

Environmental Audit Committee

Oral evidence: Addressing the risks from Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS), HC 852

Wednesday 10 September 2025

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Members present: Mr Toby Perkins (Chair); Dr Ellie Chowns; Barry Gardiner; Anna Gelderd; Alison Griffiths; Martin Rhodes; Alison Taylor; John Whitby; Sammy Wilson.

Questions 101-149

Witnesses

I: Stephanie Metzger, Policy Adviser, Sustainable Chemicals, Royal Society of Chemistry; Dr Andy Joel, Technical Support Chemist, F2 Chemicals; and Stuart Ede, Head of Sustainability, AGC Chemicals Europe, Ltd.

Written evidence from witnesses:

[Royal Society of Chemistry](#)

[F2 Chemicals](#)

[AGC Chemicals Europe](#)

Examination of witnesses

Witnesses: Stephanie Metzger, Dr Andy Joel and Stuart Ede.

Q101 **Chair:** Welcome, everybody, to the latest meeting of the Environmental Audit Committee. Today's session is part of our inquiry into addressing the risks from perfluoroalkyl and polyfluoroalkyl substances, otherwise known as PFAS. We have an excellent first panel with us. I am going to invite the panel to introduce themselves, the organisation that they represent and a very brief, 20 to 30 second introduction to their involvement in the issues of PFAS and then we will get into the specific questions to them. Welcome to the three of you. I will start with Dr Joel and invite you to introduce yourself, your organisation and your interest in this subject.

Dr Joel: I am Dr Andy Joel. I work for F2 Chemicals Ltd, and I am the technical support chemist there. I did a PhD in Durham in fluorine chemistry and I have worked for F2 Chemicals for over 30 years now.

Stephanie Metzger: My name is Stephanie Metzger. I work for the Royal Society of Chemistry where I am a policy adviser, and I am here representing the RSC and our national and international members in the chemical sciences. The RSC has over 60,000 members across the globe, and our members hail from industry, academia, government, education, charities and more. We have been working on PFAS at the RSC since around 2021 and all our work in this area draws on our members' expertise across PFAS chemistry. I am happy to be here to answer your questions today.

Stuart Ede: Good afternoon. My name is Stuart Ede. I am head of sustainability for AGC Chemicals Europe Ltd. We have a manufacturing site at Thornton Cleveleys near Blackpool. We supply a range of products, but it particularly includes PTFE and ETFE that are manufactured at our UK plant. PTFE and ETFE are large chain fluoropolymers, so they fall within the PFAS definition, but they are used in a wide range of technical applications.

Q102 **Chair:** Excellent. Ms Metzger, can I just clarify whether the two other panellists are members of the RSC? Could you lay out, from the perspective of the RSC, where your balance as a representative of your members and your balance as a scientist with knowledge on this subject lies? Do you find yourself in a position where you are making representations that ultimately might be seen to go against the interests of members of yours?

Stephanie Metzger: Of course. As I mentioned, we have over 60,000 members and you are absolutely right that they work in a wide variety of areas from industry to government, to academia and more. Of course we do our best to represent the interests of our members and the opinions of our members in all of our work, and all of our policy positions are checked internally across what we call our members' community board—



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they are elected members' representatives—which represents the membership and checks to make sure that our policy positions are scientifically accurate and representative. Of course, yes, individual members may have agreements or disagreements with the specific things that I say today, but when we develop our policy positions, they all go through consultation with our membership and we always make sure to follow the scientific evidence when making our recommendations. I am happy to share any more information about the RSC with the Committee if anyone wants more details on that.

Q103 **Chair:** Just to clarify, you did not answer whether the two other panellists are members of the RSC.

Stephanie Metzger: I am not sure.

Dr Joel: I am not.

Stuart Ede: No, I am not.

Q104 **Chair:** So you have individual members rather than corporate members, do you?

Stephanie Metzger: Exactly. All of our members are individuals, yes.

Q105 **Chair:** Thank you very much. That is useful. Dr Joel, can you explain in terms of your organisation the types of PFAS that your companies manufacture and what the most common uses of those are?

Dr Joel: We primarily make perfluorocarbons, which are substances that just have carbon fluorine in the molecule. More specifically, by that I mean also that they are fully saturated, so this means basically that they are inert fluids. They are quite unlike what I would consider to be the dangerous ones, which I would call fluorosurfactants that have a reactive or polar head. What are they used in? Medical is an important application of them. They are used in eye surgery, targeted drug delivery and contrast imaging agents. They are also used in emergency therapeutic hypothermia and in liquid breathing.

The important point I want to make about all of those is they are not used for a pharmaceutical effect. They are used for a physical effect. They are not actually changed when within the body, they are not metabolised at all; they are just excreted out. You just breathe them out afterwards. They are also used as tracers in cables in oil fields, in airflow measuring. They are used in cooling as well in high tech applications in space, military. The Large Hadron Collider uses them. They are also used in deposition vapour etching and cleaning for making semiconductors. Those are the basic ones. There are quite a few really niche things, but they are the main areas that we sell them to.

Q106 **Chair:** They are the main applications. Excellent. The same question to you, Mr Ede.



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Stuart Ede: Yes. We manufacture fluoropolymers, as I say, PTFE and ETFE particularly. They are used in a wide range of applications, particularly industrial and specialist applications so things such as screens, electronics, mobile phones and laptops use PFAS, right through to things including medical devices, so pacemakers, stents and some replacement joints. They are used in green energy, so into solar panels and into the green energy industry for batteries and water treatment. Cabling and batteries is there as well, and aerospace, so particularly safety systems in aerospace.

They are used in quite a wide range of applications and many applications are critical—the particular parameters they provide, the properties that they provide. Alternatives do not seem to be available that provide the same substance and the same approach. We have spoken to many customers who have said they would like to replace for economic reasons, because it is very expensive, but they cannot find a suitable replacement material.

Again, with some of the applications we use where they are safety critical, the replacement is difficult in terms of approvals and driving changes. The fluoropolymers themselves we manufacture are inert, so they are not hazardous. They have properties that are inert and do not affect the environment or cannot be absorbed into the blood and affect human bodies. They are used in quite a range of applications. They are also used in the processing industry, so one of the things we do find is that process industries use them, so pharmaceuticals will use them in their properties where they need particular properties of process equipment, process lining, so they are critical to a number of factors across the industry as well as final applications.

