuming that air in rooms is fairly evenly mixed. However, a recent study from the Massachusetts Institute of Technology (MIT) raises further issues about air currents and transmission.[5] The following section summarises this research

Convection effects from people themselves.

People at rest generate about 75 W, (and 84 Watts from the teacher who is larger and moving about). This heats the surrounding air and creates rising plumes of warm air. These plumes have a typical velocity on the order of 0.1–0.3 m/s, As they rise, they entrain cooler surrounding air and continue up until they encounter a layer of air at the same temperature. At this layer, the plumes will dissipate and mix with the surrounding air.

The investigators found that only the air that leaves the mouth at very low speeds can rise with the human plume. Without masks, human exhales have an initial velocity of around 1 m/s. However, stronger exhales

[5] Patterns of SARS-CoV-2 aerosol spread in typical classrooms. Gerhard K.Rencke, Emma K.Rutherfor,NikhileshGhanta, JohnKongoletos, LeonGlicksman July 2021

can have an initial velocity around 2 m/s, and talking or coughing can result in even faster speeds. When individuals are wearing a mask, air escapes mainly around the sides and out the top. The researchers argue that exhale speed has a large impact on spread of aerosols throughout the room since air that remains close to the body for extended periods rises relatively quickly with the human plume to the ceiling, whereas air that escapes the plume remains at breathing level for much longer and is likely to be pulled by other air currents in the room and spread to infect others.

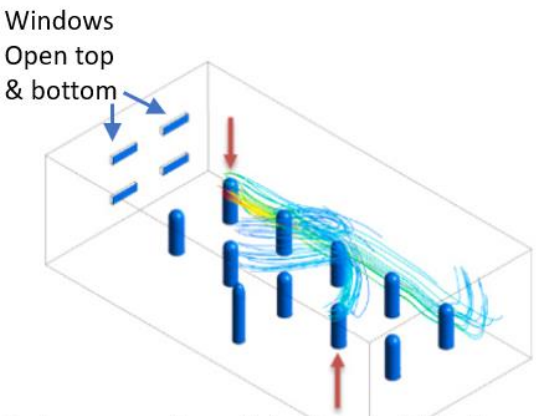
Positioning of students in relation to windows

Although airing classrooms by opening the windows is a natural instinct and the main method of ventilation in many classrooms, the study found a caveat. The team found that, counterintuitively, open windows can sometimes contribute to the horizontal spread of particles.

If the windows are on the same level as students' desks, simulations showed that the cold air that enters the room contributes to the horizontal spread of particles and droplets. The speed of the airflow will overcome the convection plume effect mentioned earlier.

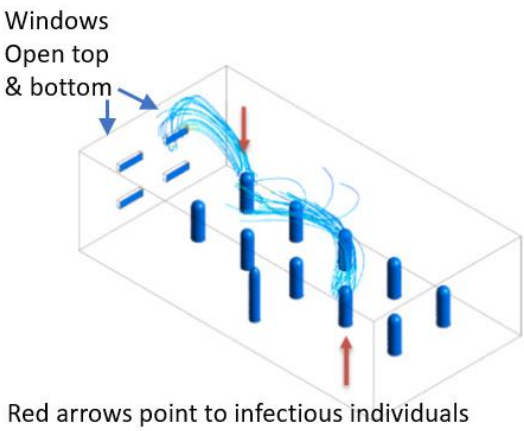
Looking at arrangements, the researchers reached a few conclusions on this aspect of ventilation:

- If the open windows are roughly at head level and in line with rows of students, (as shown to the right) then this is likely to lead to infection as particles are carried along with air currents.



Red arrows point to infectious individuals
Viral load goes from blue (low) to red (high)

- On the other hand, if the same windows, open at roughly head level, are between the rows of students this is reduced as the pattern of air currents is different.



Red arrows point to infectious individuals
Viral load goes from blue (low) to red (high)

- An additional factor that can assist in reducing the airflow-related infection is the presence of baffles inside the lower part of the window to deflect incoming air downwards (at a 45° angle).

Conclusions

- Use CO_2 monitors to see if further ventilation is needed. Actions should be taken if the level is consistently above 800ppm and especially if it is over 1500ppm.
- If your lab has mechanical ventilation, ensure it is switched on and working.
- Where possible, open as many windows and doors as you can and as widely as possible for a short period every so often.
- At lunchtime and breaktime for instance and possibly for a few minutes between lessons if there is the time to do this. Fire doors should not be propped open but they can be opened for short periods like this.
- Where possible have windows (and possibly doors) open a little on a constant basis to produce a good level of background ventilation.
- If possible, have windows open top and bottom.
- Ensure all present are wearing masks:
    - exhaled particles of modest velocity (such as a person with a mask or face shield) are entrained in the thermal plume of the body heat and rise toward the ceiling.
    - exhaled particles of higher horizontal velocities (such as a person without a mask or face shield) can escape the thermal plume and can linger within the breathing plane of others.
- If possible, stagger seating arrangements or if rows are still needed try to have the open windows in between rows rather than in line with them
- Where possible, is a baffle to redirect window air towards the ground as this allows for the buoyant plumes to redevelop and bring contaminants out of the breathing plane.

