DÁIL ÉIREANN

AN COMHCHOISTE UM SHLÁINTE

JOINT COMMITTEE ON HEALTH

Dé Céadaoin, 19 Bealtaine 2021

Wednesday, 19 May 2021

Tháinig an Comhchoiste le chéile ag 9.30 a.m.

The Joint Committee met at 9.30 a.m.

Comhaltaí a bhí i láthair / Members present:

Teachtaí Dála / Deputies	Seanadóirí / Senators
Colm Burke,	Frances Black,
Cathal Crowe,	Martin Conway.
David Cullinane,	
Bernard J. Durkan,	
Neasa Hourigan,	
Gino Kenny,	
John Lahart,	
Róisín Shortall.	

Teachta / Deputy Seán Crowe sa Chathaoir / in the Chair.

Business of Joint Committee

Chairman: Before we commence our formal proceedings this morning, I must address a housekeeping issue. The draft minutes for our meetings of 11 and 12 May were circulated earlier. Are they agreed? Agreed.

Ventilation and Covid-19: Discussion

Chairman: I welcome the witnesses. Both are members of the expert advisory group on ventilation and Covid-19, and will present on the role of ventilation in achieving better health outcomes in tackling the Covid-19 virus. I welcome Ms Orla Hegarty, associate professor at the school of architecture, planning and environmental policy at UCD, and Mr. Simon Jones, commercial director, Aereco Limited.

Before we hear their opening statements, I must point out to our witnesses that there is uncertainty as to whether parliamentary privilege applies to evidence given from a location outside the parliamentary precincts of Leinster House. Therefore, if witnesses are directed by me to cease giving evidence on a particular matter, they must respect that direction.

I ask Ms Hegarty to make her opening remarks.

Ms Orla Hegarty: I am grateful for the opportunity to attend this session. I am an architect and academic at the UCD school of architecture, planning and environmental policy. My expertise is the science of prevention because although the virus is biological, the pandemic, which spreads from one person to another, is highly environmental. Buildings are key to suppressing the pandemic. Prevention is about managing people and managing air. Vaccines alone cannot end this. They need the support of a parallel prevention plan.

Looking at buildings in Ireland, we see the following. More than half of the people who died were infected in just 0.03% of buildings. Over half of the cases in workplace outbreaks have been in just 150 buildings. Infection in overcrowded private homes is twice the rate of uncrowded homes. One in four school buildings has had a Covid-19 index case in the past four months.

The problem is infected air. We now understand that risk of transmission is predominantly indoors and very specific to certain buildings and indoor air conditions. These conditions are preventable, and this knowledge is key to stopping infections and to opening buildings at low risk. Most transmission is not from hands touching surfaces, it is from inhaling infected air. Masks are the only protection at close range. Outdoors, the virus is diluted and blown away. However, in buildings and vehicles, it can build up, fill a space, linger for hours and infect many people. Viral particles in the air behave a little like smoke and must be cleared out.

Many countries are achieving low-risk social and economic activity using prevention policies that manage people and their air. These strategies include the following: providing public health information; reducing occupancy, that is, the number of people; limiting certain activities; setting indoor air standards; measuring unsafe, stale air; improving ventilation and filtration; and, sometimes, doing structural or engineering works to buildings.

Indoor air can be measured and managed. This week, international researchers said "pre-

venting respiratory infection, like reducing waterborne or food-borne disease, is a tractable problem". Indoor spread is measurable and controllable. They warn that. "For decades, the focus of architects and building engineers was on thermal comfort ... initial investment cost, energy use, and ... performance ... [and] infection control was neglected." This was not always the case. Ireland regulated overcrowding in bedrooms to prevent TB. Before the modern era of energy efficiency and airtightness, architecture and public health were very closely aligned and that is why ventilation is regulated. However, the balance has shifted away from disease prevention as the current regulations aim only to "provide adequate ventilation while limiting energy use and avoiding occupant discomfort". One hundred years ago, Chicago suppressed the 1918 pandemic with targeted measures, including building inspectors who signed off on ventilation as a condition of trading. The city of Chicago reopened within six weeks. There was no second wave and no vaccine.

With regard to the focus on what is high risk, international evidence points very clearly to which buildings and activities are high risk and where to target resources. There is a significant body of research from theoretical and experimental sciences and building case studies. Super-spread events, where many people are infected at once, indicate the particular environmental conditions of spread. This means that targeted suppression can be very effective, as seen in Japan and other places.

There is a need to target the clusters. Covid-19 has very particular characteristics. Most people do not spread the virus to anyone else. It is said to be "highly over-dispersed", meaning spread is not a factor of average contacts. Suppressing the pandemic, therefore, is less about rules for people and more about rules for places. This is an opportunity to target interventions because most infected individuals do not contribute to the expansion of an epidemic, so the effective reproduction number could be drastically reduced by preventing relatively rare super-spread events. These super-spread conditions can arise in any enclosed space with two people or many. Indoor risk is about the building, its management and operation, the number of people and the activity. There are strong seasonal factors because indoor air quality changes with the weather, the season and the operation of the building. Infection risk indoors can be reduced by 50% with increased airflow, and by almost 90% with airflow, filtration and wearing masks. Although data in Ireland are limited, the patterns of Covid spread are very similar to other countries, so public health measures can be targeted to have the most impact.

I will now look at the high-risk areas. With regard to vehicles, high levels of ventilation and filtration are critically important in cars, vans, buses and aircraft. An outbreak on an aircraft into Dublin last summer resulted in 13 cases on the aeroplane and 59 cases in total, across six HSE regions.

With regard to housing, infection rates are double in overcrowded private homes, according to the CSO data. A significant number of infections happen within households, and rates are higher in households with children. Inadequate space in institutional and shared housing is high risk, such as in dormitories, hostels and emergency homeless accommodation. Direct provision centres have had 82 outbreaks with an average of ten cases each. Traveller and Roma housing have had 423 outbreaks with an average of 12 cases.

With regard to schools and childcare, more than one in four schools has had a Covid index case since February and, in total, there have been almost 2,500 cases linked to 579 outbreaks in schools. Last week alone, there were 61 outbreaks in schools, which was 20% of all outbreaks. Of 633 cases linked to outbreaks last week, more than one third, or 36%, were in schools and childcare facilities. There have been almost 2,000 close contact cases in childcare and after-

school facilities since last July and 342 outbreaks in approximately 900 childcare buildings, that is, more than one third of childcare facilities have had an outbreak. In hospitals, nursing homes and residential care, 55% of the people who died from Covid-19 in Ireland, were infected in fewer than 0.03% of all buildings. A mere 667 buildings accounted for the infections that led to more than half of the deaths. There have been 600 outbreaks in 581 nursing homes, but it is very uneven. In Kildare, 87% of all nursing home deaths were in just a quarter of the buildings and that needs further investigation. Inadequate ventilation is linked to poor respiratory health in older people.

More than half of all infections in workplace outbreaks were in meat and food plants. There were nearly 3,500 cases in outbreaks with an average of more than 40 cases per building in those. There have been 96 outbreaks in construction. One meat plant alone had an outbreak with 226 cases. One construction site outbreak had 148 cases.

I will deal with indoor dining, bars, gyms, places of assembly. Some places have significantly higher risks, particularly where people are indoors in close proximity for long periods of time and without masks, such as in restaurants, pubs, theatres, cinemas, hotels, and entertainment and sports venues. An outbreak in a café in Cork resulted in 57 cases. At an extreme level, one breach in hotel quarantine in Australia directly resulted in 18,000 infections, 800 deaths and a 112-day lockdown. Breaches in buildings can have a very significant impact.

Certain activities have higher risks, including exercise in gyms and for sports, singing in choirs and at religious events, and shouting, because they generate aerosols and involve deep breathing. A recent outbreak in a gym in Canada resulted in 480 cases and it spread to 49 workplaces.

This knowledge provides an opportunity for more sure-footed policies. Eliminating unsafe conditions protects everyone, including children, people with compromised immunity and those not vaccinated. It also mitigates the risk of variants, and of super-spread events. Vaccines alone cannot provide enough headroom for reopening. A prevention plan is needed.

Safe indoor air has many measurable benefits for health and well-being. It mitigates all respiratory illness, including flu, and future-proofs for another pandemic. Aside from all these benefits, good indoor air quality is a legal requirement of workplace health and safety.

This understanding of transmission and prevention has significant implications, and indicates a need for fundamental review of some incorrect assumptions in public health policy; public health information; reopening plans; sectoral rules; tracking and tracing procedures; epidemiological modelling; and building standards, inspection and enforcement. To ensure that policy is consistent and scientifically up to date, an active multidisciplinary approach is needed. It needs collaboration and engagement across disciplines including biomedical, epidemiological, environmental, sociological and other sciences.

Further analysis of these patterns of spread and investigation of buildings is needed. There must be a risk-based approach to target interventions and effectively use limited resources. If this virus were in water or food, the response would be to take samples, investigate the source and eliminate the problem. So it must be with infected air.

This is a third way that steers a scientific course between lockdown and uncontrolled spread. However, it requires a paradigm shift so that public health policy is evidence based and responsive to new knowledge. There needs to be a shift in perception that we cannot afford the cost of

control, because the economic costs of infections can be enormous and may well exceed costs of containment.