Q107 **Chair:** I appreciate it is quite a range that we are talking about here, but if we look at the more dangerous or more hazardous end of the range, would you say that the PFAS chemicals are, if you like the term, a necessary evil—that we have not found an alternative but we should be attempting to—or that they are relatively benign and we should not be worrying about them. What would be your position?

Stuart Ede: I think we must consider both aspects. The fluoropolymers we manufacture are benign, inert, so do not pose a hazard. There is a key factor of PFAS that some other PFAS, particularly when we talk about PFOA and PFOS, do have hazards, as do other chemicals. Many chemicals have hazards, and a key factor is how we control those hazards. That is a key factor that we approach in our business: how we control hazards around our manufacturing process to minimise those risks of the chemicals used while producing a product that is highly useful, is important to society and important to economics. Managing that risk is a key factor, but we must be able to manage and balance those risks rather than ignore those risks. We need to understand them and manage them.

Q108 **Chair:** That is an important question—the difference between managing risk and balancing risk against good. Managing risk is about preventing



any damage, and balancing the risk against the benefits of the product is accepting that those risks exist. To expand upon where you stand, you are selling these products. They are obviously of economic importance to you as well as important to your customers. Are you doing any work to try to find alternatives, or are you effectively saying, "These are products that we will carry on trying to develop, because we think either we can manage the risks, or the risks are worth the risk?". What is the approach your organisation is taking?

Stuart Ede: As a fluoropolymer manufacturer, our prime aim is to provide those fluoropolymers to all those applications that are critical. We do, however, accept, as you say, that balance of risk and managing that risk, and that is a key part we are looking at—how do we improve our manufacturing process? What are the alternatives and the different ways that we can manufacture those processes? How can we drive that differently, and how do we manage and reduce our emissions? The aim behind that is beyond just saying that the risk is a risk. We are saying, "The risk is as it is today. As technology advances, as improvements are made, how can we improve that performance and drive these things forward without losing the benefit that the fluoropolymers themselves provide, which are non-hazardous materials provided to society and the economy?"

Q109 **Chair:** So you are effectively saying that this is what you exist for, and as the world moves away from PFAS, there will be all kinds of scientific developments in the next five years, 50 years or 500 years, but you are not looking to a post-PFAS future. You are the Blockbuster Video, carrying on with what you do regardless of those risks in terms of the nature of the business, are you?

Stuart Ede: I would say we are not going ahead regardless of the risk. I think we are very cognisant of the risks and managing those risks carefully. As I say, fluoropolymers themselves are not hazardous and have important processes that we use them in. As you say, what we are doing is continually evaluating the science, understanding the risks, managing those risks and reducing those emissions of our manufacturing process.

Q110 **Chair:** In terms of those risks that you have balanced and identified, what are the risks to human health and to the environment?

Stuart Ede: We voluntarily phased out PFOA back in 2012. We replaced that with an alternative surfactant that we use in our polarisation process. As part of that process, we work with the Environment Agency, and we worked with REACH and others to understand the risks around those substances. We use that data to drive improvements in emissions reduction. We invested in an abatement plant when we first launched the new surfactant. We invested heavily last year in further abatement technology to try to reduce those risks. A lot of the risks are uncertain and unknown, and that is why we have taken that precautionary approach of how to avoid this becoming a problem. If we can avoid them



being present in the environment, manage the levels that are present in the environment and manage people's exposure so they are not exposed, there is less of a concern that hazard is realised. Our process is very much around that hazard management to give a risk-based approach to how we manufacture our materials.

Q111 Chair: Thank you. Dr Joel, you were at pains to stress that your company are at the perfluorocarbon end of the PFAS sector. Just explain to the Committee what distinguishes perfluorocarbons from other classes of molecules that are considered PFAS, in terms of the risks that they pose to the environment and to human health.

Dr Joel: Perfluorocarbons are not a hazard to health; I think that is an important one. They do not bioaccumulate. They have no effects on the human body; that is the main point that I want to put across.

Q112 Chair: What about to the environment?

Dr Joel: There are two things that the environment can mean here. It can mean what there is in the water courses, the soil and the seas. Perfluorocarbons do not go into that, because they are too volatile and they just go up into the air. Okay, that is the environment, so they do go into the environment—we do acknowledge that—but I would point out that that is covered by the F-gas regulations.

Q113 Chair: How does that impact on the environment differ from other classes of PFAS?

Dr Joel: Compared with fluorosurfactants such as perfluorooctanoic acid, which is readily absorbed into the human body, into water courses and everything—so it remains in the environment where, as we know, it will hang around for a long time, get picked up in the food chain and then get picked up in people—perfluorocarbons are quite different. There is an issue that we do accept around global warming and what they do to the atmosphere, but they do not hang around in the environment as in posing a threat to our health.

Q114 Chair: Thank you for that clarification. Ms Metzger, based on the wide variety of PFAS and the debate about how they are defined and whether a different approach should be taken to some rather than others, do you call for PFAS to be regulated collectively as a class of chemicals or split into smaller subclasses to recognise the differences that we have touched upon?

Stephanie Metzger: We have recommended in the past that we use a grouping approach to address PFAS. That approach, what groups you pick to categorise PFAS in, could vary in terms of their specificity. We also suggest a risk-based approach to managing chemicals, and that would include looking at individual subgroups of PFAS. We would not recommend looking at them one by one, because there are so many and it would take a very long time to get full data on every single kind, but we can group PFAS by subgroups—by ones that have similar structures



and effects—and use that information to help regulate groups that we may find to have more hazardous properties or ones that have fewer hazardous properties. That grouping approach should help to speed things up in the regulatory process. Definitely a grouping approach is needed.

Q115 Sammy Wilson: Mr Ede, you indicated that a key factor was how we managed risk. To all of you, what safeguards are there currently in place to manage that risk and to prevent the unintended environmental consequences that may come from either production or disposal of some of the products that are made from your chemicals?

Stuart Ede: In our sites, we use a number of techniques or technologies that exist for abatement. We try, first, to minimise or avoid use. Where we cannot minimise or avoid that use, we have a number of abatement technologies—things like carbon absorption, scrubbing systems, treating water and treating air emissions. Within the process, we treat our products as well. We try to treat within the product first to try to reduce as much as possible, and then we have additional scrubbing at the end to try to remove that from the environment. When we are looking at scrubbing, we are looking at air emissions and water emissions. We are also looking at our waste, how we can manage our waste better and how we can use different technologies in our waste streams. We look at the challenges of some of the waste streams that we have downstream and how we manage that.

