

Environmental Audit Committee

Oral evidence: Addressing the risks from Perfluoroalkyl, HC 852

Wednesday 25 June 2025

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Members present: Mr Toby Perkins (Chair); Olivia Blake; Julia Buckley; Barry Gardiner; Chris Hinchliff; Martin Rhodes; Blake Stephenson; Alison Taylor; John Whitby; Sammy Wilson.

Questions 1-100

Witnesses

I: Dr Joanna Cloy, Senior Project Manager, Fidra; Linsey Cottrell, Environmental Policy Officer, Conflict and Environment Observatory; Professor Michael Depledge CBE, Emeritus Professor, European Centre for Environment and Human Health.

II: Mark Hirlam, Global Sales Director, Delipac; Dr Nissanka Rajapakse, Group Head of Product Stewardship, Johnson Matthey; Andy Spence, Joint Managing Director, Britannia Fire Ltd.

Examination of witnesses

Witnesses: Dr Joanna Cloy, Senior Project Manager, Fidra; Linsey Cottrell, Environmental Policy Officer, Conflict and Environment Observatory; Professor Michael Depledge CBE, Emeritus Professor, European Centre for Environment and Human Health.

Chair: Welcome, everybody, to the 30th session of the Environmental Audit Committee in this Parliament. This is the first session of our new PFAS inquiry.

I am very pleased to have a distinguished panel in front of us. I invite our three witnesses to introduce themselves and introduce their knowledge in this area.

Professor Depledge: My name is Michael Depledge. I am emeritus professor of environment and human health at the University of Exeter medical school. I am a former chief scientist of the Environment Agency, and I was formerly a member of the Royal Commission on Environmental Pollution. I have also served on the hazardous substances advisory committee in DEFRA. I have had a long-term interest in environmental pollution and its impact on the environment and on human health and wellbeing.

Linsey Cottrell: I am Linsey Cottrell, representing CEOBS, the Conflict and Environment Observatory. We are a UK-based charity; we focus specifically on the environmental impacts of military activities and conflicts.

Dr Cloy: I am Dr Joanna Cloy. I work for Fidra, an environmental charity based in Scotland, where I am a senior project manager. Our work focuses on chemical and plastic pollution.

Q1 **Chair:** I will start with Professor Depledge. From your perspective, what are the major sources of PFAS, and where and how are PFAS entering everyday life and the environment?

Professor Depledge: The worrying thing is that PFAS is used in so many different ways. It is used in the aerospace industry as components for aircraft. It is used in the automotive industry, in car parts. It is used in electronic components, in food wrappings and in lots of medical devices. In everyday life, we use it in the clothes we wear—waterproof clothes, shoes and all those sorts of thing. Within our homes, many of our carpets, curtains and sofas are sprayed with PFAS-containing compounds.

In terms of routes of exposure, we are getting it from water, from food and from air. Many pesticides contain PFAS, so it is contaminating soil and getting into vegetables and other products that we eat. As you can see, there is an enormous range. One thing we do not know so much about is PFAS in air, but we do know that particles covered in PFAS are floating around, so that may be an important route as well. There are many different ways in which we are exposed to PFAS from products that we

come across in our lives. Everyone in this room and everyone around the country has measurable levels of PFAS in their blood.

- Q2 **Chair:** Ms Cottrell, your charity focuses on the environmental impact of armed conflict and military activities. In that context, what are the defence sector's major uses of PFAS?

Linsey Cottrell: A lot of the attention, with respect to military sources of PFAS, has been focused largely on the understanding that they are linked to military bases where there has been use of firefighting foam in training areas and air bases. The problem is that there is much less attention on how it is used elsewhere for all the other military applications. Professor Depledge has given a whole list of those, which also apply to the military. There is use in munitions, missile systems, protective clothing, in battery and energy storage for the military, in fire suppression, in all the sealants that are used and in waterproofing, so there is a whole list of other applications that are not widely understood. We do not fully understand the scale and extent that PFAS are used by the military. That applies both to how they are used in the UK, on the MOD estate, and to how they are then used and released in a conflict setting, with the impact on communities where munitions and military equipment are used.

- Q3 **Chair:** Dr Cloy, Fidra has done a PFAS project that involved looking at case studies. What key areas in which PFAS was being used came to your attention?

Dr Cloy: One project was on school uniforms and the use of PFAS. A survey of 600 parents and guardians of children of primary school age showed that the use of PFAS for stain resistance was unnecessary. First, the PFAS was washed out after 10 to 20 washes, so the benefit or perceived benefit did not last for the lifetime of the product. We also found that retailers are moving to PFAS-free and that there are alternatives to PFAS in the use of school uniforms, for example.

- Q4 **Chair:** Where within the uniform were PFAS often found?

Dr Cloy: We did not examine where the PFAS was found, but PFAS coatings are used to tell consumers that the clothing their children wear will be more stain-resistant.

- Q5 **Chair:** Professor Depledge, how does our regime in the UK for regulating PFAS compare with that of the European Union and the United States?

Professor Depledge: The EU, I think, is more advanced, more careful and more precautionary in the way it approaches things. It is moving very rapidly to consider banning a broader range of PFAS chemicals.

Individual countries in the EU are taking some strong actions. For example, Sweden is extremely concerned about PFAS and has taken some measures and is proposing a very low limit for PFAS in drinking water: about four nanograms per litre; at the moment, its level is 90 nanograms per litre, so you can see that it is taking this extremely seriously. Germany is also taking strong measures. It is starting to record some lowering of PFAS levels, due to the measures that it has been taking to restrict its use.



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In the United States, the emphasis is probably more on PFAS in drinking water. It is a very complicated regulatory system there, because you have both the federal system and the state system, and different states do different things. But how that is being affected by current developments in the US with regard to the work that the US EPA is doing, I am not quite sure.

- Q6 **Chair:** Dr Cloy, there is disagreement between academics, industry and regulators about how PFAS are defined and whether some, such as fluoropolymers, are more or less hazardous than others. Do you think that PFAS should be regulated collectively as a class of chemicals, which is what the EU seems to be heading towards, or do different chemicals classed as PFAS pose different risks? If so, should they be regulated differently and separately?

Dr Cloy: We are supportive of the precautionary approach and the use of the OECD definition of PFAS: 10,000 and over, which includes PFAS such as TFA. It is a better, unambiguous and scientifically grounded definition to use: it prevents any narrowing of the definition that would enable industry to continue to use certain PFAS. We are very supportive of alignment with the EU in a universal restriction to protect the environment and human health.

- Q7 **Barry Gardiner:** What is the risk to human health here? We have not quantified that yet in this discussion. We have said that there are risks, and Professor Depledge has said that PFAS are pretty much omnipresent in us, but what are the potential risks, Dr Cloy?

Dr Cloy: There have been a lot of studies that have linked PFAS to increased risk of cancers. There are also links with decreased fertility, and impacts on the immune system and reproductive development.

- Q8 **Barry Gardiner:** Dr Cloy, you are telling us that at the moment we spray our children's school uniforms with a substance that we know has the potential to cause cancer, and that can interfere with their fertility in the long term. That seems quite incredible, doesn't it? What happened to the precautionary principle that you mentioned?