Mr. Simon Jones: I am grateful for the opportunity to attend this session today. Over the past 150 years the link between science, the development of interventions, and organisation of public authorities has increased the success and public understanding of public health. It is time for ventilation and its impact on air quality to be seen through a similar lens.

We spend up to 90% of our time indoors and this pandemic is a disease of buildings. Regardless of where we see the balance between fomite, close or long-range transmission, the impact on health of our indoor environment has been thrust into focus.

Ventilation is a critical factor in reducing the risk of long-range airborne transmission, particularly in enclosed spaces. Often simple strategies that ensure adequate ventilation can help to reduce the spread of Covid-19 in many settings, including homes, schools, workplaces, public buildings and vehicles. Moreover, these strategies can also reduce the risk of superspreading events where many people become infected at the same time. It is an important part of a layered strategy to reduce transmission and should, of course, be used in conjunction with other measures.

As the science and our understanding of this disease has developed, ventilation is increasingly recognised as a critical factor in this multi-layered approach. While it is an important component of any building, ventilation sits within a rapidly changing landscape. The climate emergency is driving changes in regulations and fundamentally how our buildings are being asked to perform. We are about to undertake a wholesale upgrade of our existing building stock that will have dramatic impacts on the performance of every building we occupy. Our lifestyles and how we spend our time indoors continue to change. Technology is rapidly evolving, giving us more insight into how our buildings perform and how we manage them. The science related to indoor air quality continues to evolve and its impact on our health and well-being deepen.

Ventilation in buildings and how it impacts our health, in this case Covid-19, is not a field of absolutes. We must not let perfection be the enemy of the good. We already know many of our buildings do not perform as intended. We all have experience of them. Poor indoor air quality already costs us every day.

According to the EPA, 300 cases of lung cancer per year in Ireland can be linked to radon in our homes and workplaces. According to the Asthma Society of Ireland, 380,000 people currently live with asthma in Ireland, a disease we know is significantly exacerbated by poor indoor environments, such as damp and dusty homes. Every four minutes someone is admitted to hospital with asthma. This disease alone costs the State €472 million per year.

Ventilation impacts in a very real way our health and well-being, the learning outcomes of our children in school, lost days at work, lost rent and income to landlords and the State through disrepair and vacant properties as result of condensation and damp, and in other ways. The pandemic has brought into stark perspective the impacts ventilation can have in disease control.

It is time for a significant shift in how we, as a society and State, view the air we breathe and start to value it the same way we value the water we drink and the food we consume. The role of ventilation in fighting this pandemic and the additional benefits it brings must be brought further forward in our strategies and communication.

We need to mobilise professionals and provide signposts and advice for every building

owner to access consistent and technically correct information on ventilation - information that is already available. This would enable them to work with and get the best out of what they have and develop strategies to improve their buildings over time, not just for Covid-19 now and into next winter but for all the other benefits it brings.

We need better enforcement of regulations on ventilation in our new buildings and the development of better standards and guidance for our existing ones.

Ventilation in buildings needs to be at the centre of not just this pandemic but in everything we do in buildings. It is a subject matter that has an impact on all Departments, including the Departments of Education, Health, and Environment, Climate and Communications. The dividends of getting this right will repay our effort many times over.

Senator Martin Conway: I thank Ms Hegarty and Mr. Jones for their presentations on the topic. I agree that we expect water to be treated and the principle of treating our air makes common sense. I have travelled by train to Dublin all of the time during this pandemic and part of the requirement of Irish Rail is that the windows are left open. That is done for a clear reason. The principle of how air is treated is very important. I understand that in the building we are in now, unfortunately because of the pandemic we cannot use the committee rooms where our engagement with the witnesses would normally happen. My understanding is that at least one company approached Leinster House last August seeking to carry out a ventilation exercise in the committee rooms and the Chambers. As an institution, we want to see people getting back to work but we should be leading by example. It is regrettable that the Houses of the Oireachtas did not engage more with this principle and use the Oireachtas as an example of how people can return to work safely.

I am interested in hearing our witnesses' views on the industry standards and the quality and perhaps Ms Hegarty might respond . There is obviously a difference between ventilation and filtration. High efficiency particulate air filter, HEPA, filtration is seen as the Rolls-Royce model of equipment that would do what we all want to see in terms of clean air. Where are we as a country in embracing this? Are we very much behind the curve? Is there a European model? I believe that Germany is particularly ahead when it comes to this, that there are air ventilation systems in the Bundestag and that most schools and public buildings in Germany have very clean and properly ventilated air. Is there a better example than the German one in Europe? Ms Hegarty might talk to us about that. Can she also reflect on how far behind we are as a country in this area of protecting public health?

Ms Orla Hegarty: I thank Senator Conway for his question. The most important thing we need to get across today is that much of this can be dealt with by way of clear public health information and good guidance. We live in a temperate climate. We are not the United States of America, where there is a great deal of air conditioning. Most of our buildings are naturally ventilated so that people can improve things dramatically by just understanding the risks here in buildings and vehicles. Most of our buildings are small ones with openable windows. In particular, in the seasons when we are not heating or not having to heat a great deal, this can be addressed very easily at little or no cost.

In the winter season, we definitely need to start monitoring air because people are closing up buildings and there is a high risk of infection. In our larger buildings, we have mechanical or other systems and people need technical advice. We are talking in particular here about places like shops that are using wall and ceiling-mounted air conditioning units. These are very dangerous because they are not bringing in fresh air but are recirculating cool dry air and they

have been connected with outbreaks where they are blowing air around the room. Again, this is an area where advice could help.

Larger buildings that have mechanical ventilation systems are often switched to recirculate the air to save energy. If that is the case they need to be checked and may need upgrades on filtration or on equipment. There are separate risks there.

The Senator mentioned HEPA filtration. This involves very low technology portable filtration fans that people can buy, sometimes for €100 or a little bit more for a classroom, that would be very suitable for places like nursing homes and childcare settings where perhaps people cannot wear masks or where there is a concern about vulnerable children or older people being in draughts or uncomfortable conditions. These are plug-in portable fans that can be very effective. Even from where we are now, there are very simple strategies that can be used in many places, with advice.

We also need to be very careful where people are selling systems at present, which may not be effective, are not regulated and which could possibly produce harmful by-products that are dangerous to health. There is an unregulated area at present in which systems are being advertised, sold and installed without being proven to be effective or giving a benefit and which may be very expensive. This is a technical area which needs to be resolved.

On the question of Germany, it has been dealing with this and has put forward an investment of several hundred million euro in order to improve schools and public buildings. Monitoring air can be a first step. This can be done very cheaply and carbon dioxide monitors are small and portable at a price of between €100 and €200. They can be fitted to classrooms, office buildings and shops very easily. They are light and can be moved around. Spain is using these quite extensively in schools, as are other countries.

There are many low technology solutions and advice that can be taken at very little cost. There will obviously be larger buildings that need specific targeted interventions where they have been identified as risk areas.

Senator Martin Conway: I am aware that Ms Hegarty is part of the expert advisory group. Does she believe that the Government is taking this issue seriously? Ms Hegarty stated that this is very much an unregulated area. The first thing we need to do, therefore, is to introduce regulations to make the testing and monitoring of air part of what we do, in the same way that we test and monitor water.

On the systems that are being used, clearly it is worrying if there are some that are not up to scratch. Many people have engaged with and purchased equipment motivated by the right reasons. Clearly then, a job of work has to be done to bring in some sort of regulation and approved recognition for systems, standards and so on. Does Ms Hegarty believe that this work is now being taken seriously and is being done? As a committee, should we be making recommendations to the Government in this area? What is her advice be to us on that?

Ms Orla Hegarty: I cannot obviously speak for the expert committee but I can speak personally on that point. I do not feel that the response has been adequate or that the public health message has been clear. The vast majority of people to whom I speak do not know why it is important and if they have heard the word ventilation, they do not understand why it is significant. Many of the policy and sectoral documents advocate improving ventilation if appropriate or if possible. They do not explain that it is absolutely critically key as a first defence. There

are also a number of other flaws across this issue.

One is that sectoral guidance is left to the sectors to write. Whether it is sports, construction, childcare, nursing homes, shops, hairdressers or dentists, the sectors are writing their own guidance and a scientific review is not being done on whether that is consistent, correct or up to date. A significant number of documents out there are scientifically incorrect and out of date. People are doing their best and what they think is appropriate but are doing the wrong things. This needs a more co-ordinated approach and needs to align with epidemiological modelling, which is to understand the changes in how we model the spread of disease because this is not a disease of averages. Very targeted interventions could be much more effective than blanket restrictions.

Senator Martin Conway: From where does Ms Hegarty believe this response should be led? Should it be from public health, from NPHET or is there a particular Department that should take the lead on this?

Ms Orla Hegarty: That is an answer for the governance structure of where this response fits.

Senator Martin Conway: Looking at the international situation, is there any model on this level that we can look at that we could adopt here? If it is already working successfully in other countries, is there a particular model that Ms Hegarty would recommend?