As we say, our fluoropolymers are non-hazardous, but we do, as an industry, provide a safe handling guide for how to use those fluoropolymers, starting to look beyond our factory gate into the wider supply chain, how these materials are managed and how they can be handled in an appropriate way to minimise or potentially avoid the risks.

Stephanie Metzger: I will not speak to the specific technologies that my colleagues on the panel here are using at their own sites. One thing that is important to note is that at the moment, the Environment Agency has the ability to provide environmental permits to locations using substances, chemicals and hazardous substances. PFAS are not currently covered by environmental permits, or I should say that there are no limits on the amount of PFAS that can enter the environment based on environmental permits. For example, the permits at some sites say that companies may have to monitor what comes out of their effluent, out of their factory, but there are no limits on how much that can be and no requirement that they have to mandate certain treatments. We think that this is something that could be improved, and that the Environment Agency's permitting could be strengthened to make sure that manufacturing facilities—whether that is PFAS manufacturers or downstream users who use PFAS in a process—are aware of what PFAS they are using, and so that limits are set to make sure that they keep track of how much is coming out of the facility and prevent it from getting into the environment in the first place.



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The other thing, as Stuart just mentioned, was about the end-of-life management of PFAS. Once PFAS come out of the manufacturers, they go to downstream users who may use them in other industrial processes or in consumer products. At the moment, there are also no rules for what types of PFAS could end up in landfills, incineration plants or wastewater streams, so those end up going to our wastewater treatment plants. So we definitely need to take a look at the end of the life, making sure that waste management companies are aware if PFAS are coming into their waste streams so that they can handle those appropriately. At the moment, they do not really have that information. We need to look at permitting for landfills to make sure that PFAS-containing waste is not leaking out of landfills or being brought to wastewater treatment works to be treated, which at the moment do not have the capacity or appropriate technology to deal with that and it ends up just going right back into the environment.

Q116 Sammy Wilson: Are you saying that in the regulations so far—whether it is in the manufacture and the waste from the manufacturing plants or the downstream uses of them—we should be looking in our inquiry at what additional safeguards can be put in place?

Stephanie Metzger: Yes, absolutely.

Q117 Sammy Wilson: Dr Joel, would you comment on some of the points that were made and how practical they are? For example, when you produce PFAS and then it is used further downstream, what responsibility should you have for ensuring that it does not cause a problem in the environment?

Dr Joel: It is difficult, because we do not necessarily know what our customers are doing with it. We certainly advise our customers—we send out safety datasheets that have advice on how these things should be handled, and we will also keep using those systems. In our case, they are not hazardous. That is the main thing. If I could just build on what my colleague said about—

Q118 Chair: I will stop you on that—apologies, Sammy—because it was interesting that you say that. It sounds a bit like a cigarette firm saying, “We make cigarettes, but we did not realise that people were going to smoke them”. How realistic is it to say, “We are making all these PFAS products, but we do not really know what our clients are going to do with them or how they are going to dispose of them?” Shouldn’t you have some more responsibility?

Dr Joel: We do know to some degree, but they often do not want to tell us exact details because it is proprietary information. They will tell us that it is cooling and what they are cooling, but we will not know the exact details. It is not quite as vague as maybe I made out.

Q119 Sammy Wilson: If there were to be additional safeguards or regulations, they should fall on the companies that buy the products from you and then use them, rather than it being your responsibility?



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Dr Joel: That is all part of REACH, isn't it? Part of your REACH registration is making sure that information is there and can be passed on to the downstream user.

Stephanie Metzger: You brought up something that I wanted to mention about safety datasheets. When manufacturers provide data that goes with their product to the downstream user, they are not necessarily required to put any information on there about substances that are not registered as substances of very high concern. PFAS are not designated that way, so often downstream users looking at these safety datasheets or materials datasheets are not able to know if PFAS is in one of these products because it is not written explicitly. It is not like a food label where there is an ingredients list and we know every single thing. Not everything is written down on there.

That is especially true as you go down the supply chain, especially because under REACH the manufacturers and then higher level in the supply chain do have to comply with REACH regulations. If there are PFAS in something that is already a semi-finished good or a mixture or a finished good—for example, if you are buying in a product into your factory that already is mixed up and there is some PFAS in it—you are not required to register under REACH for that. You may not know, even, that that product contains that PFAS, especially because they are often used in very small amounts. So unfortunately, at the moment, the system is not necessarily set up to facilitate this kind of data sharing, which we think would help companies make better management decisions about that, whether it is choosing what products or ingredients to use or telling their customers how to dispose of things appropriately. They are not always enabled to do that at this moment.

Q120 **Sammy Wilson:** This is to Mr Ede and again to Ms Metzger. There has been a distinction made between products of low concern and products that there should be concerns about. What is the evidence for fluoropolymers, for example, that they should be regarded as products of low concern?

Stuart Ede: There has been some work around that, some studies. Some studies have looked at fluoropolymers and the criteria for polymers of low concern. There has not been a formal assessment against polymers of low concern criteria. There was a publication in about 2022 that assessed 14 different types of fluoropolymers—roughly 96% of the available fluoropolymers—which found that they would satisfy the widely accepted definition, particularly around the size of the polymer chain. The polymer chain is so long that it is not bioavailable, so it cannot migrate into cells and into the human body to pose a risk to individuals. Because the fluoropolymers are so large, their impact on the environment is very different. There is work done around fluoropolymers to show that the hazard is not there, and that the products themselves are not bioavailable and not hazardous to the environment.

Q121 **Sammy Wilson:** Is that really the distinction, then? If they are a long



chemical chain, they are regarded as low concern?

Stuart Ede: That would be a key factor: the length of the chain and the properties of that material and how it behaves in the environment. That is probably the key classification that we would be looking at in terms of hazardous versus non-hazardous PFAS—that distinction of how they behave in the environment and in the human body, and the risk they pose. That is why we talk about the difference classes and say that they should probably be treated in different ways. I totally agree that doing one by one is virtually impossible. It is not practical. It is about looking at classes and how these hazards and risks are posed, and how we use that to identify how we manage them appropriately.

Q122 **Sammy Wilson:** There is some indication that the EU is now saying that even though there is this long chain and everything else, there is a cumulative effect and therefore they should be regulated. What is your view on that?