Cleaning of equipment

(The previous extensive information on how to clean laboratory equipment has been removed from here but that does not mean it is of no relevance. It has instead been placed into a separate document).

From the beginning of the outbreak, quite an emphasis was placed on the cleaning/sanitising of hands and surfaces. This was for perfectly good reasons: more familiar viruses, especially flu, are definitely transmitted this way and some early research in April 2020[6] showed that the virus could last for some considerable time on surfaces.

As a result, looking at this and other advice from the Scottish Government, we suggested last year that shared equipment should be either disinfected between uses or, where that isn't possible, left for 72h or longer to quarantine.

But science changes, particularly when dealing with something new.

In July 2020, a paper in The Lancet Infectious Diseases[7] suggested that the previous research overstated the case as it had involved 'infecting' the surfaces with quantities of virus that were far larger than would be likely to occur in real-life situations. They did say, however, that no actual tests had been done to see if this was in fact the case.

[6] https://doi.org/10.1016/S2666-5247(20)30003-3
[7] https://doi.org/10.1016/S1473-3099(20)30561-2

Recently though, such a study has indeed been carried out and published in the same journal[8]. The researchers conclude that *"Our findings suggest that environmental contamination leading to SARS-CoV-2 transmission is unlikely to occur in real-life conditions, provided that standard cleaning procedures and precautions are enforced."*

As a result of this, and other, research, the Scottish Government changed its advice on this. First to saying that as long as hands were clean then there was no need for extra mitigations and in the latest guidance there is no mention of cleaning/quarantining of equipment at all.

It is important to note that this does **NOT** mean a complete return to normality. (The virus is still here and all possible measures should still be taken to prevent its spread)

In health and safety matters, we often use the concept of 'so far as is reasonably practicable'. This means that when we consider a safety measure, we weigh the possible gains against the costs, not just financial but also in terms of time and convenience weighed against possible impact on learning.

Given the increasing evidence that with good hand hygiene, the risk of picking up coronavirus from touching a surface is low, we think that there is no need now to sanitise or quarantine equipment in science and technology.

In the same way that evidence suggests surface transmission is less important, it is also suggesting that transmission by droplets and aerosols is **more** important. The sharing of equipment at the same time in a group will inevitably mean they are in close proximity and maximising distance is thus an important factor in minimising the spread of the virus.

Organisation

- Staff training will be needed, for ancillary as well as teaching/support staff to ensure they are familiar any new procedures, particularly those relating the new hygiene regime.
- Until further relaxations are implemented (which will hopefully be in a few weeks), physical distancing between adults and between adults and children should be 'at least' 1.0 m, preferably more. (This distance is not specified in a similar way for colleges but is still advisable)
- Preparation and clear up time may take longer so the timetabling may need to consider this.
- Where possible movement of individuals between workstations should be minimised and where workspaces are shared there is cleaning between use (e.g. each individual has a designated desk/workstation).
- Movement of children, young people and staff between classrooms / laboratories / workshops should still be discouraged wherever possible.
- Having seating plans for classes can help minimise movement and proximity and should be encouraged.
- One way of facilitating the two points above might be to reorganise timetabling so that subjects are taught in longer, but less frequent, blocks. This will be a matter for schools and their employers to determine.

[8] https://doi.org/10.1016/S1473-3099(20)30561-2

- It may be that as a part of the protective arrangements, a system will be put in place where learners stay in one classroom and the teachers move around instead. This, of course, creates issues for practical work that will need to be addressed:

  Practical work should only be done, as always, after an appropriate risk assessment. A non-lab/workshop space will limit the nature of practical work that can be done but not eliminate it. For instance, simple circuit work, use of microscopes or some microscale chemistry can, with a little preparation, readily be done in a non-lab setting. Workshop activities in technology may be rather trickier in a non-workshop setting though.

Revised lab/workshop rules.

There will probably need to be some revision of normal lab/workshop rules. Further restrictions on getting up and moving around. Minimise sharing of e.g. pencils etc. These will need to be circulated to learners before they come into school and displayed prominently in each classroom.

Procedures will need to be put in place to deal with learners who fail to observe the new protocols (e.g. will not keep their distance, will not wash hands etc.).

Procedures will also be needed for issues like illness in class, dealing with accidents.

There will also need to be procedures in place, on a whole school basis, for toilets. When can learners go? Supervision to ensure no mixing etc.