Ms Orla Hegarty: Some countries have scientific review boards that are multidisciplinary. That would make a considerable difference. Obviously the focus of NPHET is on hospital buildings and on mitigating risk there. Hospitals are only 86 of our 2.5 million buildings. The focus in hospitals is different to the focus on what is happening in the community. It is also important to note that hospital buildings generally, particularly the newer buildings, are built to a very high standard of ventilation. Even within that, we do not have rules within the hospital sector that will protect staff in terms of higher quality personal protective equipment, PPE, for those staff still working behind Perspex screens in some places without masks. Again, that is not a protection. A suite of measures are needed, especially within sectors. There needs to be consistency and the measures should be based on scientific principles rather than what is convenient in a given sector.

Deputy David Cullinane: I will ask a quick question first. Are both Mr. Jones and Ms Hegarty on the expert group?

Chairman: They are.

Ms Orla Hegarty: Was that question addressed to me?

Deputy David Cullinane: Yes, I am asking generally. There are two witnesses, Mr. Jones and Ms Hegarty. Are they both on the expert group?

Ms Orla Hegarty: We are, yes.

Deputy David Cullinane: When was the last time the group met?

Ms Orla Hegarty: It was within the past ten days or two weeks. I do not have the exact date, but it was within the past week or so.

Deputy David Cullinane: I am looking at the Government website. Initially, when the expert group started to meet, the minutes and reports of the meetings were published online.

There are minutes of the meetings of 2 February, 5 February and 8 February. Then it stops and no minutes or reports are published on the website. Why is that the case? I assume the group has met several times since then.

Ms Orla Hegarty: I think we have met on 11 occasions. The reporting of the group moved from the National Public Health Emergency Team to the senior officials group in Government. The group is no longer reporting to NPHET. That would have changed in March, although I do not have the exact date in front of me - it may have been in April. I understand the reports produced by NPHET will be published but I do not think they are on the website at the moment.

Deputy David Cullinane: Both witnesses raised the importance of public education, ensuring transparency and making sure the information gets out. I hear what Ms Hegarty said about the group originally reporting to NPHET but now reporting to the senior officials group that was set up to manage Covid-19. If the minutes of the meetings are not being published, we cannot see what is being discussed or what recommendations are being made. Is this something the group has raised? Were the members of the group aware that the minutes of the meetings stopped being published on 8 February?

Mr. Simon Jones: The internal workings of the group are that our minutes are recorded in any event. We understand the HSE website is slow to publish minutes generally. It takes some time to get them up. As such, the reports have not been published yet. Our understanding is that the plan is to do so.

On a certain date we stopped reporting to NPHET and moved across to the senior officials group. At that point, public reporting of reports and minutes ceased. That does not mean those reports and minutes are not kept on record within the group. They would be available to be published somewhere if that was the decision.

Deputy David Cullinane: I accept that. My point is broader. I am not saying it directly to this group because it is not the responsibility of the group to ensure the reports and minutes are published. I accept that minutes are taken and records are kept. However, it is important that they are made public so that we can learn from them as well. For the purposes of preparing for this meeting I logged on-----

Chairman: There is a problem with the sound and picture. You are too near to the device, Deputy Cullinane.

Deputy David Cullinane: I am some distance from my phone now. I will repeat the point. I have no difficulty with the witnesses. I am saying that in terms of process, public education and access to information it would be better if the minutes of the meetings were published so that we could see them. For the purposes of preparing for this session, I was able to see the minutes for 2 February, 5 February and 8 February. Then it stopped. Is that something the group could take up with the HSE? Can they ensure that the information on whatever meetings that have taken place since then is made publicly available? Both witnesses have made a strong contention that there is a lack of awareness and education in respect of ventilation. If an expert group is in place, I imagine it would be beneficial to the expert group and the witnesses that what has been discussed is made publicly available.

Mr. Simon Jones: I would not disagree with that. It is something I know our chairperson has raised. We can follow up externally again and ask the question again.

Deputy David Cullinane: To follow up on a question asked by the previous speaker on

international evidence and best practice, where do we rate as a state or country in Europe in respect of the overall management of air quality? I know we are putting a focus on this because of Covid-19. The witnesses expressed the view that air management and air quality was a greater issue than Covid. Obviously, in a pandemic it becomes a major issue to better manage air quality and prevent the spread of this virus. However, it has wider implications for the health of people and in other areas. In terms of the overall management of air quality where do we rank in Europe? Are there data? Have studies been done on how we rank? Is it correct to assume the Department of the Environment, Climate and Communications has overall responsibility for the management of air quality? Has each Department responsibility in law to publish air management or air quality plans? Is there an obligation on each Department to manage this in their buildings and so on? Is that a requirement of each Department at this point?

Ms Orla Hegarty: I will address the question on data first. It is difficult to measure buildings. We have buildings in use that are 200 or 300 years old. We have buildings that have been adapted over time. We have new buildings and some that have energy upgrades. People have used them in different ways. Sometimes they are used in a more crowded way than they were designed for or for a different purpose. It is difficult to make comparisons.

We do not have ventilation regulated centrally in any way in Europe. Each country regulates its standards. Obviously, there is the factor of the local climate and other conditions.

Some other countries are doing far better in the pandemic response, especially Asian countries that have adopted this approach right from the beginning. Countries like Vietnam, Taiwan, Singapore, Japan and China have responded with a clear message on ventilation as prevention. They did this from the beginning of the pandemic. Western countries, especially English-speaking western countries, have been especially slow and, I would say, resistant to adopting this as part of the pandemic response. We can see the outcomes in comparing cases and deaths across the two different regions.

Who is responsible? Responsibility is scattered. The Department of Housing, Local Government and Heritage has standards for new buildings. As we know, we have self-certification of new buildings, so certifying compliance is in the control of the developer or owner and not necessarily picked up anywhere independently. Having standards and performance are two different things. We can have an issue with the people who operate the building not knowing how it should be considered and so they may block up vents or overpopulate rooms. The remit of the Department of Housing, Local Government and Heritage stops at construction. The Sustainable Energy Authority of Ireland has some responsibility in respect of air quality standards. The Health and Safety Authority has a role under workplace health and safety. Then again, not every building is a workplace. There is inconsistency and there has not been a focus on this. Building regulation standards only tend to change in response to an event. If there is a structural collapse, a fire or some other emergency, we tend to react and have new regulations. We have not had an issue with air quality since the tuberculosis era.

We have drifted into a medical response to issues, whereby we medicate and treat the illness rather than prevent it. We have probably had 50 years of this, building from the oil crisis. We have not had the experience of SARS or other pandemics that some other countries have had in more recent years. Now is the time to react to this event and take it seriously.

Chairman: You are on mute and your time is up, Deputy Cullinane, unless you have one more point you want to make. You are still on mute.

Deputy David Cullinane: No. I will leave it at that.

Deputy John Lahart: I thank our witnesses for those very interesting documents and presentations. This issue has major implications. I am interested in the application of ventilation. I visited a lot of schools in my constituency prior to Christmas and the way in which the age of the building influenced how the school managed ventilation was really interesting. With the ultra-modern, state-of-the-art buildings, big and bright and with a huge amount of natural light, which is really healthy, and quite open indoor plaza spaces, I got a sense that they were very well ventilated from a design and engineering point of view. In the schools that were 30 or 40 years old the ventilation consisted of wide open entrance doors, windows open in every classroom, cold classrooms and children and teachers wearing warmer clothes. That is simply unsustainable. As we move forward now, particularly into retail and hospitality spaces, the role of ventilation is critical, whether or not it is with a view to dealing with a further pandemic at some stage down the road. We know indoors is a no-no, but what have we learned about the obvious hospitality activities of eating and drinking and how we can apply those lessons to those areas? What kind of advice are the witnesses now in a position to give? What are we learning? What is the halfway house or even the quarter-way house between fully open-air, which is almost but not completely impossible in the Irish context, and indoors, which is impossible in the context of a pandemic? What kinds of lessons have we learned?

Ms Orla Hegarty: As for schools, the age of the school building obviously has an impact. A lot of older schools built before perhaps the 1970s were designed with the memory of TB still alive. They have good cross-ventilation, higher ceilings and more space. A lot of that has been squeezed down and engineered out, I think, and some of those older buildings may have had retrofits involving sealed windows and partitions and other things, which have made them more dangerous. What the schools did between August and Christmas was very commendable in that they were really the only ones to take this seriously in the autumn. However, in the absence of any way of measuring safe air quality, the schools probably over-ventilated in a lot of cases, that is, they opened all the windows and the classrooms were very cold and uncomfortable because school management did not know when to stop. If we provide CO2 monitoring in schools, we can find a happy balance because we can assess in real time whether risk conditions are rising. Then we can open the windows for 15 minutes or take the class outside for 15 minutes, prevent risk and keep people comfortable. That is the only option for next winter because children will not be vaccinated, so the schools need a plan for autumn and it needs to start immediately to be in place by winter. The nursing homes probably fit in that category as well.