Stuart Ede: I think that that cumulation factor again needs to look at the combination. If they are long chains and they are not interacting with the environment and they are not breaking down, the durability is a key factor, and that poses low risk. But combination effects are important, especially when we are looking at the smaller chains and looking at how we do that. Investigation under REACH and hazards—understanding more about those hazards and how we manage them better—is really important, but key for us in manufacturing is how we make sure the emissions are minimised in the first place and try to avoid them where possible.

Stephanie Metzger: I am aware of the polymers of low concern criteria that my colleague is referencing. The OECD is the body that originally created this polymer of low concern criteria back in the 1990s. It has not done any work on this since 2009, but in its most recent update in January 2024, it specifically addressed the issue of fluoropolymers and whether or not this was considered a polymer of low concern. It said that, first of all, there is no agreement universally that fluoropolymers are polymers of low concern or that they meet the criteria that the body laid out. I believe that the studies that my colleague is referencing were produced by or carried out by the companies themselves. I am not aware of any independent verification of this from other sources.

In addition, this polymers of low concern criteria is not universally accepted. It has been implemented slightly differently in different countries' individual chemicals regulation. So the OECD has recommended consulting against each individual country's regulations where you are looking at that product. It may be slightly different depending on whether you look at the UK versus the EU versus Japan or somewhere.

The other thing that is important to note is that while fluoropolymers certainly do have this larger size that makes them less likely to be able to



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bioaccumulate in our bodies, the chemicals that are used—the other kinds of PFAS that are used to manufacture the fluoropolymers—are the kinds that have been shown definitively to build up in our body and to cause human health problems. For example, historically fluoropolymer manufacturing used a PFAS called PFOA. I know that that has been phased out by this point and companies that manufacture fluoropolymers have moved on to a number of substitute PFAS. But in addition to the substitute ones also turning out to have some negative health effects, we have also seen that PFOA can still occur as an unintentional byproduct of fluoropolymer manufacturing, even if it is not intentionally used. We have seen that, for example, in waters in the UK that have been tested.

I think that the important thing with PFAS, with fluoropolymers—this would go for any chemicals—is that we need to look at the entire lifecycle of the chemical, how it is manufactured, how it is used and how it is managed at the end of its life. We need, as we have all talked about already, to think about controlling those risks at all those stages. In the manufacturing stage, we need to take a look at those other chemicals that are being used to make fluoropolymers, which are proven to be quite harmful to human health and to the environment.

Q123 Sammy Wilson: Dr Joel, in one of your earlier answers, you indicated that the products that you produce do not have an impact on the body and quickly disperse once they enter rivers or the sea. How do you independently demonstrate that that is the case? Is it studies done by the company or is it studies done by outside bodies that have shown that that is the case, and that they do not accumulate in the environment?

Dr Joel: I would say that it is a mixture, yes. There have been a lot of studies done on them because of the medical applications. A lot of work has been done looking at whether they accumulate in the body. This is where they have injected them into the body first and then seen what happens to them rather than see if they are accumulated there. That is totally independent from us. The final phase is more a chemical knowledge that the company has. It is to do with the fact that they have ridiculously low solubility in water, so they do not hang around in water but they do evaporate really fast. It is based on that knowledge.

Q124 Sammy Wilson: So a lot of the evidence that you have that these are not harmful would be studies done by the company itself? Or, on balance, is it independent studies that would give you that evidence?

Dr Joel: Things like water solubility are well established. It is well established in the industry, so you could say that it is not independent in that regard.

Q125 Sammy Wilson: Dr Joel and Mr Ede, how do you monitor around your own plants for the accumulation of any pollution that there may be from the products that you produce, and find out or try to measure the degree of contamination?



Stuart Ede: We do a number of studies. The first step for us is reviewing our emissions and monitoring what is emitted in the first place. Under our environmental permit, we have looked at the environment around the chemicals we are using. We have put voluntary measures in place to decide what we are going to put as our own limits, and where we have said that we need to be below this level, based on independent studies or third-party studies around the levels that are there. We use modelling. We use a lot of modelling work to say, "If these emissions are present, how would this spread and what would the impact be?" to make sure they are below the levels of hazard as defined using government and regulatory protocols to understand what those levels are. We do that for air. We do a similar thing for water. We have recently just started looking with the Environment Agency and our local council at what is in the soil local to the site.

Q126 **Sammy Wilson:** Ms Metzger made the point earlier that sometimes there may be regulations regarding certain contents of the chemicals that you are using, but there is no limit on the amount that you can dispose of. Regardless of that, are you saying that it does not that that is not the regulations, because you are looking at the contamination anyhow, regardless of whether you are putting out 400 litres or 4,000 litres?

Stuart Ede: What we are assessing is the impact of those emissions. Quite correctly, the permit does not state a limit. The permit requires us to follow best practice to provide environmental protection. We use these studies to inform us and say, "If we have these levels of emissions, what is the impact on the environment and on human health. Is that at an acceptable level?" We submit those reports to the Environment Agency to demonstrate why we believe what we are doing does not have that significant environmental impact.

As a verification, we are looking at legacy issues. We are looking at what is in the soil from legacy issues, to understand both sides of legacy. We also do studies to ensure that the emissions we are making should not lead to problems, and we will continue evaluating those studies. Through voluntary industry programmes, for example, we are committing to emissions reductions beyond regulatory requirements. That is something where we have done quite a lot of work with Environment Agency. When we substituted PFOA, it was a key factor. We spent a lot of time working with the agency and explaining to it how we were going to reduce our emissions regardless of what the limits said—there were not any in the Environment Agency—and working with the Environment Agency to understand what would be an acceptable emission to protect the environment and protect people.

Dr Joel: I want to go back to what my colleague said about the Environment Agency. There is an issue here that it does not quite know what it should be doing and we are not quite sure, therefore, what we should be doing. Obviously, we are all here to help with this. We are in a situation at the minute where we are discussing with the Environment



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Agency exactly what we should be doing. As yet, we have not actually done any analysis of the land contamination situation. That is at the request of the Environment Agency to lay off until it has decided what it wants to analyse.

Q127 **Sammy Wilson:** It has asked you not to do analysis?

Dr Joel: Not to do it as yet, yes. It surely will do it, but not as yet. We do not think that there is any reason to think that there is any contamination in the land as a result of what we have been doing there, because all our processes are bunded or in sealed systems or whatever, so there is no reason to think that anything has happened there. We have not been on the site that long, so we do not think that there is any historical contamination there from 50 years ago or whatever. We do not think that that is an issue, but we do have to check it. We are waiting for the Environment Agency to get back to us on that.