Outdoor Learning

- While the weather remains good, outdoor learning may be something worth looking at in more detail. While more particularly suitable for younger learners outdoor learning for older age-groups is certainly something that could be looked at. How learning and teaching is adapted for an outdoor environment should also be considered.
- Education Scotland provides a summary of outdoor learning resources which can support schools and practitioners in taking more learning out of the classroom. (https://education.gov.scot/improvement/learning-resources/a-summary-of-outdoor-learning-resources/)
- The Outdoor Learning Directory provides links to a variety of resources that can be filtered by subject area and curriculum level (https://outdoorlearningdirectory.com/)
- The Teaching Learning Outdoors (https://professionallearning.education.gov.scot/learn/learning-activities/teaching-learning-outdoors/step-1/) and Supporting Learning Outdoors (https://www.sapoe.org.uk/courses/supporting-learning-outdoors/) professional learning courses are available free to all teachers and support staff.
- Specialist outdoor educators from organisations supporting outdoor learning can also provide advice, training and information, and can work alongside school staff.
- A map of outdoor education providers is available (https://nnolscotland.blogspot.com/2020/08/map-of-outdoor-learning-and-play.html) as well as a directory of residential providers (https://education.gov.scot/media/p43ojdtg/ol-contact-directory.pdf) - some of whom may be able to provide advice and support to schools. Further support can be accessed through the Scottish Advisory Panel for Outdoor Education who will be able to put school staff in contact with their local authority outdoor learning lead.

- Support and guidance on in relation to off-site outdoor learning (to be planned in reference to the most up-to-date Scottish Government offsite visits guidance) can be found on the Going Out There framework. (https://www.goingoutthere.co.uk/)

Further advice about outdoors learning in sciences and technologies can be found here:

- https://www.ase.org.uk/system/files/Grimshaw%20et%20al_0.pdf
- https://www.stem.org.uk/news-and-views/opinions/teaching-secondary-science-outside-classroom
- https://www.weareteachers.com/outdoor-science/

Remote learning

There are circumstances in which this will still be important:

- If there is another significant 'wave' that results in schools having to be closed again. This is unlikely but cannot be ruled out.
- If learners are having to self-isolate after a positive test. Or indeed if they are unable to attend school for other reasons.
- If teachers need to self-isolate for similar reasons to those above
- To enhance learning, assist learners catch-up etc.

This being the case, sciences and technologies departments should try to make sure that they develop their skills in this area as much as possible. In each department, there is likely to be at least one person who has developed quite high-level, relevant skills and it would be helpful if the department could arrange to share this expertise to upskill all.

What else SSERC is doing?

- As well as issuing regular updates of guidance documents, we will be available to offer bespoke advice to schools and colleges to assist them with issues they have that may be particular to their establishments.
- We have produced numerous videos and other resources to help support remote teaching. This can be found at (https://www.sserc.org.uk/subject-areas/sserc-home-learning/)
- Our reconfigured courses, in addition to offering the training that is core to them, will also seek to support home/remote learning by modelling good practice and offering advice based on our experiences with distance learning.

Wider School issues

Such issues are outwith the remit of this document.

The latest government guidance that covers schools in the wider context can be found here.
https://www.gov.scot/publications/coronavirus-covid-19-guidance-on-reducing-the-risks-in-schools/

Here you will find advice on general school issues, including ones that will impact on the sciences and technologies such as:

- Cleaning

- Travel
- Potential infection
- and much more

Frequently Asked Questions

Newer FAQs will be added at the end **of this section – No updates for this edition.**

Older FAQs that are no longer relevant have been removed

What about alcohol gel and practicals?

While they **can** be a fire risk in the lab, the risk in normal use is very low. There should be no problems as long as care is taken not to expose to any source of ignitions until all fumes have dispersed and there is no trace of anything left on the learners hands.

What about air conditioning? Is there a danger that moving the air around like this can spread the virus?

If the air conditioning is taking in air from outside there is little problem. If it is a self-contained system that is simply recirculating air within the same room then it does create a marginally higher risk but there will still be a significant level of dilution. For airborne infection proximity seems to be the most important factor.

HSE announced (June 23rd 2020). The risk of air conditioning spreading coronavirus (COVID-19) in the workplace is extremely low.

However, they do suggest that '*. . . if you use a centralised ventilation system that removes and circulates air to different rooms it is recommended that you turn off recirculation and use a fresh air supply.'*

Most of the schools in our area have been issued with huge quantities of hand sanitiser - 1750 litres in my school! What are your recommendations for where we should be storing this?

We are currently (7the August) investigating further but unless there has been an exemption put in place (possible but we are not aware of one) then if the hand sanitiser is alcohol based then it is a flammable liquid and thus, under the requirements of DSEAR, need to be stored as such. These quantities obviously create problems for a school.