As for retail and hospitality, all buildings can be made safe. Once we start measuring, we can target the risks. Clearly, many buildings are low-risk because, otherwise, the pandemic would be even worse. The issue, therefore, is how we find the conditions that are dangerous and deal with them. This is not perceptible to humans. I was in a large building yesterday with a CO2 monitor. It felt reasonably comfortable at all times, yet when I looked at my CO2 monitor the reading went from safe to unsafe within five minutes in a different part of the building. That would not have been perceptible to anybody not carrying a monitor to check air conditions. As humans, we cannot guess at this, no more than we can guess at safe water. We need to start monitoring. People do not stay very long in retail environments and they wear masks, so the key issue in retail is to keep the numbers low, keep the air moving and protect the staff, particularly those who are there for longer periods and perhaps using back areas, storerooms and break rooms where they take off masks. They can be the danger areas.

Hospitality is probably the most challenging sector, but that is not to say it cannot be dealt

with. It is the most challenging because people sit close together across a table, breathe the same air, tend to stay a long time and do not wear masks and a lot of buildings have been adapted and changed over the years and tables can be very close together. Every building needs to be looked at differently and individually within a framework of good advice on the spacing of tables, particularly filtration and localised filtration to tables, which may be a good option for restaurants. That is the HEPA filtration we spoke about earlier. It basically comprises just a fan and a filter which cleans virus particles and other particles from the air continuously while people are in the room. Then it is a matter of taking particular care of staff, back areas, toilets and cold rooms. The means by which people travel to hospitality environments can be as high-risk as the actual building they enter.

Deputy John Lahart: This is really interesting stuff. How would Ms Hegarty see it being put on a structured, formal basis in terms of feeding into any future plans in the autumn and the winter? That is the first matter.

My second point is about public transport: trams, the DART, trains and buses. They are back up to 50% capacity now. What kinds of data does Ms Hegarty have on that?

An obvious area which was connected with antigen testing recently is stadiums. Are there any data on the air quality in the stands of a GAA, rugby or soccer ground? Has the expert advisory group come up with any advices in that regard?

Ms Orla Hegarty: I do not have specifics in that regard. On public transport, I suppose each transport operator would have to do some level of assessment.

Deputy John Lahart: Have they done so, does Ms Hegarty know?

Ms Orla Hegarty: Not that I am aware of. I have seen signage on some public transport about open windows but I think that when people do not understand why windows should be left open, they may close them again. I know-----

Deputy John Lahart: I am sorry for interrupting Ms Hegarty. It is just to feed into what she says. I see all the windows open. I just feel that that stems from perhaps not a particularly scientific approach. How can we assist public transport companies towards best practice in this regard? They cannot be faulted because we are learning all the time, but how could they be assisted with this? What technology could we put at their disposal? In other words, how could we make public transport reasonably reassuring for the public in greater numbers - or can we at all - in terms of air quality?

Ms Orla Hegarty: There are a number of things. The first is to improve airflow such that if vehicles have systems installed they are on full fresh air and not recirculating air that could have virus in it and in order that there is a good throughput of air all the time, that occupancy is managed such that there is no overcrowding and that people wear good masks, not lightweight ones. The general position in places such as Taiwan and now Austria is that everybody wears a higher standard of mask and does not have a haphazard view of masks. There are two things-----

Deputy John Lahart: This is the mask I am wearing today. These are the ones we can buy in all our shops. Is this a good-quality mask? This is what everybody is wearing besides the cloth ones.

Ms Orla Hegarty: The surgical masks people are wearing are effectively designed for protection from droplets in hospitals. For protection from aerosol particles, that is, the very fine,

lighter particles, which is what we are talking about, N95 or higher protection masks are recommended. Some countries have moved to those, and the examples of that are in Asia, specifically Taiwan. The masks are being provided by the Taiwanese Government.

Deputy John Lahart: My mask is a surgical mask, is it?

Ms Orla Hegarty: Yes. The blue paper-like masks are surgical masks. The two issues with masks are filtration, that is, the material used, and fit. Surgical masks are often not a very good fit in that there are gaps around the edges which make them ineffective against aerosol particles. As I was saying, the Taiwanese Government mass-procured all their masks, people there are provided with a certain number of masks at very low cost every two weeks and everybody wears a very good mask. Some parts of Europe have required such masks on public transport or in retail or other establishments.

Deputy John Lahart: Is that something Ms Hegarty recommends?

Ms Orla Hegarty: Yes, we should be moving towards higher grade masks, particularly in settings like public transport or more crowded environments. In Japan, there is sort of silence rule on public transport because infected people put less of the virus into the air if they are not speaking or shouting. We should give people the simple advice that not speaking or speaking in a very low voice can reduce risks.

Deputy John Lahart: Is NPHET aware of Ms Hegarty's recommendation? I believe in masks but there are still conflicting reports as to their efficacy.

Ms Orla Hegarty: I am not an expert on occupational health. The advice I am giving is based on the information I have gathered from speaking to other people, including aerosol physicists and people who work in occupational health. That is the point I am making about it being a multidisciplinary issue. It is very important that all of these people are around the table for our risk assessment to balance everything. In the early stages last year, there were concerns about supplies and procurement. There were concerns about people buying up supplies which would not then be available to people in the hospitals. Those things have changed over the course of the year. Similarly, in making these kinds of decisions, there must be a balance between risk and availability. This may involve equipment, masks and the settings in which people are. We must also consider whether cheaper and easier mitigations are available.

Deputy John Lahart: When Ms Hegarty recommends-----

Chairman: I am sorry but Deputy Lahart has gone over his time.

Deputy John Lahart: Have I gone over? Okay. That is fine. I did not get a warning.

Chairman: Mr. Jones was looking to come in. I ask him to be quick as we need to move on to the next questioner.

Mr. Simon Jones: I will be very quick. There were two questions as people reached for an understanding of how we implement this. The reality is this is very complex to do. We have to get down to basics. Good public information and awareness about the benefits of ventilation will go a very long way in getting people to be aware of their surroundings. I look on the screen in front of me and see that every single person is in a different environment right now. We can learn a lot from the world of retrofitting. We need bespoke solutions for each individual room and building. That is the hard reality. There is no easy road with regard to ventilation

in existing buildings. One needs professionals, people who are capable of assessing risk and people who understand health and safety at work. People need to go into spaces, look at them and understand how to get the best out of those buildings. It goes back to the idea of perfection being the enemy of the good. We can look for the perfect solution for every building but the reality is that we have to start somewhere. The best place to start is with awareness. We have to get people to understand and be cognisant of the air they breathe. We can start to develop advice and tools over time to enable people to get the best out of what they have and, eventually, develop strategies to improve those buildings over time. That is the point I wanted to make.

Deputy Róisín Shortall: I thank both our guests for their presentations. The case they have made makes absolute sense. Sometimes straightforward, common-sense things are overlooked and a more complicated approach to things is taken. It is incredible that, after 15 months of a pandemic, Mr. Jones still has to tell us that we need to get down to basics. One has to ask why we have not been dealing with those basics up to now.

I have a question for Mr. Jones. With regard to the expert advisory group on which both of our guests serve, given the level of expertise within that group, has it produced-----

Mr. Simon Jones: I am sorry. There was a bleep and I missed the last words of the Deputy's question.

Deputy Róisín Shortall: I asked whether the expert group has produced a report.

Mr. Simon Jones: Yes, we have produced two reports so far. The first outlined the details of the actions of the expert group. The second looked in more detail at the best advice available at the moment. A point which has been made here a couple of times is that good advice is already available right across the sector. We have seen such advice from American Society of Heating, Refrigerating and Air-Conditioning Engineers, ASHRAE, from the Chartered Institution of Building Services Engineers, CIBSE, and from the Federation of European Heating, Ventilation and Air Conditioning Associations, REHVA. Many international organisations are already producing very good advice. From a solutions perspective, the expert group is not reinventing the wheel. A lot of that information is already available. That is being reported.

Deputy Róisín Shortall: I have been interested in ventilation for some time but I also listen very carefully to the public health advice given at a political level or by NPHET. One rarely hears ventilation being mentioned. I am curious as to why that is the case. Has the group made recommendations in the reports it has produced? To whom did those reports go?

Mr. Simon Jones: To answer the first part of the Deputy's question, people's awareness of ventilation and the discussion of ventilation have always been problems. It is an invisible thing, a natural thing we do every second of the day without thinking about it. Even getting people to be cognisant of the air we breathe is very difficult indeed. This pandemic has certainly brought that into focus but issues of indoor air quality and poor health are slow burners. They are not as dramatic as the pandemic so we do not see it. I apologise; what was the second part of the Deputy's question?

Deputy Róisín Shortall: Did the group make recommendations and to whom did any such recommendations go?

Mr. Simon Jones: Yes, we did make some recommendations. Most of them are in line with the Health Protection Surveillance Centre, HPSC, documents and other advice that was out there. The advice in the first two reports went to NPHET. It sat with NPHET. Since then, we

have reported to the civil servant group. We have moved away from reports and towards letters to the civil servant group. These letters are more specific to given sectors.

Deputy Róisín Shortall: It is my understanding that neither of the reports and none of those letters have been published. Is that the case?

Mr. Simon Jones: Yes, that is correct. It is my understanding that he HSE plans to publish the first two reports of the expert group. I also understand that the sector-specific reports or letters to the civil servant group are not to be reported anywhere.