Q128 **Anna Gelderd:** What role should PFAS manufacturers take in remediating legacy PFAS contamination? I will come to you, Dr Joel, to reply first.

Dr Joel: I am not too sure how we should be tasked with that. In our case, I do not think that there is any, because, as I say, perfluorocarbons do not end up in the ground or around the watercourse. In a wider context, I do not think that it is easy to do that. If you consider that the site of the Buncefield fire is a heavily contaminated site, will you be able to trace where those PFAS came from 20 years ago and who manufactured them? So there is a practical issue as well.

Q129 **Anna Gelderd:** Do you have a suggestion of who would be doing that, if it was not the manufacturers?

Dr Joel: I am not sure if I would do in that case, but it has to be the users, I would have thought—maybe not the end user or maybe not the consumer. The area that worried me is PFAS in food packaging and stuff like that. I do not think that it would be the manufacturer of the PFAS that is an issue here, but the manufacturer of the food wrapper.

Q130 **Anna Gelderd:** Mr Ede, do you have a view on this?

Stuart Ede: Yes; one of the things that we do have in the UK, which can be used very effectively, is the part 2A regulations for contaminated land. They do have a very clear process of risk assessment to understand the risk. They have a very clear process of understanding what that risk caused and how that risk related to what has happened. They then have a very clear process of how to understand and allocate that liability, looking at a range of users, a range of options, and how that can be divided up.

I think that the answer has to be that there cannot be a one-stop shop of: it is that one person. We have to look at how PFAS have been used as a society in the environment, by manufacturers, by consumers and by



producers, and look at how we manage that. It has to be managed on a risk basis, case by case, looking at the risk that we are trying to remediate, why we are trying to remediate it and what the objective is. Part 2A, for me, could be a very effective way of doing that. There are some challenges around part 2A in terms of understanding of councils and funding regimes and expertise, but that could be a very effective regime to provide a solution to how we manage these problems on a risk basis.

Q131 Anna Gelderd: Ms Metzger, should manufacturers bear responsibility for downstream impacts of PFAS once they have entered the environment?

Stephanie Metzger: There are a few areas that we need to look at here. First, in general, as we have all said before, we need to have better information sharing through the supply chain about what ingredients and what chemicals are being used. At the moment, if information is not being shared, downstream users are not able to make appropriate management decisions. Secondly, contaminated land regulations are useful to try to assess who might be responsible for pollution. That could be a downstream user, an upstream manufacturer or a landfill. There are a lot of places that are contaminated with PFAS. In fact, the Environment Agency has suggested that there are more than 10,000 PFAS hotspots in the UK with levels of contamination that they are concerned about.

However, as my colleague just mentioned, local authorities at the moment do not really have the capacity or expertise to effectively use the contaminated land laws to identify these sites and take appropriate action. It often takes a long time, which could mean that activities are happening on that land that are posing risks to the public or to the environment that cannot be controlled. In addition, in general the RSC supports the polluter pays principle, which the Government have already committed to in the Environment Act. The polluter pays principle says that those responsible for pollution should be the ones to be responsible or cleaning it up, whether that is physically doing so or funding that cleanup.

We did a survey with YouGov at the end of last year, published in January this year, of a representative sample of UK adults, to ask about their attitudes to PFAS and how it should be managed and what needs to be done. Seventy-five per cent of respondents said that they would support a fee or a tax on PFAS manufacturing and using industries to help fund end-of-life management and environmental cleanup. So the public is on the same page as us—that the polluters should be responsible for that.

There are other countries that have been implemented this. For example, in the EU, they recently updated their Urban Wastewater Treatment Directive, which came into effect at the beginning of this year. It said that 80% of wastewater treatment plant upgrades, which could remove some of these new emerging contaminants such as PFAS, need to be funded by the responsible industry to prevent that cost being passed on to the consumer, such as through their water bills. In addition, in the United



States, they have a law, CERCLA, about contaminated land, which also comes with a superfund trust. The CERCLA law gives the EPA the legal authority to find out who is liable for pollution on a site and hold them legally accountable for cleaning that up. Or, if they cannot find a legal liable party—for example, if a business has gone out of business because it is an old site—they are able to use the superfund trust to pay for that cleanup. That superfund is funded by a levy on the chemicals industry. So there are some good examples in other countries of how they are going about this process of identifying who has been responsible for contamination and then making sure that those actors are responsible for fixing the problem.

Q132 Anna Gelderd: I represent a coastal community in south-east Cornwall and residents are very supportive of the polluter pays principle. It is something that constituents across the country find very powerful and are very behind. In short, should manufacturers bear responsibility for cleaning up what they produced?

Stephanie Metzger: Yes, I think so. The RSC has committed to this principle in a number of our policy positions, not just about PFAS but also about other contaminants of emerging concern, which have PFAS, microplastics and other things like that. Yes, we think that it is important, because not only should actors who have contaminated land, air, water or the environment bear responsibility for improving that situation, but it is an incentive for companies to make better choices going forward, to invest in processes that can stop any pollution from leaving their factory in the first place and to formulate products in a better way that is healthier for humans and healthier for the environment. Ultimately, that is important not only for cleaning up the legacy problem, but for encouraging better practices in the future that can use sustainable chemistry in a way that can bring these benefits to society in a way that does not accidentally expose us to hazards.

Q133 Anna Gelderd: That point about incentivising the right practices is a really valid one. Thank you so much for that contribution.

Mr Ede, is PFOA currently emitted from your Thornton-Cleveleys site, and has your company taken any steps to address the findings of that contamination around the site of PFOA?

Stuart Ede: I think that those are two separate questions, and I will try to answer them both. Currently, there are some legacy emissions of PFOA from the site, which the council and the Environment Agency are evaluating. Our treatment plant that we installed last year has been put in place to try to minimise that. We have seen a more than 90% reduction in the trace amounts of PFOA in our effluent from that process.

As I explained before, we are working with the Environment Agency and the local council on a programme of investigation of legacy issues. The site itself has a history dating back to the 1890s. AGC became involved in the site in 1999. We are working with the Environment Agency around



legacy issues and what has happened, getting an understanding and using a part 2a approach around that voluntary risk assessment to ask: what is there? What is it doing? What is the potential harm—is there any harm? What are the risks? We are managing those emissions and that contamination in exactly that way. We are trying to look at what happened, how we can be responsible and how we can drive that forward. Also, where there are legacy emissions still ongoing, how can we reduce those? How can we eliminate them using the right techniques and technology?