Dr Cloy: We want the UK Government to take the precautionary principle and not use substance-by-substance restrictions. There are restricted PFAS, such as PFOA and PFOS, which are phased out, but they have been replaced with other, poorly designed chemicals that have similar structures. Other PFAS will replace the restricted ones, and that results in regrettable substitution. We really need to use alternatives to PFAS and promote those sustainable, safer alternatives to the harmful chemicals. It is the persistence that is the biggest problem.

Professor Depledge: I just want to echo and expand on what Dr Cloy said, with which I wholly agree. The medical implications are even broader. Delays in puberty have been recorded in relation to PFAS. The cancers that have been seen include testicular cancer and kidney cancers. I myself have done work on the thyroid and on one PFAS, PFOA. That work showed an increased risk of thyroid cancers. The immune system seems to

be impacted: children's ability, after vaccination, to produce antibodies is reduced, although that has not been linked to increased risk of infection.

Barry Gardiner: My goodness! We have established from what you have said that this is pretty toxic and long-lasting stuff.

Professor Depledge: Yes.

Q9 **Barry Gardiner:** I thought we had UK REACH, and that we regulated our chemicals. That was one of the most important things that we did after Brexit: we imported the REACH regulations into the UK. Dr Cloy talked about new chemicals being produced and the sub-groups that have been restricted, but I understand that no sub-groups have been banned in the UK since January 2021. Is there a failure of our regulation? What is going on here?

Professor Depledge: Yes, it is a failure of our regulation. The US EPA knew about the problems of PFAS being highly persistent and associated with an increased risk of cancer back in 1998, so my question is why action was not taken then. The US EPA began some measures in the early 2000s, though it was not very stringent. The term "forever chemicals" came in 2019 from a Harvard professor, Joseph Allen. We were well aware of these things a long time ago. I think it does demonstrate a failure of the evaluation and regulatory procedures to get on top of this.

Barry Gardiner: You are all indicating that you want to speak. Let's bring in Linsey Cottrell.

Linsey Cottrell: I wanted to make another point about regulation. The proposal coming through the EU is that there should always be a clause for essential societal use, and militaries are pretty much always included in that. There is a history of that occurring in legislation. There is an exemption for military use for F-gases and for the restrictions on hazardous substances in electronic equipment. UK REACH allows for defence exemptions as well. With respect to implementing legislation, it is very important that the military exemptions and the associated risks are properly understood and that there are proper evaluations of that military use, because it is so extensive, as I explained earlier.

Q10 **Barry Gardiner:** If we are going to give exemptions for something that is so persistent and so toxic, it comes down to a definition of what is essential. We managed, in a previous phase of human life on this planet, to do without these chemicals, so in what sense are they essential?

Now you have all stopped putting your hands up—Dr Cloy, you are the brave one. Go on.

Dr Cloy: The way we view the essential use approach is that, yes, we understand that in some products the use of PFAS is thought to be necessary for health or safety or critical to the functioning of society, but it is far better to act quickly, assume that all PFAS are problematic and support alternatives. Derogations really should be time-bound.

Q11 **Barry Gardiner:** Professor Depledge, you are well experienced in this



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area from your time at the Environment Agency; you will have appeared many times before Committees like this. When we are framing recommendations to the Government, what should our recommendations be for the approach to chemical regulation in general, and to the integration of regulation on PFAS?

Professor Depledge: That is quite a difficult question to answer. From my perspective, one would want to think much more carefully about regulations that limit the use of newly emerging chemicals until we have a greater degree of confidence that they will not result in toxicity and persistence in the environment. I do not think we are doing that well at the moment. We are still putting highly persistent chemicals into the environment and then asking, after they have been there a while, whether they are dangerous and what we should do about it. We really are getting things the wrong way around.

When we are using chemicals that will get into the environment and into humans, our starting point must be the medical principle of “do no harm”. We must be pretty confident before these chemicals are used that they will do no harm. We have understood for a long time that persistence is a very bad thing for chemicals to have if they are put into the environment.

In relation to PFAS, there is so much that we do not know. Even if we banned the 100 PFAS that we know most about—and we do not know much about them—what are we going to do about the other 14,000 or 15,000? Will they just be slipped in without our knowing anything about them? Will we then go through the same procedure of looking retrospectively at how we got here, why they are out there and what we can do about it?

Q12 **Barry Gardiner:** If this Committee were to make recommendations, which we will have to, you are suggesting that there should be a principle that we should know that chemicals will do no harm and whether they are persistent. Would you recommend that we determine safe exposure levels of any new chemicals for human beings? New chemicals are being manufactured all the time. Should we have some sort of threshold that says that we should first establish a safe exposure level before allowing something to be commercially developed in the open market?

Professor Depledge: Yes, I would say that. I would also add protection of the environment—of ecosystems—to that. It has to apply to both.

Q13 **Barry Gardiner:** Given that the EU is seeking to apply the essential use concept to regulation, how should critical and necessary use in industry be determined? In a sense, as I asked earlier, what is essential use, and how do we weigh up the competing interests? Is there a framework for that, or should we be recommending that there is a framework?

Professor Depledge: I think we should recommend a framework, but in a way, it is about how much risk society is willing to tolerate. That has to be brought into the discussion.



Dr Cloy: I would add that we need to be careful of divergence and diverging from the EU. If we go down a threshold approach, we will not necessarily be able to use the precautionary principle, and there will be a time lag in finding out about the prevalence of these problematic PFAS in the environment or in humans. It is far better to take that group-based approach where there is a strong carbon to fluorine bond that leads to the persistence of PFAS chemicals.

Linsey Cottrell: Going back to the point about the source of munitions and how significant that is, we obviously have big increases in military expenditure. Think about the announcement this week of 5% of GDP by 2030, but we don't know about the concentrations of PFAS in munitions. I think we spent £1.4 billion in 2023-24 on weapons and munitions—and that is just in the UK industry; it does not include what was spent on exports. It was around £14.8 billion last year on UK defence exports. We are not sure how much of that was specifically weapons, but the unknown sector was about £4 billion. We are talking about significant volumes in what may seem a fairly insignificant component of the whole. PFAS is obviously used across the whole of society, but we must not forget that the military aspect will only increase, reflecting what will happen with expenditure.

Q14 **Barry Gardiner:** What could the UK learn from the EU's safe and sustainable design framework? How can we avoid regrettable substitution? I know these are used as technical terms, but, Professor Depledge, can you put them in layman's language for us?

Professor Depledge: In the past, when various chemicals have been used and identified as posing a threat to the environment, industry has promptly come up with an alternative that is somewhat different and thought to be less harmful, and that takes over. Then we discover that actually the new chemical has not been fully evaluated and we don't know its long-term effects. Then we get a nasty surprise when some new problems emerge. That is certainly a regrettable substitution.

The EU's idea, which has been proposed in the UK in many different forms, is to try to design chemicals for use that we know much more about and that will break down. Those are chemicals by design. There is a whole area of endeavour called green chemistry where that is precisely the goal: to try to make molecules that do the job we want them to do, but will then break down or be captured in some way and detoxified.

Coming back to your essential use point, which is a terribly difficult one, even if we give permission for chemicals to be used because they are essential, I don't think we pay enough attention to how we manage those chemicals in their essential use. We could take a great deal more care and put a great deal more effort into ensuring that they do not get released into the environment.

Barry Gardiner: Thank you very much.

Chair: Professor Depledge, can I ask you to speak a little louder? You are

being picked up fine on the broadcast, but in the room it is quite quiet.