Deputy Róisín Shortall: Perhaps this committee can play a role in getting access to those letters and recommendations and publishing them. It seems crazy to have an expert group looking at this area, making recommendations and advising the Government when no one is hearing about it. That just does not make any sense at all. It is something the committee should take up.

I am very short on time. May I ask Ms Hegarty what are the short-term immediate solutions for household ventilation? She said that one can deal with 50% of the problem by improving airflow. With regard to improving air filtration, what kind of costs are we talking about in this regard in either a domestic setting, a school setting or a small business? I am thinking of the hairdressers and retail outlets opening up this week or last week. What are they doing about that? Have they had any direction or guidance from any State agency as regards what they should do about ventilation?

Ms Orla Hegarty: As I understand it, the work safety protocol was reissued last week. This does mention ventilation. I have been reading quite a lot of sectoral guidance since May of last year when the construction industry produced its first set of advice. These documents come across as official guidance and people in the sector are taking them as official because they have yellow covers and an official *imprimatur*. They are often highly inconsistent and unscientific however. Other than the work safety protocol, I do not know of any clear advice for anybody opening a shop or small business. I believe many people mean well but are not doing the right things. In some cases, they may be making the situation worse. It is really important that a clear message goes out.

With regard to households, again I suspect that a lot of infection was happening in cars, as well as in homes. When people are told not to meet or that two households can meet together, the risk does not relate to whether two or three households are involved but to the air conditions in the room. It is the equivalent of inviting a smoker into one's home. How would someone deal with that situation? How would it be worse if there were ten people in the room and two of them were smoking? People must understand the logic of that. It can be very dangerous in a car with two people.

Deputy Róisín Shortall: Why is Dr. Hegarty's advice falling on deaf ears on the part of NPHET and the Government?

Ms Orla Hegarty: There has been a resistance to understanding how the virus transmits by aerosol. There has been a strong belief in some quarters that this is not how it transmits but the science now tells us otherwise. Second, there has been no joined-up thinking between the expert groups in that they operate independently and do not collaborate so people in different disciplines use different terminology and possibly have mistaken beliefs sometimes. I have come across people who assume that improving ventilation means that we put engineering and equipment into every building and that this is not feasible. That is not what this is about.

The word "ventilation" has been seen as another add-on beyond distancing, masks and hand washing instead of being seen as core to everything. Thinking of it as ventilation, it has not translated into "this is about how we use buildings." It is much more than ventilation. It is about how people move around in buildings, how many people are in the building, how long they stay for, whether they are wearing masks and whether they are more vulnerable. A targeted approach that picks out the really high-risk areas would be much more effective than a lock-down. It would involve an incremental approach involving prevention, particularly schools, childcare, nursing homes and indoor dining and hospitality, over the next few months while the weather is good.

Deputy Neasa Hourigan: I will concentrate on how we arrive at the building standards we have and implement, and how we implement and enforce them. We are talking about quite a broad spectrum of typologies. Things like hepa filtration and single-room occupancy have been issues in hospital settings for at least a decade. Businesses and schools are a different consideration than homes. I know there has been some research in Ireland on the very poor ventilation quality in our homes. While this may not necessarily speak to Covid transmission, it certainly speaks to the level of asthma we have.

Regarding how we arrive at our building standards, the original Building Control Act provided for a Building Regulations Advisory Board where experts would have joined together to advise the Department about what is appropriate. That seems to have been disbanded. Do the witnesses think a mechanism like that would have been useful in the past year?

Ms Orla Hegarty: The Building Regulations Advisory Board is there in statute. It was disbanded in about 2012 and has not been in operation since. This is a major failing because individual buildings are being reviewed in isolation when they are all connected. In the case of the new build-to-rent apartment standards, I do not believe there was due consideration of the impact of taking out cross ventilation, lowering ceiling heights so there was less volume, making spaces smaller and removing lobbies to corridors so that there was more of a risk, as we have seen in buildings with long corridors such as the quarantine hotels in Australia, of pressure build up in rooms with long corridors where there are heavy fire doors and one gets airflow conditions that cannot be predicted. This has caused cross contamination in quarantine hotels in Australia. Daylight standards have been reduced, balconies have been taken out, which means it is difficult to purge ventilate a room, and more people are sharing lifts than is probably appropriate for public health. An independent building regulation advisory board that works openly and transparently with a lot of high-level expertise would be very helpful because often a change is made in one area without recognition of the impact and these things are all connected through architecture, be they climate change, the pandemic, cost saving or daylight. The lack of an open board or possibly a mechanism for those kinds of discussions has been detrimental. It would be good to see that resumed.

To answer the question about ventilation, we have had improving energy performance requirements over the past ten or 15 years driven by the energy performance and buildings directive from Europe but the ventilation standards have been very slow to catch up in parallel with that. Ironically, some of our newer buildings that are more airtight may be higher risk for Covid than some of our older buildings.

Mr. Simon Jones: It is worth making the point that this is a problem across Europe and that at a European level, they are trying to look towards the independent inspection of standard ventilation systems in homes. Ireland is leading the way here. In our latest revision of building regulations under Part F, we need an independent validator or inspector of ventilation systems

in all new homes. That is to be applauded. We are the first country in Europe to go that far in saying that all new buildings need to be inspected by somebody independent. This is definitely to be welcomed. Unfortunately, this falls down a bit because the t's and i's have not been crossed and dotted and there is no central database where that information is held and can be audited. As of today, we do not know how many homes have been inspected and we certainly do not know how many of them have passed or failed. The devil is in the detail with that kind of stuff that really adds power to those regulations. In some ways, our ventilation regulations are pretty good and are certainly in line with many other countries. What is key is inspection, policing and making sure the supply chain is delivering.

Deputy Neasa Hourigan: That brings me on to my next question because as the witnesses know, there was a commitment in the Safe As Houses report and the programme for Government to end the self certification of buildings in general, which would improve the situation greatly.

I wish to address the construction products regulations declaration of performance. We have talked about ventilation systems. I know a lot of the discussion is about simply opening windows and making people aware. We will be dealing with more and more mechanical items, particularly in newer buildings where there is an airtightness requirement. As far as I am aware, there has never been a conviction for proprietary building materials that are incorrect or badly certified. Is that a concern? I think Ms Hegarty mentioned that there are products on the market that are not fully compliant or do what they say on the tin.

Ms Orla Hegarty: My concern is that there is confusion. What I have spoken about here is hepa filtration - a very basic fan and filter that people can run very safely just drawing the air through it while they are in a room, be it a crèche or bedroom. This is advisable everywhere and could be a good solution for many buildings and businesses. Other systems are available. There are very specialist systems to do with UV light, which may have some specialist installations and are sometimes used in hospitals and other specialist locations, that may have applications in other buildings here but require specialist independent advice and installation. There are other systems on sale in Ireland that use light, ionisation and other systems that have not been regulated for this purpose and may not be effective. Some systems produce by-products like ozone, which is damaging to the lungs. People are selling systems that do this. They are also selling systems that operate when the room is empty, which is of limited use. If you are going to bring people into a restaurant for the evening, for example, using these systems before people arrive is of very limited benefit. Airing the place well before people arrive and having filtration around the room would be very effective and safe. Using some kind of other system may be an expensive option and may not be effective. It is important that advice coming from the Government be very clear so that people who are struggling in their businesses and well intended are given good advice.

Deputy Gino Kenny: I thank Ms Hegarty and Mr. Jones for this fascinating debate on ventilation. How long does Ms Hegarty think we will be wearing masks in settings, particularly public transport and workplaces? The guidelines for the lockdown will be eased in time but could we still be wearing masks on public transport in a couple of years' time?

Ms Orla Hegarty: I do not know that it is possible to answer that because there are a lot of unknowns with this disease and there are a lot of unknowns over the next few months, especially with variants. We need to be very cautious opening, in risk assessment terms, with a small percentage of the population vaccinated.

Masks are by far the best protection we have. The highest risk is close to somebody who is infected. Another strange characteristic of this disease is that most of the people who get infected are infected by somebody who does not know that they are ill. You are infected by somebody who is either pre-symptomatic or asymptomatic. He or she is not showing symptoms. That is why it has been so difficult to tackle this disease around the world. Other illnesses may have something that demonstrates symptoms and people stay at home, but not with this one.

Masks are by far our best defence because they do two things. They stop somebody who may be infected putting virus into the air and they protect the other person who is breathing. They are also cheap, low-tech, manageable and visible. Unlike some other places where they are removing mask restrictions, we should be very careful about rowing back on that because people have been very compliant here with wearing masks. Wearing masks might be more of an issue in specialist settings. Clearly, people in Asia wearing masks on public transport as a matter of course has been very effective.

Somebody asked about entertainment and hospitality. A trial was run at a concert in Germany last summer where people were put in very good quality masks and very good ventilation was put in the building. They found they were both effective mitigation measures for a large crowd gathering for a concert. Some of this may come down to what mitigation measures people are willing to accept to have more social contact. There is a balance here rather than going back to the way things were. It is about adapting to things that will work so that we can have social and economic activity, in the main, by targeting specific areas and accepting mitigation measures that are effective but yet allow us to do most of what we want to do.