An important factor is understanding these emerging techniques and the research that is going on. We are not just saying that we will look at what we are doing now. We are also trying to look at history to say that, whether or not we caused that, it is a legacy around our area. A lot of our employees live locally, and we are trying to drive the understanding of how we look after our community, how we act as a responsible manufacturer of fluoropolymers, which are important, and how we drive that forward.

Q134 Anna Gelderd: Would it be fair to say that at the moment you do not know how much residual PFOA is in the site? You are currently working on that?

Stuart Ede: We are currently working on that, yes.

Stephanie Metzger: I am happy to share this with the Committee after the fact. There was a great new study that came out in July this year that investigated the site, and the river and bay around there, to try to pin down some of these numbers, because it is important to characterise the site. At the RSC we think it is really important to have adequate monitoring in place to make sure that we are measuring and understanding what pollution is happening where. You cannot manage what you do not know, so you have to be able to consistently monitor these areas.

This goes back to where we need to be able to strengthen the actions in the Environment Agency, because I believe that this study showed that not only was there PFOA, unintentionally, I believe, as a byproduct coming out of that effluent—it is great to hear that the new treatment is working, by the way—but that that effluent still has PFOA in it. It has also unintentionally added a byproduct, or transformation product, of PFHxS, which is another PFAS that was just heavily restricted internationally by the Stockholm Convention, and some others that we had not known much about yet.

That illustrates how important it is for the Environment Agency to have the resources to go and do that sort of monitoring, so that it can better understand the site. That is both to help to make sure businesses know what is going on in their site, and that they are fully aware of their responsibilities—for example, if they were to have a stricter permit—and also for the Environment Agency itself to understand what permits it



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needs to do. At the moment, these permits have not been keeping up to date with what the science says, essentially.

Q135 **Anna Gelderd:** You have touched on my final question, and I might come to other members of the panel. Any further thoughts about what enforcement or incentive structures would be most effective in managing the risks of PFAS contamination? Dr Joel, I will come to you.

Dr Joel: Yes, the Environment Agency is there to limit what we do, in the sense of what we emit into the environment. Yes, it needs to have a good idea of what limits to put on us. It also needs to work out how we are going to measure that, and that is the other important thing. I think that that is more where it is struggling at the minute. That is the impression that I get, certainly, for our site. I think that it is fair to say that we are doing this in consultation with it, but it has to take its own route.

Q136 **Anna Gelderd:** How do you feel that the incentive structure is working at the moment, Mr Ede? Do you have anything further to say about the enforcement or incentive for dealing with these risks?

Stuart Ede: It is very important that the Environment Agency has the ability to enforce, and that is very important for where people are not taking appropriate action. I do think that the incentive is really important. You have discussed the studies that were brought out in July, and we are currently doing that work. We are currently looking at over 25 PFAS in our effluent and trying to characterise that. We are working with the Environment Agency on that data and pulling that data for the Environment Agency. There is a huge cost to that. We are doing that work. The Environment Agency, as Dr Joel has highlighted, is challenged. It is struggling, so we are working with third-party laboratories to understand that. We are working with the Environment Agency to try to understand what else we can provide it.

Incentives really help—almost an incentive to say that we are doing this because we think it is the right thing, and we are going as far as we possibly can. But in the economic structure that we have and the constraints that we are facing, it becomes challenging. We do not want to be in a position of enforcement. That is not where we see ourselves. We see that as a failure, being in enforcement. So it is important that we have that for those companies that will not respond, but equally we need to reward where we can or incentivise where we can those that are trying to do the right thing.

We need support and certainly research from central governments—particularly for some of our chemicals, we can only find one laboratory in the UK that can do the testing. We do not have a competitive market to go and look at to understand how we can get reviewed data, how we can get challenge data and how we can get support. That is a real structure for incentives of how can we be helped to provide the solutions. Not incentives to say, “You should clean this up more because you have not done the right thing”, but more incentives of how we can help. The



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incentive bit comes around the structures from the Environment Agency to support us in driving the conclusion that is needed and provides an improvement.

Q137 Anna Gelderd: In my office, nobody gets a biscuit for doing the right thing. They are instructed to do so and I assume that that is what they are doing.

Stephanie Metzger: I have a couple quick points to buff that up a bit, because one investment that the Government recently made was into new mass spectrometry and spectroscopy infrastructure. They made an investment of £49 million into that. That is exactly the type of infrastructure that we need to build out in this country to do that sort of testing, that sort of monitoring. That was a great thing, we thought, that that investment was made. We would be happy for more of that type of investment to be made. In fact, our YouGov survey showed the same, with 77% of respondents supporting additional government funding for research and innovation into things like monitoring and testing and into remediation technologies. Similarly, I already said that 75% supported a fee or tax on these industries for end-of-life management and clean-up, so there is one incentive. If you pollute, you have to pay.

On the other side, that environmental permitting can provide guidance and assistance to companies to make sure that they know what their responsibilities are. That is where supporting the Environment Agency to have the resources to do this is important. At the moment, the head of the Environment Agency said herself that she feels that it does not have enough resources to be able to tackle this problem. I believe at the moment that it is looking at something like four sites out of the 10,000 hotspots that it has identified. So it is not going to happen overnight, but it definitely needs to have the resources needed and the skills and training and their staff to be able to address these issues.

Q138 John Whitby: Mr Ede has already mentioned the alternative to PFOA in 2012. A question to all of you: do you believe that all PFAS could be replaced with alternatives?

Stuart Ede: That is a challenge. We would say that we have not yet seen evidence of that capability, as I highlighted. We do have customers who we speak to who have said to us, "We would love to find a cheaper and more economical alternative. We cannot afford these PFAS, but we just cannot find things with the right properties, with the dry durability that can sustain these conditions". I would never say that it is impossible to find them. That would be wrong. There is a possibility. Is there a vision or evidence in the next five or 10 years that we will be able to completely phase them all out? I do not see that. I think that what we can look at is manufacturing processes. Can we find alternatives in the manufacturing process? Potentially. That is active research that we have with our parent company to look at how we change our manufacturing process to provide those environmental benefits and to drive sustainability of our final products, which are non-hazardous.



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Q139 **John Whitby:** Would you agree with that view?

Dr Joel: Yes, very much so. Our products are high value. If there was an alternative, our customers would use them because it would be a lot cheaper. You could replace them in some applications but you would have a product that did not work as well. It is maybe not as safe, even, in many applications. For example with tracers, you would be using radioactive tracers rather than inert liquids, which is not ideal.