- Q15 **Sammy Wilson:** I have a follow-up question. The argument seems to be whether we take a precautionary approach or whether we go for specific chemicals where there has been proven harm. You said that there is so much we do not know about these chemicals, that there are studies that show there could be risks, and also studies that would contest that view. There are products that it is essential to have. Is the precautionary approach a realistic one? Is it borne out by some of the science?

Professor Depledge: I personally believe it is borne out by some of the science. There has been a shift over recent years. I don't want to speak for the rest of the scientific community, but I think the scientific community are generally moving much more to a weight of evidence approach, in which we pull together the hints and messages that we get in the scientific studies, which bring together information that accumulates and accumulates until we might not know for absolutely certain that there is a link between a particular PFAS and a particular disease outcome, but the weight of evidence is so strong that it points in that direction.

When you say that some things are essential, that is clearly true, but you have to bear in mind the consequences of taking these substances and putting them in the environment. Once they are there, they will be there for a thousand years, and they will accumulate. In an ageing population they accumulate across your lifespan. In the ageing public, we are going to have higher and higher levels of these chemicals in our bodies.

Then it is a question of cleaning them up. DEFRA did a study that showed there are between 3,000 and 10,000 hotspots around the UK, and that to clean them up would cost between £31 billion and £121 billion. All of these things have to be factored in when you talk about, "They are essential. Let's get on and use them."

- Q16 **Blake Stephenson:** You will know that DEFRA recently published a policy paper outlining their interim approach to the persistent, mobile and toxic concept to support UK REACH risk management for PFAS. I will start with you, Dr Cloy. You can make the other point that you wanted to make as well. What are your views on DEFRA's interim position on PFAS?

Dr Cloy: We see it as a good first step in the right direction because the persistence of PFAS is acknowledged. But we do want reassurance that a universal restriction would be considered, and that we should not use a lack of toxicity data as a reason for inaction, or to keep going down the substance-by-substance approach. We know that these compounds are accumulating in the environment and causing harm.

The other point I wanted to make, which is related, is that we recently did a study with the University of York. It was the first UK look at PFAS contamination in rivers. It specifically focused on the short-chain TFA PFAS, which is a breakdown product of the longer-chain PFAS. We found that 98% of the sites investigated were contaminated. We really need to bear that in mind. We know—we have the evidence. The scientific bodies of evidence on PFAS are growing, and need to be taken into consideration



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so that we don't go down the track of doing more and more monitoring, with the burden on regulators and the burden of trying to remediate, which is an impractical solution. The best solution is alternatives to PFAS.

Q17 Blake Stephenson: The same question to you, Professor Depledge. What is your view on the interim position from DEFRA?

Professor Depledge: I agree with Dr Cloy. In fact, I would say exactly the same. One point that Dr Cloy made is that this business of testing chemicals one by one is insufficient, ultimately. Once these chemicals are in the environment, they are not there singly; they are there together with a whole load of other chemicals. We have to have a much more sophisticated view about how to test.

It is true that the Environment Agency—even when I worked there, which was a long time ago in the early 2000s, we had a massive problem with finding the resources to do environmental monitoring. We were spending about £20 million a year just to get guys to jump in a van, drive out to the river, take a sample of water and send it to a lab. We were measuring 3.8 million determinants in any given year.

The proliferation of chemicals in the world, as we were talking about a little bit earlier, is very great indeed. There has been a 50-fold increase in global chemical production in the last 50 years, and that is set to triple again by 2050. We are not going to be able to monitor them all, so when you come with a class of chemicals such as PFAS, with thousands and thousands of them, you have to take serious measures to limit their release and, as Dr Cloy said, find alternatives that do not persist.

Q18 Blake Stephenson: You will probably know better than me that Denmark has adopted a national action plan. Do you think that the UK should do something similar to inform the future—our prioritisation and what change we need to make?

Professor Depledge: Yes, I do. Denmark has taken a really good initiative, and it is worthwhile examining that and seeing what we could do.

Q19 Blake Stephenson: I will come to you shortly, Dr Cloy—you were nodding, so I think you are in agreement. In the spirit of finding recommendations for the Government, Professor Depledge, what do you think an action plan like that should cover?

Professor Depledge: It should certainly take a serious look at PFAS in air, water and soils. We should keep monitoring very carefully what is happening with the latest science on what the safer levels are. I am particularly struck by the rapid lowering of levels in drinking water that are being proposed. We need really just a very active programme that constantly reviews the latest evidence and builds that into our actions.

Q20 Blake Stephenson: Do you have anything further to add on that, Dr Cloy?



Dr Cloy: Denmark banned PFAS in food packaging in 2020, and it will restrict PFAS in clothing and footwear by 2026. We believe that following in the footsteps of Denmark and France, which is restricting PFAS in cosmetics, clothing and ski waxes, is how we can take measures to try to prevent irreversible contamination of the environment.

- Q21 **Blake Stephenson:** Would changes to UK REACH help the UK respond more effectively to emerging chemical threats such as PFAS?

Professor Depledge: The sort of thing I was alluding to earlier, which is a much more detailed evaluation of chemicals before they get out into the environment, should be a priority for UK REACH, to come up with some new ways of thinking about this and to get a wider—when I say wider, I mean interdisciplinary—view on the likely use and fate of chemicals. At the moment, they are very much considered from the point of view of how toxic they are, how much will be produced and that sort of thing, but they are not really considered in terms of, “What is their likely use going to be in the broader environment?”, “What is going to happen over a long period of time? What would be the consequences if these chemicals persisted in the environment? How would we get them back? How would we break them down?”, and “What are the alternatives?” I could come up with a longer list than that, but it is about that sort of thinking, and I think a revamp or review of UK REACH would be worthwhile.

Dr Cloy: I agree with Professor Depledge. We need UK REACH to keep up with EU REACH, and we need to really consider chemicals carefully when they go to market. There are so many poorly designed chemicals in use in the UK. If we use that universal restriction on PFAS, using the definition of the OECD, that is a positive thing that we can do that would help the identification of alternatives and promote innovation with products.

- Q22 **Blake Stephenson:** I am conscious that I have not asked you any questions, Ms Cottrell, and I do apologise. Do you have anything to add on my batch of questions?

Linsey Cottrell: I agree with what has already been said, but unsurprisingly, I want to reiterate the need for an action plan to have a full review of the scope of the uses and applications of military use of PFAS. Also, with respect to UK REACH, we need careful and cautious consideration of when defence exemptions may be applied.

Blake Stephenson: That is very helpful—thank you.

- Q23 **Chair:** Dr Cloy, before I bring in Julia Buckley, you have talked about the UK having a consistent approach with the EU, but during the evidence we have heard, “Denmark is doing this, and Germany is doing that.” It does not sound like actually there is any universality over there in the first place. If various nations within the EU can make their own derogations, is there actually an EU standard for us to try to recommend anyway?

Dr Cloy: Denmark and France want to be seen to be going above and beyond the EU REACH approach, which is hopefully going to come in. They are just trying to take action to protect their environment and health. We



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know that PFAS is in rainwater, and it is also believed to be airborne, so those national boundaries are meaningless if we are polluting the globe to such a wide extent anyway.

- Q24 **Chair:** My question is about the recommendations that we make, and I want to clarify what you are saying. You are saying that, as a minimum, the UK Government should be looking to be in line with the European minimum, while accepting that some nations are going further than that. Is that what you are saying?