A better option would be for the council to see about storing it centrally – as they will be able to find suitable storage more easily – and send it out in smaller quantities.

Even so, there will still need to be suitable storage on site. So either a room will need to be converted to a flammable store (possible a little used toilet could be adapted as it already has ventilation) or one or more flammable cabinets will need to be purchased and positioned in a suitable place. The details will depend on how much is stored on the premises at any one time.

This is, however, like all Health and Safety issues, a matter for the employer. So the school should contact their Local Authority and raise the issue with them.

Disinfectant concentration

There have been numerous questions about this:

Milton's

Milton have changed their guidance on dilution when their products are being used for disinfecting Covid-19. Rather than the general figures stated on the packet/bottle, you would use the following.

- Fluid: 60ml fluid per litre of cold water
- Tablets: 2 tablets per litre of cold water.

Milton on their website suggest a contact time of 15 minutes.

Bleach

The WHO recommends a 1:100 dilution of bleach that is 5%. Research published in the Lancet Microbe suggest that this concentration will 'kill' the virus in under 5 minutes. (The revised figures for Milton's fluid, which is chemically similar, are about this concentration as well) However, it seems that many bleaches sold in the UK are a lower concentration, 1-1.5%.

So in order to get to the 0.05% dilution that is suitable you will need to dilute as follows

- 1 part 5% bleach + 99 parts cold water* OR
- 1 part 1% bleach + 19 parts cold water
- (for other concentrations, calculate as appropriate)

Contact time

Milton suggest 15 minutes for their product but the lancet paper suggests that a similar dilution of bleach will be effective in under 5. If there is time, it is probably prudent to leave for 15 but the evidence suggests that a shorter exposure will not be a problem.

Thick v Thin bleaches

There is no difference in effectiveness as far as the ingredients are concerned but the thick bleaches tend to be higher in sodium Hypochlorite.

- Thin Bleach £0.19 per litre – 1%
- Thick Bleach £0.52 per litre – 4.6%

* To be absolutely certain of having the right level of available chlorine, you should dilute a 4.5% bleach 1+89 rather than 1+99 but given that this will be a concentration of 0.046% rather than 0.05, very close, then leaving it for, say, 10 minutes rather than 5 should guarantee effectiveness.

Thick bleach has various additives, the main function of which is to help it stick to vertical surfaces like lavatory pans, for long enough to be effective This is not relevant for our purposes.

The thick bleach will work out more economical but be careful diluting it – as it contains surfactants, it is best to add the bleach to the water and stir gently rather than the other way round – that will result in less foam being produced.

Incompatibilty

Do not mix bleach (or Milton's) with other products as toxic chlorine can be produced.

Be careful of using these, or any other chlorine-based disinfectants on coloured items, especially cloth as it can get bleached. Bleach can also corrode metals, even stainless steel over time so be careful with any metal items.

Are alcohol-based sanitisers permitted in laboratories?

We have heard suggestions that alcohol-based sanitisers should not ever be used in laboratories or workshops because of their flammability. We disagree.

As long as they are not used next to a source of ignition and time is allowed for the alcohol to evaporate from hands, we think the risk is not significant. Experiments at SSERC with alcohol-based gel soaked into paper tissue showed that it was very difficult to get it to light without it being extremely close to the flame. Caution should be observed but, used sensibly, we see no significant risk. Once the stock has been exhausted, it would perhaps be prudent to make the next purchase an alcohol-free formula but there is no reason to withdraw your current stock from use.

Regarding alcohol -free formulations - there are now several on the market that seem to be active against coronaviruses: mostly ones based on quaternary ammonium compounds. When assessing the overall risk, it

is worth bearing in mind that though these are not flammable, research suggests they need at least two minutes on the hand to provide the same level of protection you get from alcohol gels in 20-30 seconds.

Face coverings in practical laboratories or workshops

Face coverings now need to be worn by teachers and learners in all classrooms. This includes laboratories.

There do not seem to be any Health & Safety issues that would cause any problems.

Bunsen burners are OK. There is no realistic likelihood of a mask coming into contact with a flame while being worn even if they are combustible

Contamination isn't likely to be a problem either. While it is possible that the covering might absorb some fumes and allow their release later, all that will be happening is that, at worst, the same dose will be spread out over a longer period of time. Theoretically there might be minor issues with a build up of impurities leading to a long-term, low level but potentially problematic inhalation of contaminants. But normal mask hygiene should stop this anyway.

Masks should either be disposable or be washed on a daily basis, which should prevent this being an issue. Now we are of course dealing with children so it is quite likely this won't happen that regularly but it is not likely to be an issue unless something is actually spilled on the mask – in which case it will definitely need to be cleaned.