Q140 **Chair:** Before you move on, Mr Whitby, if I could just come back to you, Mr Ede, and I will come back to John in a moment. You will be conscious that in some jurisdictions around Europe there have been additional restrictions put on PFAS chemicals, such as in Denmark and France. You will be conscious of the European situation. In those cases, are the decisions that have been made in those jurisdictions impacting on some of the products that you currently manufacture? If so, what impact has that had on those applications?

Stuart Ede: We are seeing that most of the restrictions are focused on consumer applications, whereas we are focused on the industrial business-to-business-type applications, high-tech applications. I think that in some cases, with things like a frying pan, we know that it will be more durable, it will have different properties and it will last longer if you have the fluoropolymer coating. Other materials are present that do perhaps as good a job and do not need such a long lifespan. In those applications, there is little impact on us because they are not the markets we are targeting. The more high-end markets where we are targeting, such as the green energy fuel cells—

Q141 **Chair:** So none of the bans that have been put in place there would have affected you?

Stuart Ede: It would have had a minor impact, but not our main business impact.

Q142 **John Whitby:** Going back to the fact that we cannot replace all PFAS, what uses of it do you think should be deemed critical? Are there any areas where we could replace them and look for alternatives? What would be a critical use of PFAS?

Dr Joel: Medical ones would be an obvious one, both for my colleague's industry and my own, because they do not do anything when they are in the human body. I cannot see there being alternatives to it. In fact, I know that certainly for eye surgery, there is no alternative for them.

Q143 **John Whitby:** When you have an alternative—you have the alternative to PFOA—how do you ensure that the alternative does not pose the same risk or similar risk to the original? How do you manage that sort of risk?

Stuart Ede: That is a key factor that we need to consider if we are to phase out PFAS—the regrettable-substitution argument. One of the things we have is REACH regulations. It is very effective, that information sharing. It is about understanding what are these chemicals that we are



evaluating and how we are evaluating them. That is a key factor for fluoropolymers. They are not hazardous in their final uses. In the manufacturing process, we are looking at those chemicals and evaluating them, doing studies independently and with third parties, to understand what the hazards are of these chemicals, and taking the approach of avoiding emissions of these chemicals in the first place until we can prove that they are there. That is sometimes why it takes quite a long time to find replacements, because we can very quickly choose one and then find that there is a problem. So we do lots of evaluations and they take time.

Many of our customers could spend 10 years replacing them because of the way they are used in safety applications, in aerospace, transport, or green energy, where they have a long lifespan. That is why they are used—they are very durable and they have a long lifespan. To evaluate the lifespan is quite difficult, so there is a challenge in that, and making sure the studies are accurate, correct and follow due protocol. That is maybe where regulation could be enforced and used better to help that sharing of information, using things like REACH to make sure that the studies are done appropriately before they are put into use.

Stephanie Metzger: I will address your previous questions and this one. First, absolutely, regrettable substitution is an important thing to consider, because we do not want to move from one chemical to another that also has problems. That is why it is also very important to shift our approach to the way that we decide what chemical to use—when we are looking at formulation, or when we are looking at how to regulate them, making sure that we are looking across the lifecycle of the chemical to determine its full impacts. This is important because in the manufacturing processes sometimes there may be unintended consequences from chemicals that may have more beneficial uses down the line. Or they may be critical for certain applications but then cause other problems, like when they get into the environment. So you have to make that balance.

One issue with PFAS in particular is that in the past, a lot of substitution away from PFAS has been to other PFAS, which has often caused this regrettable substitution. In particular, as I mentioned before, when PFOA was phased out, some companies moved to other types of fluorosurfactants that were still PFAS and turned out to also cause a lot of issues for human health and the environment, just via a slightly different biological mechanism. That is why the grouping approach to regulation is important to make sure we are not just jumping from one to another. We do not want to play whack-a-mole. We want to be able to get them all at once.

In terms of the availability of substituting PFAS, there is not a one-size-fits-all replacement for PFAS. There is obviously many different kinds of PFAS, so there will be many different options for substitutes. My colleagues are correct in that there are some applications where we do not have good options at this point, but there are also a lot of applications where we do. There is a continuum of both our technological



readiness and the economic readiness and availability of those alternatives.

We have worked with a lot of our community on this issue to look at not only what materials are available for substitutions, but also the process that a company might go through to assess how they might go about substituting, doing that alternatives assessment and making sure that they are picking something else that will have a lesser impact and still be effective for the use that they need. There are a lot of materials out there that can provide the properties that PFAS provide. A lot of them are being innovated and are already commercially available in the UK. So it is potentially a large market opportunity for the UK, where we have these companies making PFAS alternatives that have been telling us that their markets have been ballooning in the past couple of years. The demand has been growing. Obviously, there will be some uses—some of these critical uses—where we may want to continue using PFAS if we can guarantee that they are used in a very controlled way and that we have controlled for all of these risks across the lifecycle. But there is also a lot of opportunity there that the UK innovators can take advantage of.

Q144 John Whitby: Another question for you, Ms Metzger. How could improved access to industry data support safer chemical management?

Stephanie Metzger: That is a great question. We have been looking a lot recently at how data sharing can help enable industry, government and civil society to make better choices. Sharing data throughout the supply chain is important. There is work going on now on things like digital product passports and using new technologies that we have to enable that sharing to be more seamless, and to be digitalised so that it is more accessible. I talked earlier about how at the moment things like safety datasheets do not necessarily contain all of the information that companies might need, depending on what different substances are categorised—for example, a category of substances of very high concern. That goes with the UK's classification, labelling and packaging regulations. That is under the Health and Safety Executive.

Also, sharing data with Government might help regulators to understand what is coming down the pipeline—literally and figuratively in this case—and what types of chemicals and what types of new mixtures or new applications of chemicals might be happening, so that they can make sure they are updating their risk assessments appropriately. That would be good on the other hand as well, for industry, because more communication with the regulators means that they can be prepared if any regulatory action is coming down the line, to make sure that companies can respond in a way that is agile and economically viable.

In general, this is a good example of where sharing this information might also help companies to improve their products because, again, down the line, sometimes downstream users of PFAS do not realise that they are using PFAS. Then they find out and then they go, "Well, I'd like something different please", or, "I want to demand that information to



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learn about how to use this product better". Facilitation of information should help them to make better choices about how they want to formulate their products and how, again, they are controlling those risks.