Dr Cloy: We should follow the EU's proposal of a universal restriction on PFAS—that would be the group-based approach.

Chair: I have to tell you that some in this Committee do not like following the EU, but we will move straight on.

- Q25 **Julia Buckley:** I am interested to hear your description of the controls and regulation before PFAS come to market. Once PFAS are already there, we also want to understand more about the monitoring. Dr Cloy, how is current PFAS exposure monitored and mapped in the UK, and how do you feel about that?

Dr Cloy: Professor Depledge mentioned the hotspots that we are aware of in the UK, particularly in Benthams, where residents have been told to wash their vegetables, for example. People in Jersey are also exposed to PFAS in drinking water, because of contamination of the airfield there. Bloodletting has even been recommended because of the concerns about those residents' health.

I believe the regulators are monitoring restricted PFAS, but the monitoring of all PFAS would require resources. We measure the total organofluorine, but there are flaws in that approach, as there are in monitoring only select PFAS. Monitoring is tricky, and we do not want to see more and more expensive, resource-intensive monitoring. The best approach is to tackle the use of PFAS in products, and to do that as quickly as we can.

- Q26 **Julia Buckley:** I want to push back on that slightly. We have seen with other types of pollution—particularly water pollution, but also air pollution—how monitoring can expose the levels of risk of harm and the result in how people's health deteriorates. That generates quite a lot of public interest and then a policy response. There is a role for exposing the scale and scope of the problem, is there not?

Dr Cloy: Yes.

Julia Buckley: Professor Depledge, this is your area of expertise, so perhaps you could bring us up to speed.

Professor Depledge: The Environment Agency monitors 47 or 48 of about 100 registered PFAS that come in at over 1 tonne per year, but many other PFAS are probably used around the country in smaller amounts—we really do not know.



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The Drinking Water Inspectorate does not have regulations; it has guidelines for the water companies. The water companies are supposed to be checking for about 20 different PFAS substances in water supplies. There are those kinds of things going on, and then the Health and Safety Executive is interacting with the EU study that was looking at levels of PFAS in British people. Those are some examples of the kind of monitoring that is going on.

In terms of having an understanding of where these substances are, the two investigative journalists who operate Watershed Investigations have worked with a variety of scientists to compile a map of the hotspots for pollution in the UK, including the PFAS hotspots. That might interest you.

It is particularly interesting because of the environmental chemical mixtures, which are one of the things we have talked about. PFAS mixtures are discharged, with other chemicals added into those mixtures. Maybe we can evaluate their toxicity and likely persistence—maybe—but then there are mixtures that arise in the environment. If you look at some of the hotspots on these maps, they are not only hotspots for PFAS but hotspots for PCBs, pesticide residues, pharmaceutical residues and myriad other chemicals. We have no idea how these chemicals interact as mixtures—that is a complete unknown. We just know that these hotspots tend to occur around industrial areas, landfill sites, military bases, Air Force bases and so on. Hopefully that will be useful.

Q27 Julia Buckley: How do you think mapping can inform targeted interventions or remediation? We are policymakers, and we want to put recommendations to Ministers. Do you have any thoughts about that?

Professor Depledge: First of all—of course, I would say this—I think we need more research to see if we can detect the impacts of the mixtures around these sites, and also epidemiological studies. If we are detecting major impacts on ecosystems and human health and wellbeing, some measures will have to be taken to try to clean it up or move people away from those sites, but as I said, the cost of doing this is enormous.

Q28 Julia Buckley: Linsey, we have heard a couple of times about issues specifically coming from military sites. Is there no current statutory requirement or liability for military sites to conduct any of this monitoring or mapping, or to produce reports about the impact of activities?

Linsey Cottrell: For quite a number of years, the MoD has had a land quality framework through which it assesses its liability with respect to contamination. It has already been doing that, but of course, it has its own resource constraints on what it can actually do. There is now one consultant appointed to the framework; years ago, there were at least four on the programme, so I think it has been very much contracted over the years.

Professor Depledge mentioned Watershed Investigations and the Forever Pollution Project, which identified about 79 military sites across the UK that are presumptive sites of contamination—presumptive because we do not actually know how many military sites are contaminated. The list



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released by the Forever Pollution Project is not exhaustive. The project states in its methodology that, although there is pollution all across Europe, its investigators had to use a lot of open sources because they did not have co-operation from the militaries to identify the sites.

I think they identified 93 contaminated military base sites—90 of which are in Germany, and 3 in Sweden—but that is an underestimate. The sustainability report of the German MoD for last year has now come out. It is now reporting its own programme of investigations, and the number is much higher—about 163 sites in Germany. Sweden has listed about seven priority sites, so what we have in the public domain is probably an underestimate. For example, there are 16 QinetiQ sites across the UK, at which it tests munitions and missile systems, but only three of those sites are included on that list. There are probably more than are in the public domain, because environment mapping is not a public source at the moment.

Q29 Julia Buckley: To push back on that, there are obviously sensitivities around the data and access to military sites.

Linsey Cottrell: Yes.

Q30 Julia Buckley: You said that the MoD is monitoring this problem through the land quality framework. Do you mean that it is marking its own homework? We heard how the Environment Agency and HSE are responsible in other areas, and Ofwat has strategic overview of monitoring everybody else's water or pollution. Could you clarify the interaction? Who is doing it?

Linsey Cottrell: The MoD is regulated by the Defence Environmental Protection Regulator, which issues annual reports, but its last report, issued in March, does not include any assessments on contaminated land. There is a lack of transparency. If you submit a freedom of information request, you will generally get that information, but it is not in the MoD's annual reports on its contaminated land investigation programmes, nor in the Defence Safety Authority's annual assurance reports, so there is a gap there. That assurance report is worrying in that it cites resource and training capacity limitations. There is a limited assurance, given across all the organisations, that those organisations audit environmental protection assurance. The lack of resources for those organisations to fulfil their roles themselves, and the need to properly fund what they are meant to be doing, is a common theme.

Q31 Julia Buckley: That is interesting. The military not only have exemptions for use but, instead of being a hotspot, are a sort of not-spot. They can do their own survey, and they do not have to publish it unless forced to do so. Would it be better if a third party, an overarching agency, were able to do that, or if the military were required to publish that information? Which avenue do you feel would bring about more transparency?

Linsey Cottrell: There is a memorandum of understanding between the MoD and the Environment Agency, so it is not necessarily a closed system. The MoD is positioned to comply with UK legislation. I am not saying that



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the MoD is pushing back against it; it is about its capacity, and the scale of the problem it has. Of course, the MoD does not fall under the remit of the Office for Environmental Protection either, so it does sit outside the box. This issue needs more funding, and more transparency on what the MoD is actually doing. Publish that in the annual sustainability reporting. Sorry, I have lost my train of thought.

Julia Buckley: Your answer is really helpful—thank you. We will ensure that, in our report, it is on the radar that there is a gap in the data, and we note your important point about the lack of resourcing and training on that important reporting.

Linsey Cottrell: I have just remembered my point. Lack of transparency also risks a lot of speculation about what the issues are, so it is important that we are transparent about the potential risks linked to the MoD sites. If there is not that transparency, it lowers confidence in the MoD's accountability. It is really important.