Deputy Gino Kenny: On supermarkets in particular, because they were one of the retail settings that happened to close during the pandemic, and shopping centres have been closed to a lesser degree, how well ventilated are supermarkets and shopping centres? There are certain shopping centres - I am not going to name the company - that do not have any windows whatsoever. How well-ventilated and safe are these places, particularly if people congregate there?

Ms Orla Hegarty: We do not know in the absence of data. I did some spot checks in supermarkets using a CO2 monitor and, with a little bit of effort, most of them would be relatively safe. Some of the concerns about people being infected in supermarkets is because the people are not going anywhere else, but that does not mean that they were not in another unsafe setting, maybe on transport or in their own home, that they did not realise was unsafe.

In terms of workers in supermarkets, I would have a concern that in some places people are still working behind Perspex, which is not safe, and that they are sharing break rooms and toilets where they are not aware of the dangers of spread caused by just going on a break with another staff member or going to changing rooms. We notice very clearly a classroom or a supermarket and less so the back areas of locker rooms, staffrooms, toilets, lifts and corridors where the risk might actually be because there are pockets of dead air, somebody has passed through earlier and somebody comes through later and moves into the same space. We need a more joined-up approach more broadly than just the supermarket.

Mr. Simon Jones: Large city centre buildings, shopping centres and supermarkets are highly engineered environments. The relative safety or not of those environments should be quite easily determinable because they have big mechanical ventilation systems where you can set how much fresh air those buildings get. If they are not capable of delivering that, then that is an engineering problem but it should be a determinable risk. I would be confident if they were inspected and those involved worked with the available advice that is out there, those buildings

should be able to be made relatively safe.

Deputy Gino Kenny: My last question is on Ms Hegarty's statement where she said concerning the number of deaths that people "were infected in fewer than 0.03% of all buildings", which equated to 667 buildings. As we know, half of the deaths that took place in the South of Ireland were in nursing homes. How much of a factor was the lack of ventilation in residential nursing settings? How can we remedy the situation in the future?

Ms Orla Hegarty: We do not have records on the air quality in any of these buildings at any given time. All we can do is look at the patterns of spread, the speed of spread and the fact some buildings are much more highly impacted than others. They are all clues that this virus is airborne and has lingered in the air. I have also looked pretty closely at some of the other nursing home outbreaks in the Netherlands and especially in Canada and the same patterns are there of very rapid spread.

The conditions in nursing homes are quite particular and this is the reason we have had the problem. They tend to be underventilated because people are looking to keep warm. The operators are largely private and they look to save money on energy. Nursing homes are often in converted or subdivided buildings that maybe, when they were changed, ventilation was not considered properly or vents were blocked up. The people who are there are more vulnerable.

The climate makes a considerable impact. I did not get into it today but the spread of the initial phase of the pandemic was in very particular climate conditions across North America, Europe, Iran, Wuhan and Japan where the air temperature was between 5° and 11° Celsius outside with low absolute humidity. There was a very strong pattern to that. In those particular climate conditions, which would be typical of Ireland in heating season, if you bring that air indoors and heat it to 20° for comfort, it is incredibly dry, and dry low humidity air is connected also with a higher risk of Covid in indoor air conditions. So you have a perfect storm of overheated buildings, underventilated very dry air, people who are most susceptible and certain buildings. Unlike in homes where people have showers and there is cooking, which puts moisture in the air, that does not happen in nursing homes. There is a low occupancy and those activities are not happening close to patients, so you probably had people whose noses and throats dried out, and mucus is a person's first protection against this. For a whole series of reasons it is quite explainable what happened in nursing homes. More and more evidence shows, to my mind and certainly from speaking to people working in lots of different disciplines ranging from medicine to physics and chemistry, there is an alignment that plausibly explains why the areas were at risk and, more importantly, how we can prevent it happening again.

Deputy Bernard J. Durkan: This is an issue in which I have a special interest because I happen to suffer from a sinus condition. My sinuses are particularly irritated by dust and particles of all descriptions. It is of the utmost importance to address the needs identified. It is necessary to avail of technology in every way possible, particularly in the context of hospital wards, nursing homes, public transport, taxis and cars. To what extent have the delegates managed to monitor the quality of available technology, whether it involves a backpack-type installation that can be carried around and placed in a room when required or is part of the building? To what extent do these appliances do what they are supposed to do? In other words, do they trap all particulate matter, some or 90%? How effective is the technology? Does it prevent the spread of viruses such as Covid? To what extent has it been possible to test this, if such tests have been carried out?

Mr. Simon Jones: There is a hierarchy of control in ventilation. The first phase involves

removing the pollutant in the first instance, which requires the replacement of stale air with air that is typically from outdoors. If that outdoor air is not safe enough, filtered outdoor air is used. That is the first defence. The second is when polluted air cannot be removed wholesale from a space. In that case, recirculation through filtering of the space is the next solution. This is where we start to talk about HEPA filters, be they portable or part of the building. Where air is recirculated, the pollutants are passed through effective filters to deal with them. The next phase is to deactivate the substance one is seeking to prevent from entering. This is where we start to talk about technology such as UV lights, which can kill viruses.

All these technologies, in the right circumstances and appropriately used, have been able to show complete effectiveness at removing pollutants from spaces but they have to be appropriately specified. One has to understand what one is trying to achieve with them in the given space. A good example is HEPA filter recirculation through portable devices. Those devices can typically remove close to 100% of viruses in a single air pass. While they are very effective, their ability to be effective in a space depends on how much air they are capable of moving in a given period. Therefore, they have to be appropriately sized and located in the right spots, and so it goes. The simple answer to the Deputy's question is that these technologies are capable of dealing with almost every issue we face, be it Covid or another pollutant, in these spaces; the challenge is using them appropriately.

Deputy Bernard J. Durkan: Is the measurement in microns? To what extent has evidence been produced? Has it been made available to the witnesses?

I am aware that there is an efficacy rate of almost 100%. To the extent that technology is of the quality required to remove 100% of viruses, it is possible not to have draughts, including for schools, without having draughts. We all had air conditioning in the form of draughts in our houses 40 or 50 years ago but that has changed over time. I will outline an experience I had in Europe some years ago. When I went back to my hotel, I never looked at the air conditioning and went to bed, woke up in the middle of the night gasping for breath, presuming I was suffering from various terminal illnesses that were going to change my life, and almost panicked. I had to look around in the dark for the switches to turn them on. I could not believe the difference when the tension went. It had never happened to me before. I went back to sleep and everything was rosy and perfect. As a result of my experience, I realise that there is a need for some kind of standard. This could apply to aircraft also. I see no reason in the world why it could not apply with 100% effectiveness.

Depending on the size of the equipment and the size of the building or dwelling in which it is used, it can work with 100% effectiveness and clean the air of viruses, which is the vital issue at this stage. What essential examination of the devices has taken place? What evaluation of the cost has taken place? Could Mr Jones point us in an appropriate direction in addition to having the committee taking it upon itself to talk to the Government and set up a structure that deals with this kind of thing as a matter of urgency? Incidentally, I am totally supportive of the initiative. It is a great idea.

Mr. Simon Jones: It is important to remember that there are no absolutes; nothing is 100% perfect. Even if a device is capable of removing 99.9% of viruses in a single air pass, its ability to be effective in a space depends on whether it is appropriately sized. A recent study showed that four or five HEPA filters are needed in a single classroom of a particular size to deliver effective control. The first port of call should always be fresh air, or fresh outside air. Another point to remember is that if air is being recirculated, one may be removing particulates and viruses but one is not dealing with other pollutants. While dealing with one problem, another

can build up, such as humidity, VOCs, chemicals in the air, and other pollutants or gases. That is why I say there is a hierarchy. We try to deal with ventilation with a view to removing pollutants in the first place, replacing them with fresh outside air. If that is not enough, we start to look to other technologies. The challenge is determining when fresh outside air is not enough and there is a need to supplement it. If organisations such as schools are to invest in HEPA filters, how do they know they are at a point at which they need to do so? The devices are not cheap for a school. If a school has 20 or 30 classrooms and two or three HEPA filters are needed per classroom, a big investment will be required. How does the school know it is in a position to need those types of products?

Deputy Bernard J. Durkan: How big would the investment be for the school, airline company or building?

Chairman: The Deputy is out of time.

Deputy Bernard J. Durkan: I will return to the matter at some point. I did not get an answer on whether measurements are in microns.

Deputy Cathal Crowe: I am present in Leinster House. I thank Ms Hegarty and Mr. Jones for attending our meeting this morning. I have read their statements with interest. We have had an interesting discussion, yet part of me believes it is one we should have had months ago. We very much feel we are facing the final furlong of the Covid crisis. Maybe the witnesses share this view. Covid will still be here after the crisis but we feel we are in the final stage of getting people vaccinated and restoring normality to the country. The discussion we are having today would probably have been very much worthwhile last autumn or early last winter when people were more inclined to be indoors and we were facing the peak Covid period.