Q145 John Whitby: How aware do you think the general public are as to the risks associated with exposure to certain types of PFAS?

Stephanie Metzger: This was what the YouGov survey that we did last year was great for. We found out that about 67% of respondents were not aware of PFAS. Some were more aware if we said the term "forever chemicals" because that tends to be what is in the news. There is definitely still a lack of awareness in the public of what PFAS are.

In the survey we gave them some scientific information about PFAS, just so that everybody had same basis to participate. What was interesting was that regardless of the level of toxicity of PFAS, 90% of respondents wanted there to be more controls on their use. They recognised that some PFAS could be of lower toxicity and some might be of higher toxicity—and of course we do not know about a lot of them—but they said that regardless, they felt that it was important that we put appropriate controls across the life cycle. That was telling.

Absolutely, they were keen for more information on this. They wanted information from trusted, credible sources. They wanted experts to tell them information. They also wanted to know where the funding was coming from for the people who were giving them information, so that they could understand if they had any conflicts of interest.

They definitely wanted more information in order to make better choices as a consumer, but they also felt that it was the Government's responsibility to protect them in this case, because this is a complex topic. There are no labels that say "PFAS" on your frying pan or raincoat, and as a day-to-day person just going about your life, it would take a lot of work to get to the level that all of us in this room are getting to, to understand the complexities of this topic. This is something where they felt that it was the Government's responsibility to make sure that they were protected so that they could go about their life confident in the choices that they were making, whether that is where they were going to spend their time outside or what products they were going to buy.

Q146 John Whitby: Mr Ede and Mr Joel, what forms of public engagement do you currently undertake regarding PFAS production?

Dr Joel: I do not know that we do anything at this stage, to be honest. I am not sure if we do anything at all. I do not know if you guys are.

Stuart Ede: We obviously engage our own employees. Over 80% of our 200 employees live within 15 miles of the site and are part of our local community, and we have quite a lot of engagement with that community.

We have engaged with our own MP and our councillors as part of the investigation that the council are undertaking around the contamination



we talked about earlier. We are engaged directly with them. We are supporting the council with understanding. We are engaging with them through the council leaders, with MPs and with councillors, who represent the people. We are taking them on board to explain to them what we are doing. We are showing them around the site and explaining our activities because we recognise that engagement is key. If people do not understand, they will jump to conclusions. Equally, if they do not understand, they have fear. We are trying to be open and to explain to people what we are trying to do. We are also trying to activate an open-door policy where people can ask questions of us, and trying to help—it is a challenge for us—using our local community leaders, trying to get out there and say, “What is it that people want to understand? How can we help?” That is the important factor.

As we said, when people hear “PFAS” they hear “bad things”. They do not necessarily hear the flip side of fluoropolymers or PFCs, which are not hazardous, and the criticality of them and how they support things. That is quite challenging. It is a very broad topic. It has hazardous chemicals and non-hazardous chemicals, and there is lots of science behind it. How to communicate that is a real challenge for us. That is what we were trying to do, and we appreciate we probably could do it differently. We need some more support on that and how we do that.

Q147 Chair: Just before we finish, Ms Metzger, it seems to me that within the spectrum of different chemicals that we are talking about here, there are three different, alternative situations. You have the situation where a PFAS chemical can be replaced. You have the situation where we have a chemical with a critical application, which there is no current replacement for. Then we have a situation where it might be possible technically to replace a PFAS chemical but it might be more expensive or complicated, and that may be the first category for us to look at. In those situations it may well be that Government in the future start more strictly regulating this area, either through the Environment Agency and permits or through legislation.

What advice would you give to members of yours, whether that be companies like we have here who manufacture the PFAS themselves or whether that be the end users, about the steps that they should be taking to protect their future business in the case where things are capable of being replaced, but maybe not easily?

Stephanie Metzger: The RSC is not usually in the business of giving business advice, but one thing I say a lot when I give presentations and speak to people on this topic is that the most important thing to do today is to understand if you are using PFAS, where, and how. Again, a lot of companies over the last few years have realised all of a sudden that this is an issue and that they do not know if they use PFAS or not. That is a good start, to find out, “Do I use PFAS, and if so, in what applications? Why do I use it? What properties do I need out of that material? Where does it go in my process or in my product?” That gives you the knowledge base to then be able to make informed decisions.



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The second thing is that chemists are doing amazing research and innovations, not only in new materials that could be used either with or as a replacement for PFAS, but also in the way that we go about designing and formulating products and processes. One good example was one of the panellists from your July session, the gentleman from Britannia Fire, who said that not only did they substitute away from PFAS but they also redesigned the actual fire hydrant canister that they used to provide better properties. That was a good example of where they did not need to find a replacement for PFAS because they turned the design process on its head and found a new and more innovative way to provide the same service.

This is where chemical scientists, material scientists and engineers are thinking more outside the box, not in that linear, traditional model that we may have used in the past. They are thinking about these broader concerns about safety, sustainability and how we move to a circular economy, and using all of those factors—in addition to just the pure functionality of the product—to decide how they are going to formulate something. That is a new way of thinking that a lot of our members are pioneering at this moment.

The other thing is that it is important to continue talking with Government. We always encourage our members to get in touch with their MPs or to share their research with Government because it turns out oftentimes that they are doing research that they did not know was valuable—well, they know it is valuable for themselves, but they did not realise how valuable it was to you all. Sharing that research with you to make sure that you are enabled to make the best decisions with the most up-to-date evidence is super important.

Q148 Barry Gardiner: Dr Joel, I was struck by the difference between your response and what Mr Ede said about the importance of consulting, being open and engaging with the public. Is there a reason why your company feels that is not important, or is it just that you have never considered that level of engagement? Or is it that you do not want to stir them up and get them worried?

Dr Joel: I will go for the middle one. First off, we are quite a bit of a smaller company and I am not sure we have the resources to do that. The second one is that I know that AGC Chemicals has had a lot of interest from journalists, which has possibly prompted it to engage with the public more. We have not. We have not had that impetus to do so.

Q149 Barry Gardiner: Do you think after the hordes of people who are watching this Select Committee inquiry start banging your door down and demanding—

Dr Joel: Yes, the question has been asked. We are going to have to think about this and address it.

Chair: Thank you very much. We will bring this first panel to a close now.



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Let me thank all three of you for coming and speaking to us, and for the evidence that you have provided.