Q32 **Julia Buckley:** We will make sure we forward that to the MoD.

That is a specific example of a very bespoke type of site, which has its own issues and constraints. Professor Depledge, reflecting back on your time as the chief scientific adviser to the EA and your previous career, can you tell us about any gaps or lack of collaboration between different agencies? You listed a whole ream of them—the Health and Safety Executive, the Environment Agency and so on. We have a plethora in this ecosystem, have we not? Do they work together well, and how could that be made more effective?

Professor Depledge: In my time there anyway, I think they worked reasonably well. Certainly, there were meetings between the different organisations, but one of the difficulties is that the teams do not stay the same over a long period of time, so there is no institutional memory of all the different chemicals that have been assessed.

If we think about PFAS alone, it has had a long history, and many other chemicals have had a long history—like bisphenol A, the plasticiser. Now we are getting information about microplastics. That will be the next thing. Indeed, that links to PFAS as well, because many microplastics release PFAS. My problem is that the teams do not meet enough and that there is not a long-term memory to keep learning from the different incidents. It is likely that new environmental chemicals will appear on your agenda and that we will go through a similar procedure again, not having learned anything much from the previous experiences.

Q33 **Julia Buckley:** What about data sharing and monitoring? Is there anything there?

Professor Depledge: Yes, I think there is a huge amount there. I am glad you asked me that. One of the things I did in the Environment Agency was to set up a thing called SKEP, which stood for Scientific Knowledge for Environmental Protection. That is back in the days when we were a member of the EU, and the idea was to get together all the



environment agencies of the different European countries—in fact, we got 17—to share their experiences of particular problems like PFAS. It was not PFAS at the time, but we were concerned about various other chemicals, and those were shared among the environment agencies of Europe. We shared research findings, because we had funded research in universities and research institutes, and we talked about the practical actions that could be taken and the policies that could be developed as a result of what we had found out. It was a fairly useful collaboration. It went on from about 2005 to 2010, funded by the EU. Then the funding collapsed, and it collapsed.

- Q34 **Julia Buckley:** Do you think that could be replicated under the newly established Office for Environmental Protection, which is trying to offer that framework?

Professor Depledge: Yes, I would be a great fan of that. Again, you could make it interdisciplinary, bringing in social scientists, policy experts and researchers—the whole deal. You would get a much more synthesised and integrated view of the state of the problem and how to come up with policy solutions that do not have too many unintended consequences.

- Q35 **Julia Buckley:** Dr Cloy, will you comment on that, and on any other gaps that you think might be in the data, whether that is gaps in the data itself or in transparency?

Dr Cloy: I was going to mention the persistent organic pollutants. Some PFAS have been classified as persistent organic pollutants, so they have been restricted under the Stockholm convention. That is an example of one of the frameworks that globally protects against PFAS contamination of the environment and humans.

Could you repeat the question?

- Q36 **Julia Buckley:** Do you think there are any current gaps in the data, or where we do have good data, is there anything we could do around transparency and accountability? We heard the specific example in the MoD, where there is a gap, but what about the rest of the data? Are there any issues?

Dr Cloy: PFAS are used in pesticides as active ingredients, for example, and we can get information about those, but we cannot get information about PFAS used in the inert ingredients of pesticides. Pesticides are complicated, as they have their own set of regulations. We definitely need to be aware of the gap, because TFA is one of those problematic breakdown products that comes from things like PFAS pesticides. On other gaps, I mentioned the gaps in toxicity data for PFAS. We do not have a lot of that information because there is such a diverse and large range of PFAS, but we should not use that as a reason not to do more about pushing alternatives to PFAS.

- Q37 **Julia Buckley:** We have heard your message loud and clear on pushing the alternatives and restrictions. To be clear about monitoring, is there a specific regulation that you would welcome and that would close the gap



you have identified?

Dr Cloy: Monitoring has a place. For example, we have seen the extent of UK river contamination. If the regulators can use a joined-up approach with the industry they regulate, that is something. I work on sewage sludge, and through the chemicals investigation programme, we know there is PFAS monitoring of biosolids. Bringing together all those stakeholders is key, but that is just a small part of it. Things such as pesticides, biosolids and their application to land are a direct source of PFAS into the environment.

Q38 **Julia Buckley:** Excellent. That is a model that could be replicated across PFAS.

This is my last question, and I will accept any takers. In the UK, are people living in deprived areas considered more at risk from PFAS? You all referred to the online report with the mapping. Has that exposed whether this falls differently in areas of deprivation, and if so, what impact does it have on them?

Professor Depledge: The experience of the Environment Agency regarding exposure to chemicals more generally is that people living near industrial sites, landfill sites and so on are more likely to be exposed. We can see that quite clearly, and the data on the mapping shows it. It is in those areas that tend to be deprived. The number of studies showing the ill health of people who are deprived is enormous. The difficulty is that the link has not necessarily been made between exposure to environmental chemicals and ill health, simply because there are so many confounding factors. I am sure there have been some studies, but I do not know them. The problem is that, in those deprived areas, people perhaps smoke, drink or use drugs more.

Q39 **Julia Buckley:** So we would have to disaggregate the variables to show the different impacts. We would need to find a more affluent area that has also been exposed to PFAS to be able to demonstrate the link. As you said earlier, there are gaps in the scientific research. Dr Cloy, do you want to come back before we wrap up this section?

Dr Cloy: There are also socioeconomic divides in things such as being able to afford organic food produce. Biosolids cannot be used for organic production, and PFAS pesticides will not be used, which is another less direct exposure. It is also worth mentioning occupation as a potential factor in how exposed you are to PFAS.

Q40 **Julia Buckley:** I think that leads us back to you, Linsey. Are there any studies, or any concern at all, about the exposure of military personnel? They often live on site, don't they?

Linsey Cottrell: I am not aware of any specific link to PFAS, but other studies have been done on military exposure in conflict settings, such as burning sites in Afghanistan and that kind of stuff, but it is very limited with respect to other environmental exposures. I just want to make a point about another study, but this is the global *Lancet* report that linked about 9 million premature deaths a year to air quality and pollution. I

know that is not PFAS-specific, but there are figures out there on pollution and its links to human health.

- Q41 **Barry Gardiner:** I want to return to the bloodletting that you mentioned earlier in the town of Bentham. I notice that some chap called Orlando Bloom recently paid £10,000 to have his blood purified from microplastics and PFAS. Picking up on what you said about specific professions, given we know that the aqueous film forming foams—or AFFFs—used during firefighting training and operations have been a particular source of PFAS pollution, might it be advisable for employers to avoid future lawsuits by getting their employees in the firefighting industry checked over with one of Orlando Bloom’s bloodletting procedures? You called it “bloodletting”, but I think they call it something rather less dramatic, perhaps “blood cleansing”.

Dr Cloy: I believe I mentioned bloodletting—I mentioned it in relation to the Jersey exposure, but maybe Professor Depledge knows more about Bentham and whether that was recommended there as well. In terms of the firefighting foams, we are aware of a consultation that is expected to tackle, or hopefully make more progress, on PFAS in that. This idea of bloodletting is really complicated, and also the PFAS litigation that we have seen in America is a big and complicated thing, especially in relation to biosolids. Some states have banned biosolid use because of farmland that has become contaminated with PFAS.