I have several points for the witnesses. Their statements have convinced me. Ventilation is something I was interested in anyway. Is some of what they are saying at odds with a policy direction that the Government has pursued in recent years, namely, retrofitting homes and building energy rating, BER, certification? There is a rush among anyone who wants to sell a house at the moment to get to a C, a B or, better again, an A grade and there are incentives to those building homes to put in mitigating measures such as insulation etc. One now sees very few homes with chimneys, which traditionally were the source of ventilation in Ireland before the more modern systems, as they created updrafts. In my house, if the fire is lighting the sitting room door will slam in because of the updraft it creates. That is not a feature in many Irish homes being built nowadays and it certainly is not a feature in apartments. I will put that question to Mr. Jones, as it is the kind of technology he deals with.

Mr. Simon Jones: The answer is quite simple. Had I been asked that question maybe even five years ago I would have said that yes, many of the practices and policies were at odds with what we are discussing today but I really do not think that is the case now. Ventilation and indoor environmental quality is very much aligned with the goals of the Sustainable Energy Authority of Ireland, SEAI, and the plan for retrofitting our buildings. It is a core tenet of it. Certainly under the deep retrofit programmes carried out, there is quite extensive auditing of ventilation systems. It was one of the first organisations to take up this independent validating of ventilation systems as part of that programme. While it may not be perfect, it is certainly moving in the right direction and there is no reason for it to be at odds. One of the key selling points for improving our building stock is the improvement to the indoor environment. That is one of the core tenets of the SEAI's approach to selling retrofitting.

Deputy Cathal Crowe: I thank Mr. Jones. I have two questions for Ms Hegarty. One is on HEPA filtration in aircraft. There is a debate under way at the moment and we are at the cusp of international air travel resuming. From everything I have read, HEPA filtration in aircraft claims to be 99.7% effective, yet there is a caveat that it depends on whether the air you are breathing in has actually gone through the filtration system. If it is from the passenger in front or behind, it is a different story. Does Ms Hegarty believe international air travel, with its extensive network of HEPA filtration, is safe?

Many pubs in Ireland have massive air filtration systems in their ceilings. They were probably brought in before the smoking ban. Many have become obsolete yet they are massive pieces of infrastructure bolted onto the ceilings of pubs which have not been used in many years because of the smoking ban and most places do not using them any more. Do those systems have a function? Might they be upgraded or repurposed when pubs reopen so that it will be safe when people are congregating and drinking indoors? I ask because it will not always be possible for everyone to always be outside, going by what Irish weather is like.

Ms Orla Hegarty: To finish Deputy Durkan's question first, CO2 is measured at parts per million and 800 is considered to be what we are aiming for.

To comment on schools, one in four of our population goes to school every morning. They will not be vaccinated for the autumn. When people speak about a return to normality, one quarter of the population will not have protection and will be vulnerable for the rest of this year. In my view, whatever money needs to be spent on schools is money well spent because it will keep the rest of society open, as well as keeping education and the economy open. It is critically important that there be a plan for schools over the summer in order that they can operate comfortably and safely for next winter. The discussion about population protection with vaccination rates at 80% refers to 80% of adults. That is, at best, 60% of the population. Regardless of the vaccination programme over the next number of months, a prevention plan in ventilation is critically needed. Vaccination on its own will not allow things to reopen; it is mathematically not possible.

On BER certificates, I completely concur with Mr. Jones on the regulations in place now. However there is a very weak link in terms of compliance and enforcement because the sector is still left to regulate itself. This is too important to be left to the sector.

Deputy Cathal Crowe: Forgive me, we only have one minute on this. Will Ms Hegarty answer the question about the pubs? I am sorry to cut across.

Ms Orla Hegarty: On pubs, that is why we measure it. Some pubs may have great systems, and let us find out where they are so we can open them.

On aircraft, there has been a lot of different information. It depends on the age of the plane, the number of people in it and how good the system is. It seems that some of the risk is when it is parked at the gate, when it is taxiing and when people are getting on through air bridges. It appears that unsafe air conditions can arise there rather than in mid-flight. We need more information. In principle, were people to be wearing good quality masks on aeroplanes and were there independently verified ventilation and filtration, it would be possible to engineer a relatively safe solution if the industry was minded to do that.

Senator Frances Black: I thank the witnesses for their attendance and for their fantastic presentations, which were so concise and detailed. They were fascinating and it something I

was not aware of. I appreciate their highlighting the importance of eliminating infected air with good ventilation.

At this stage of the pandemic, when everyone is exhausted after lockdown and after a long, tough winter, many people seem to have lost hope. The reopening of society and reconnection with community is incredibly important now but based on what we have heard today, it seems that we as a health committee need to start planning around the implementation of ventilation systems that will operate as we come out of the summer into the winter once again. This information is extremely important and I totally agree about schools. It is critical at this point. We need to focus long and hard on how we will protect young people and children. In her opening statement, Ms Hegarty rightly stated "Vaccines alone cannot provide enough headroom for reopening", and I fully agree with her in this regard.

I have a couple of questions and I ask the witnesses to forgive me if I am repeating some of them as I lost the line earlier and could not hear some of the meeting. To follow up on Deputy Durkan's question on the cost for schools, do the witnesses have any idea about that? I think it needs to be made a top priority. What would the witnesses like us, as a committee, to do to support them in the work they are doing?

Ms Orla Hegarty: On cost, as a very first measure, for less than €1 million every school could have one CO2 meter that could be moved around. There are about 4,000 schools so it would be well within that cost. That would also raise awareness as a first step and identify dead areas and hot spots. If every classroom needed a monitor, which is probably where we need to move, it would be considerably more because there are probably tens of thousands of classrooms. There is a balance of identifying risk and areas that need to be watched. Even with a change of wind direction, conditions in a classroom can go from low to high risk pretty easily, so it needs active monitoring. As for filtration, some classrooms are well designed for cross-ventilation and may be relatively low risk, but others may have smaller spaces for special needs education, childcare or early years education where people might not be wearing masks and filtration would be a better option. The exercise would need to be done on how that money was spent. Germany is spending a lot of money on this area, as are American schools.

We do not have as big a challenge as many other places because we have a mild climate and we naturally ventilate our buildings. In America most of the schools are mechanically ventilated. We have an easier problem to fix or maybe we have buildings that are more responsive to be able to deal with high-risk situations quickly. Measuring is part of it. I do not have an assessment of the cost for every school. Basic information could probably go a very long way.

Regarding supporting the work, I will speak personally because I cannot speak for the group. It would be very beneficial if there was a forum for multidisciplinary engagement. As things stand, the people dealing with behavioural science, the people dealing with the medical side, the people calculating the epidemiological projections and the people dealing with ventilation all work in isolation. There is no sharing of knowledge or information that would help people to refine what they are doing to use the resources more strategically.

The key point in all of this is that we do not need to prevent every case to stop a pandemic. We do not need to deal with every building. We just need to do enough to get the R-nought below 1. Very strategic activity in places where people gather in large numbers, on public transport and in particular high-risk settings such as meat plants, could have a very substantial impact overall. It is not a case of spending money on every building or changing everybody's home. It is about advising people how to live more safely so that they can make strategic deci-

sions that are safer. It is the cumulative effort of that, along with targeted measures somewhere else. It is just a proactive approach, using what we have and using it wisely.

Mr. Simon Jones: Most of the benefits of improving ventilation and awareness of ventilation fall in the lap of health. Almost no resources, whether that is time or money, are allocated to improving ventilation and creating awareness of the impacts of ventilation on health. This does not just apply to the pandemic. It applies beyond the pandemic to health in general, as I pointed out in my opening statement. Money spent improving awareness and outcomes through ventilation for this pandemic has other benefits too. Getting this right will pay us dividends well beyond the pandemic.

Senator Frances Black: I believe it would save lives. The committee might need to consider publishing a report, as we did with the report on vitamin D we produced a few months ago, to highlight the importance of this issue.

Deputy Colm Burke: I thank both witnesses for their presentations and contributions. We have many older buildings which are providing vital services. I am on the board of a hospital that was initially built in 1741. While it has undergone considerable adaptation, it is still an old building. Likewise, many of our public facilities are old buildings. If the witnesses were doing a national plan on this issue, what areas would they prioritise to get the changes that are required for filtration and air ventilation?

Unfortunately, many people contracted Covid in the past year in nursing homes and community hospitals. What major changes need to be made in those facilities? Should we set a timeline for each of those facilities to reach the required standard? What level of investment is required to get that done? Nursing homes are normally kept very warm and there is not a sense that fresh air is circulating in the place. Is that an area we should now be prioritising?

Ms Orla Hegarty: I will answer the questions in reverse order. Nursing homes, community hospitals, long-term care facilities and that kind of institutional housing, including direct provision and other similar locations, really need to be considered in the same way as schools should be for the autumn. This is a new disease and vaccination is also new. The duration of immunity is unknown, particularly in older populations and among people who might have a low response to vaccination. I would definitely have a concern about nursing homes, care homes and community hospitals. There could be a further problem in the autumn. In the same way that schools need to be preparing now, those buildings should be considered as representing an upcoming risk in the autumn.

As Mr. Jones has said, there are international standards that we can plug into if they are adopted. In particular, we cannot assume that an engineer or an architect will be available to every business and building owner. People need to be able to pick up and read simple advice to allow them to make careful decisions, whether that is turning off a unit in a hairdressing salon or opening a back door in a shop, restaurant or wherever. Beyond the technical advice, it is very important that practical guidance is given to people about some of this.