- Q42 **Barry Gardiner:** Two questions to the Deputy Prime Minister today, at Prime Minister’s question time, related to the ongoing health issues caused to military personnel from the nuclear testing back in the 1950s. I am conscious that they are talking about huge compensation payments there. Do you think it might be sensible for this Committee to at least caution about that in our report to Government? You are nodding, but that is not going to go on the record. If you could say either yes or no, that would be really helpful.

Linsey Cottrell: I would say yes.

Dr Cloy: I would say yes as well.

Professor Depledge: I would say yes too.

- Q43 **Chris Hinchliff:** I want to follow up on the discussion around chemical mixtures. What do we actually know about how PFAS interact with other chemicals? How does that impact the risks they pose? Dr Cloy, you are nodding, so perhaps I will go to you first.

Dr Cloy: We did a study with the James Hutton Institute on biosolids and the cocktail effect. There is not a scientific consensus at the moment, because it is such a difficult thing to model accurately and to understand the risks. A recommendation from that work was that we need to understand cocktail effects more. The combined impact of compounds could have increased risks, compared with the single compounds, or the additive effects of individual compounds. When they are in a mixture, their harm can be exacerbated. Professor Depledge mentioned microplastics;



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they absorb chemicals like PFAS, which is also noteworthy because the microplastics will transport those chemicals in chemical cocktails as well. Yes, maybe we need better science for modelling the risks and the harm, but it is a very difficult one to try to get accurate answers to.

- Q44 **Chris Hinchliff:** I will come to the other members of the panel in just a minute, but I would like to respond to that, Dr Cloy. You have mentioned multiple times how difficult it is to get the science to prove some of these points. Do you think that the Committee's report should be saying something about the precautionary principle in relation to these points, rather than waiting for totally conclusive science on them?

Dr Cloy: Yes, because the chemical cocktails are so different depending on the environmental compartment that you are looking at, for example.

- Q45 **Chris Hinchliff:** Thank you. Ms Cottrell, did you want to come in?

Linsey Cottrell: I want to reiterate the point about munitions. Obviously, that is quite an important point, because they themselves are a mixture. When you detonate explosives, there is always a residual explosive component left, such as TNT, which is a carcinogenic, mixed with metals and PFAS. Again, I am not aware of any research that has looked at that cocktail mix when it gets airborne and is dispersed either in a training exercise on a military estate or, as I have said before, in a conflict setting, and at how that impacts the local communities where it is being used.

- Q46 **Chris Hinchliff:** Professor Depledge, I would like to ask you some further questions. We have talked about the precautionary principle, but could you also expand on how strong our evidential base on this issue is, and whether you feel that we need further epidemiological studies to inform regulation?

Professor Depledge: Certainly. One of the things I would like to tell you about is that, over the last 18 months, myself and Professor Louise Heathwaite, the CEO of Natural Environment Research Council, have been supporting a Royal Society study on chemical mixtures. We held a workshop of experts in this field, and we are trying to synthesise a report at the moment.

The first thing that was very evident was that we know very little about mixtures, their toxicity and how they actually work. Of course, there is an infinite number of mixtures that you can have. There is some research, and a certain belief among some of the community, that synergistic effects are quite rare. Those effects are more than additive; they are over the top. It is the added effect plus something on top in terms of toxicity. It was suggested that the synergistic effects are quite rare, but I think there is accumulating evidence that that may not be the case, and I have certainly taken a strong interest in recent months in trying to see how broadly synergistic effects occur.

If you do a toxicity test in the laboratory on one chemical, do it on another chemical and then mix them together, and you have a predisposition to think that they are just additively toxic, you come up with one view. If



they are more than additively toxic, you are really underestimating their toxicity. This urges us to move towards the precautionary principle, and an approach that links the precautionary principle to this weight of evidence.

On one specific thing in relation to PFAS, we know that PFOA or PFOS are not necessarily occurring alone, and they may be contaminated with other PFAS. With many of the other 14,000 PFAS, if some are released together, studies have shown that they act synergistically and have more toxicity than the individuals ones alone. I think that is where we are with that. Sorry, did I answer your question?

Q47 Chris Hinchliff: I think you did. To follow up, although I might be prompting you to repeat a statement you have already made, what would you like to see this Committee recommending to Government to tackle the potential of those synergistic effects now?

Professor Depledge: Much more intense risk assessment and a more cautious approach—the precautionary approach. There are two kinds of instances that I have tried to allude to: first, the mixtures that may be discharged by industry from a pipe, which we can evaluate the toxicity of to some extent; and secondly, mixtures that arise in the environment, and the way to detect those is to intensify monitoring and to look for biological effects. You asked me whether there should be more epidemiological studies—yes, there should be. I hope that is programmes like the Biobank; in Europe, the EU biomonitoring programme; and in America, the NHANES programme, which gathers a huge amount of toxicological data, plus lifestyle data, age demographics and all sorts of things.

Those programmes will be the sorts that reveal whether chemicals are causing a particular problem. In fact, the study I alluded to earlier that I did with colleagues on PFOA—one of the PFAS—was done using the NHANES database in the USA. That showed a doubling of the risk of thyroid disease and liver damage in people with PFAS in their blood above a certain level. They are useful.

Q48 Chris Hinchliff: To some extent, such studies are having to run to catch up, because the chemicals are already out there and we are trying to work out what the problem is, when perhaps we should have known what the potential problems were before the chemicals were in the public sphere. Dr Cloy, what is known about the long-term health effects of the PFAS that have replaced those already banned?

Dr Cloy: Professor Depledge might be better at answering the question on chronic exposure to PFAS and human health, but we know of cases of regrettable substitution. For example, GenX was a regrettable substitute for PFOA, and down the line it was also found to be harmful, or perceived to be harmful, to human and environmental health.

Chris Hinchliff: Did you want to come in on that, Professor Depledge?

Professor Depledge: Only to say that the kind of listing that I was giving you of different diseases and so on is primarily associated, I think, in the studies that have been done, with PFOA and PFOS.



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We know something about the mechanism. We have things in our bodies called peroxisomes. PFAS seems to interact with chemicals that activate very important things in our cells, which affect glucose metabolism and all kinds of other things. I will not go through the extensive list of metabolic effects that they have, but they underlie the development of type 2 diabetes, cancers, kidney disease and many other things.

Q49 **Chris Hinchliff:** We know, as was just described, that regrettable substitution has happened. It may be happening now. What can be done to prevent further regrettable substitution going forward?

Professor Depledge: Again, more detailed evaluation of the chemicals that we are adding in as substitutes, before we put them out there. An interesting thing to think about is the way that chemical companies take on insurance when they produce a new chemical. They try to insure against anything going wrong in the future. They think that the chemical is okay, but they insure just in case something goes wrong. I may be wrong, but as I understand it, they cannot get insurance on PFAS compounds any longer, so from that point of view, perhaps they are being compelled to look elsewhere for different chemicals.

Q50 **John Whitby:** Dr Cloy, how widespread is the public's understanding of the dangers of, and exposure to, PFAS?

Dr Cloy: I would say that it is not well understood by the public. There is not transparency in consumer goods, but there are some progressive retailers that have supported a pledge to go PFAS-free, including Ikea. Even global chains such as McDonald's and Patagonia have phased out or are phasing out PFAS from products, but it is not widely known because we do not have that transparency. We do not want to cause consumers over-concern, but they do have the right to make an informed decision. The public ask us how they can make their homes PFAS-free, and we have to tell them that it is impossible because PFAS is used in such a diverse range of everyday products.