The Deputy spoke about older buildings. There are only 86 hospital buildings. It is well within the resources available to look at each of those buildings and carry out an assessment of where the risk areas are. The entire building may not have a problem; there may be pockets of risk. In the short term, simple implementation measures could be made even within days in some cases.

Deputy Colm Burke: Is Ms Hegarty saying that because of the way nursing homes and community facilities were constructed, we did not make provision for adequate ventilation? Does major work now need to be done to those nursing homes, even though many of them are less than 20 years old?

Ms Orla Hegarty: I do not think we can know without assessing them. However, the regulations we have are very generalised for natural ventilation. Even design performance may not reflect the actual performance. How they perform on paper may not be what happens in reality. What happens this morning may be compliant, but with a change of wind direction, a very still day, somebody not opening a window or somebody blocking a vent this afternoon, it could become very non-compliant. It is impossible to say where the problem is.

As we also have a system of self-certification, it is impossible to know who signed off on that building and whether they did a careful assessment, whether they gave good advice to the people who are running the building or whether a subsequent change was made without any professional input, for example, changing doors, adding partitions, doubling up on rooms or something else.

Deputy Colm Burke: Who has responsibility for inspection? What level of change do we require on inspection of buildings to ensure they are compliant with the regulations?

Ms Orla Hegarty: I believe Deputy Hourigan referred to the Safe as Houses report and the very broad concerns about whether our building control system is resourced and fit for purpose. The Food Safety Authority of Ireland has strong powers related to food safety, to close businesses if there is a danger to public health, to do inspections and which operates independently with a defined remit. We do not have anything like that in the building sector. We have a system whereby owners and developers hire people to sign off on buildings and, in the main, they are not independently verified.

Mr. Simon Jones: Many of the buildings the Deputy asked about in his opening question are larger public buildings. They are well managed and covered by the likes of the Office of Public Works, OPW, the Health and Safety Authority, HSA, the HSE, the Department, and HIQA. They all have structures above them and within them that are capable of resourcing the kind of advice and help that they need. A colleague of ours in the UK, as part of the Scientific Advisory Group for Emergencies, SAGE, coined the term this week that the success of this summer will come down to three "Vs", namely, vaccines, variants and ventilation. That is a pertinent point at the moment, in that what will make or break us for the next two quarters will be how successful we are with vaccines, how variants impact on that and how we deal with our buildings.

Deputy Colm Burke: Do buildings that are currently being built under current regulations now need to be reviewed to make sure that they can be adapted appropriately? Is it the case that any building that is under construction should be immediately looked at to put in the adaptations required?

Mr. Simon Jones: All new buildings come under regulations. We have started to introduce terminology within regulations around matters such as capacity, recognising that it is not okay to just meet minimum requirements for ventilation and that there needs to be some flexibility inherent within buildings. That is very welcome. Regulators in the UK are currently revising their ventilation regulations. They have looked at them again in light of Covid. We have had a commitment from building standards authorities in Ireland that, in the next revision, they will

be cognisant of disease control in regulations for buildings. The thing to be aware of when talking about regulations is that we are typically talking about flow rate, which is the amount of air moving in buildings. There is sometimes quite a difference from what we would call background ventilation, to maintain reasonable levels of general air quality, and the volumes of air that we are looking to move to limit risks of infection. We need to be in a space where our buildings are capable of doing both.

Ms Orla Hegarty: It is broader than building regulations, which are to do with measuring the air flow and volume of air. We need to look at our apartment and hotel regulations, as well as at other settings. I have particular concern about the reduced standards for apartment sizes that were brought in about three years ago, which do not have cross-ventilation or balconies and have up to 20% less volume of air than they would have had previously. We need to be concerned about the deregulation of standards. It merits a review in light of the pandemic.

Chairman: I have a couple of questions and comments myself. Ms Hegarty spoke about how Chicago suppressed the 1918 pandemic with targeted measures, including building inspectors who signed off on ventilation as a condition of trading, and the city reopened within six weeks. Here we are 100 years later and we are almost starting again, going by some of the evidence that was given today. There was some mention of the situation in Australia. We are aware of the strict quarantines involved there. Regarding the Irish quarantine, I am conscious that we are taking away people's liberties because of the health concerns. Are the witnesses aware of particular criteria, especially related to ventilation, in some of the hotels selected so far? Has that come into consideration when a hotel is assessed? We have all stayed in hotels where, for instance, the windows did not open, so one relied primarily on the air conditioning and so on. Are the witnesses aware of that as an issue? Regarding the strict approach taken in Australia, the witnesses have mentioned the fire doors, and how that trapped the air within that corridor. Do the witnesses have any recommendations for that?

I do not know what the witnesses' experience of most aeroplanes is, but many of them are fairly dirty, and filthy in some cases. It is a while since I have been on a plane. After getting off a plane, you usually have a cold or something else a couple of days later. It is down to people sneezing or coughing on the planes and down to the ventilation systems. The witnesses said there had to be an independent verification system. Maybe they will expand on that.

The figures at the start of Ms Hegarty's opening statement state that half of the people who died were infected in 0.3% of the buildings. Over half of workplace outbreaks have been in just 150 buildings. One in four school buildings have been affected. It has been mentioned that we are at the end of the road with Covid. I do not think so if we are talking about one in four school buildings having a Covid-19 index case in the last four months. Would the witnesses accept that we need to be much more targeted, especially in those 150 buildings? I imagine that if I knew where those 150 buildings were, I would be a bit wary of going in and out of them. I presume some are hospitals and nursing homes. Do the witnesses think it would be helpful for people to be able to make those judgments? Do they think there should be some sort of targeted intervention now, at this stage, when we are rolling out the vaccine? I do not think this is going away any time soon and we may face another wave. If we have buildings where there is a particular problem, should there be some sort of focus on those buildings?

The witnesses mentioned the schools. It makes sense to have some sort of supports for those schools from the Department, especially where there is overcrowding in the classroom and for the old buildings. Do the witnesses have recommendations for some sort of fund for schools? They mentioned the carbon dioxide meter. Is that a minimum that they are saying

should be introduced in schools?

Ms Orla Hegarty: Carbon dioxide monitoring in schools is a cheap, quick, easy way, and would pay for itself with energy savings because people will not have to overventilate and sit in the cold. They will be able to ventilate adequately for the risk, so they will save on heating bills. The Chairman mentioned testing in Chicago. I recently noticed that San Francisco has posters in windows of business premises where they have had an independent inspection. Somebody has come out and given advice. It is not just about inspecting the building but about public confidence to go back to enter those businesses again. They have posters in the windows to state that the building was inspected on a certain date, which system they are using, or if the door has to be open, the filter has to be on, or whatever the requirements are. There is really good public health information.

Regarding the quarantine hotels, we have a lot of information from Australia and New Zealand about risk factors there, very strongly indicating that traditional hotels with rooms off long corridors with air conditioning are a bad idea for disease spread. It is not a minor risk. The outbreak in Victoria was purely down to a hotel breach and 800 people died as a result of that breach. Perth recently had a five-day shutdown following a hotel quarantine breach. They are now looking more broadly at non-city centre locations akin to low-rise buildings or even caravan parks, that type of setting, for their permanent quarantine facilities in Australia. It also means one takes away the risk of city centre staff members living in overcrowded conditions themselves whereby outbreaks can spread or who perhaps have a second job or use public transport. Outside city locations seem to be better, as do hotels with opening windows and not air-conditioned hotels. It is getting away from that corridor model. We have plenty of advice from Australia that could be adopted here from what they have learned. Can the Chair remind me of the final point?

Chairman: It was on aeroplanes and the point you made about the verification there as well. Is there something more that can be done? Again, there is a fear that as soon as people get the green light, a lot of them will jump on planes to get some sunshine.

Ms Orla Hegarty: There are serious concerns about aircraft because obviously one can open a window on a bus but on a plane, one cannot. It comes down to the operation of that individual aircraft. Is it serious enough that there needs to be independent monitoring? I suppose that is a political decision. Data would help in all of this. The HSE is gathering data from every outbreak. They know which schools, crèches and hospitals have had outbreaks but those data are not available. Anything I have quoted today is from publicly available sources. I do not have access to any more but there is a lot more available. I think we have to start using those data, rather than having them in a filing cabinet somewhere. That is how risk assessment could be done and how targeted interventions could be done. They have data about cases related to travel, quarantine, hotels, schools, childcare facilities and nursing homes. If it is a case of inspecting buildings, clearly that is an indication of where to start.

Chairman: The committee appreciates the witnesses' coming in this morning. We certainly will look for the reports mentioned in the witness statements. It would be useful for the committee to get copies of those reports. The suggestion that we try to produce a report on this issue is useful. If there is anything else that the witnesses feel they have not had a chance to expand on this morning, we would appreciate it were they to send it in writing to the committee. It was a useful intervention this morning. A lot of information was provided that hopefully people will take on board in their own lives, particularly those at home. There is a responsibility on school authorities and the Department of Education to follow up on some of the statements made this

morning.

That concludes our business for today.

The joint committee adjourned at 11.33 a.m. until 9.30 a.m. on Wednesday, 26 May 2021.