Q51 **John Whitby:** Thank you. We have heard several times today about the known hotspots around the country. Do you think the Government should be screening the blood of communities in those areas?

Dr Cloy: I would like to repeat myself. We don't need to do this monitoring because we know we have a problem, and we need to push for the upstream solutions to remove these chemicals. They are found in rainwater and the air that we breathe. Perhaps that would not be completely necessary. I do see a role for monitoring, but we do not want to wait 10 years for the results of a long-term study before we take action.

Linsey Cottrell: On monitoring for contaminated sites, where you have a legacy of pollution that has to be dealt with, monitoring is critically important, because otherwise you won't understand the scale and who the receptors are to that contamination. In that sense, it is really important for those priority sites.



Professor Depledge: I just want to respond to what you were saying about measuring PFAS in blood. I feel very torn about whether you should do that. Supposing you did a study like that, you would be alerting people to the fact that they have PFAS. But if you identify people with very high levels of PFAS, there isn't an awful lot you can do about it, and yet they might be reading up about the chance of getting cancer and various other things going wrong with them. There is a bit of a dilemma there: if you can't do anything about it, is it really ethical to start telling people that they have it? I don't know. That is a big debate that would have to be had somewhere.

Finally, I want to say something about product safety law in relation to businesses that include PFAS in their products. In the world of law, which is not my world, there are now people talking about the General Product Safety Regulations, which say that businesses have an obligation to put safe products on the market. That applies to the manufacturers and people in the supply chain. There are now questions about whether, if you put something on the market that has a lot of PFAS in and expose customers to it, there is a legal obligation to deal with.

Dr Cloy: I just want to add that there was a study by Wildlife and Countryside Link, a charity membership body, which tested the blood of nine parliamentarians and found PFAS in all those samples.

Q52 **John Whitby:** This is a question for all of you. Is enough known about the sources of exposure, particularly from historic landfill sites, sewage treatment works, sludge spread on land and so on?

Dr Cloy: You mentioned the use of sewage sludge on land. In the UK, around 80% of biosolids are applied to agricultural land, so the food that people are eating potentially has PFAS that have bioaccumulated in them, and that is also the case with livestock. Our food produce is potentially getting contaminated where biosolids have been used. It is the contaminated sites, and there are numerous studies linking exposure from water and food. We know that PFAS bioaccumulates, and that it biomagnifies within wildlife when they are exposed.

Professor Depledge: We know a lot about all the different sources, and there are just so many, but it might be valuable to know which are the most important. Are we getting it mainly through water, or is air an equally important route? Is it our diet? If we knew something about that, when we come to regulate more effectively, we would know where to target first to have the biggest impact.

Q53 **John Whitby:** What should be the regulators' priorities for reducing exposure?

Professor Depledge: I think it would be very good to regulate what is in water—to actually regulate it, not just provide guidelines—and really drive down the levels that are acceptable in drinking water. The point that Dr Cloy made about contaminating land, particularly agricultural land, would also be a priority. With waste water, you have to meet certain regulations regarding the contaminants in it, but in solid waste and sludge, I do not



believe there is a regulation that says you have to do that, but I may be wrong.

Dr Cloy: I work on sewage sludge, and I am aware that only the heavy metals are regulated; they are monitored by regulators and pathogens are controlled through voluntary measures. I believe that there is going to be improved regulations coming in, but there has been no pledge to tackle PFAS in materials that are applied to land, such as biosolids.

Linsey Cottrell: We have a big push for building homes and development, so as part of the planning process, we need properly strong guidance on the assessment of PFAS in soils and the exposure to people on brownfield sites, so that local authorities are properly resourced and equipped to deal with the risks posed by new developments—that is very important.

Q54 **Chair:** Finally, Dr Cloy, you have spoken many times today about the precautionary principle. Once this panel has finished, we will be hearing from a number of organisations that have used PFAS in their products, including some who have been able to transition on to other products and some who have not. I cannot predict what they will say, but they might say, “Hang on a second. We have these products that are of great importance. We haven’t been able to effectively find a replacement, and you do not yet know whether there is any damage caused by our product. Why stop us manufacturing this product until you know whether there is actually anything wrong with it?” What would I say to them?

Dr Cloy: I would say that the best thing is to safeguard for the future and to phase out PFAS from products. We have seen what has happened in America with PFAS litigation, for example, and we know that there could be a growing demand from consumers for PFAS-free, especially with the media interest that has been gathering around forever chemicals.

Q55 **Chair:** I absolutely take that point, but a “phasing out” is not quite the same language that we were hearing earlier, which seemed to say, “On a precautionary basis, let’s ban them.” Do you accept that there may be cases where Government would say that there just is not an alternative to this and it is necessary?

Dr Cloy: Yes, but we are aware of alternatives in sectors such as the food packaging. We know that there are alternatives to the food packaging uses of PFAS. With refrigerants, we also know that there are alternatives to F gases, but there probably are sectors out there that would need more time to develop the alternatives. If the Government incentivised those alternatives, I think that is a positive change, and we would see growth within that area of PFAS alternatives.

Chair: Dr Cloy, Professor Depledge and Ms Cottrell, thank you very much indeed for your attendance and the excellent evidence that you have given. I now bring this first panel to a close.

Examination of witnesses

Witnesses: Andy Spence, Dr Nissanka Rajapakse and Mark Hirlam.

Q56 Chair: Welcome to the second panel of today's inquiry into PFAS, their uses, and the issues associated with them. I am pleased to say that our second panel are representatives of various businesses with experience in this area. I will ask our three panellists to introduce themselves and explain what their businesses' involvement in PFAS has been from their perspective, any mitigations they have put in place, and their initial representations on the importance of the PFAS they use.

Dr Rajapakse: My name is Nissanka Rajapakse, and I am heading up product stewardship within Johnson Matthey. My background is as a toxicologist. In a previous role, I worked for the Food Standards Agency, while the committee on toxicity and carcinogenicity was assessing PFOS and PFOA in 2005. Johnson Matthey is a global market leader in many of the chemical and sustainable technologies needed to reach net zero. Many of the world's leading energy, chemical and automotive companies use our advanced metals chemistry and technological solutions to enable decarbonisation and reduction in harmful emissions from their operations and products while in use. We employ approximately 4,000 people in the UK. We have 11 UK sites, and are investing heavily in the UK at the moment. Capital expenditure over the last five years has been over £1 billion, and we plan to continue investing about £350 million in the next three years.

PFAS are relevant to JM in two main areas. The most relevant for today is its use within our hydrogen technologies business. We produce the key performance-driving component of fuel cells and electrolyzers. Those are based on platinum and iridium catalysts, which are embedded in fluoropolymers, and a fluoropolymer membrane between those two elements. This allows the breakdown of hydrogen to form energy. We purchase fluoropolymers from manufacturers in Europe, and we then synthesise and manufacture the performance component, which is called a catalyst-coated membrane. That then goes to original equipment manufacturers to create fuel cells and electrolyzers.

The other role that PFAS play in Johnson Matthey, but also all chemical industries, is the importance of fluoropolymers and fluoroelastomers in industrial equipment—seals, gaskets, piping—that is critical to most chemical manufacturing plants. The performance that these fluoropolymers deliver, in terms of stability and resistance to harsh chemical conditions or high temperatures, and low coefficient of friction, is critical to ensuring that our plants operate safely and predictably.

Chair: I am going to bring Chris Hinchliff in briefly to make a declaration of interest.

Chris Hinchliff: Johnson Matthey are a major employer in my constituency in my hometown of Royston. I am in ongoing communication

with them as a result.

Andy Spence: Good afternoon, Chair. I am the managing director for Britannia Fire Ltd, a small to medium-sized enterprise based in Norfolk. We have been established since 1970, manufacturing portable fire equipment, which we proudly sell into the UK but also export to the Middle East, the Far East and Europe, which is a really big customer. It is great to be here today to talk about portable fire equipment. I am also a board director for the Fire Industry Association and an expert standards writer for British standards as well, at BSI.

Talking about portable fire extinguishers for us as a business, it is really important to say at the outset that we have moved completely away from PFAS in our organisation, and we did so back in 2024. There are three problems we have found along the way, in that transition to PFAS-free products—one being testing new products and passing British standards to meet the required standards that you need to carry the certification. The second is the disposal of the chemicals. There is also some confusion between C6 and C8 chemistry, so PFOA and PFAS. I think that people need more education around that piece as well. When you explain to people, they understand that they need to do the right thing, but it is getting that message across. The first one has been achieved but the other two problems need some assistance.

Mark Hirlam: Good afternoon, everyone. I am pleased to tell you that PFAS plays no part in the products that we are bringing to market. We are a paper producer, bringing paperboard into the market that is used predominantly for food and drink. Predominantly, those materials needed barrier properties, and to achieve barrier properties in that market historically, you were coating paperboard with PE and PLA. Delipac doesn't contain any of those materials, I am pleased to say—so in that regard, being plastic-free, we have a big tick in the box.

However, PFAS is a different subject altogether. We were alerted to the dangers of PFAS back in 2019, by a major UK supermarket who simply said, "How much PFAS is in Delipac?" Frankly, we didn't know, because at that time we weren't testing for it, and at that time there weren't many organisations that could provide testing for that. We were put in touch with Fidra, of all people, so we started talking to Dr Cloy and her colleagues, who were unbelievably helpful in encouraging us to get our products tested for PFAS. Fortunately, our technology does not contain any PFAS, and it is certified under various EU chemicals agency certifications, toxins in packaging, and it is also fully compliant with EU REACH regulations.

EU REACH is quite important, because UK REACH has adopted some of the standards of EU REACH, but not all. If you think about the sphere in which we are operating—we are talking about food and drinks packaging—do you really want to be drinking or eating out of something that is potentially contaminated with PFAS? Of course you don't. I suppose what we are doing right now is waiting for there to be some UK-specific regulation that we can have our product tested against.

Q57 **Chair:** So you are saying that your product has never included these. It may have been a happy accident when you discovered that, but that is the case. It is not that you have removed PFAS from your product.

Mark Hirlam: It is a happy coincidence, but we live in a world where a number of our competitors in the UK are saying things like, "We don't knowingly add any PFAS to our product." That is a world away from getting certification, which is hugely important for us. We are disrupting the status quo in the world of food and drinks packaging, and the only thing you can do to defend yourself against that is to be certified at every level for all these materials.

Q58 **Chair:** Thank you for that. We did not find it easy to find businesses that wanted to come and discuss these issues in the public eye. I am particularly grateful to Johnson Matthey. It is obviously important to hear the voices of those businesses that are currently using PFAS, but it is also important to hear from those businesses that have been able to make changes away from PFAS products. All these perspectives are very relevant.

Dr Rajapakse, what are the main barriers to identifying PFAS alternatives from your perspective? Is it technical standards, commercial viability, regulations or a mixture of all three?

Dr Rajapakse: It is largely the commercial and performance aspects. The requirements of fuel cell and electrolyser key performance indicators that are pushed down from our customers to us are very stringent. They are tens of thousands of hours of operation time, and they want predictability of that performance and at a certain cost. The fluoropolymers have been in use for a couple of decades now and have demonstrated themselves in these applications. There is a supply chain that allows predictability there as well.

The difficulty we find is that the operating conditions within a fuel cell or electrolyser are extremely harsh. You have high potential differences, there are lots of reactive chemistries occurring, and it challenges the chemistry of the membranes and the cathode and anode in these materials. Alternatives are being researched; we are actively researching both internally within the company and through collaborations with industry partners, as well as academics in the UK, US and Switzerland to try to identify alternatives. The fluoropolymer component is a significant cost as well, so we are keen to find alternatives that do not have this concern associated with them, but we are struggling at the moment. There are positive signs, but it will take a little more time and investment.

Q59 **Chair:** We will explore that in more detail as we go forward. Mr Spence, once you developed PFAS-free products, did you find that had commercial benefits, with increased demand? Are your competitors still using PFAS fire extinguishers, or has the whole industry moved on now?

Andy Spence: That is a really good question. What we decided to do was try to educate our customers by looking at the products that we had previously supplied them that had contained PFAS. We did something that



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the Government did a few years ago with a scrappage scheme. We said, "We'll take away your old extinguisher that is contaminated, we'll recycle that as much as we can, we'll dispose of the contents, and we'll give you a discount against the new product, which will mean you're ahead of the game before costs start to rise." One of the things we have noticed is that costs have started to rise already. When we first initiated that scheme back in 2024, it was £434 to dispose of an IBC bulk container. Last month, it was £2,800. There are people taking advantage of this, and we need to look at how we can deal with that. That is one reason we wanted to get involved.

We have also developed a better product—a better offering for the customer. We use composite materials to manufacture our fire extinguishers, so they do not need an annual service each year. They do not rust and corrode like a typical extinguisher, so our foam inside them can last for sometimes eight or 10 years, depending on which model the extinguisher is. Our competitors have to change their foam out every five years, because of rust and corrosion of the metal cylinder. That is a really good advantage that puts us ahead of the game, as a British manufacturer. Our competitors are still selling PFAS products, but those products mainly come from overseas.

Q60 Chair: Mr Hirlam, you were marketing away in your previous comments, saying why your products are better than those of some of your competitors, quite rightly. Do you see increased demand for PFAS-free products in the food sector?

Mark Hirlam: We sell our products from the top down, not the bottom up. In other words, we talk to high street retailers and brand owners at a national, European and global level. To be fair to all three groups, they are hugely receptive to the idea of having a product that is PFAS-free, and certainly the European and global people, because they are being pressed by legislation in their regions. You heard earlier, from Dr Jo Cloy from Fidra, that Denmark and other countries started the ban in Europe. That is now being followed by a ban in Canada, for example, and a ban coming in various parts of the United States on a state-by-state basis. I think that European and global brand owners and retailers are feeling the pressure more than it is perhaps being felt in the UK, but I think that is only because there is a lack of required certification in the UK. Once we have that certification, I think it will put people under equal pressure.

Q61 Chair: Obviously, to an extent, the different regulatory approaches do not matter to you, because you are compliant with any of them, but do you think that it would be beneficial for businesses across the sectors if the UK aligned with European regulatory approaches?

Mark Hirlam: I am not suggesting that the European regulation is better than anyone else's, but it is the only one we can sign up to right now. If there were UK certification, we would be at the front of the queue, elbowing people out of the way, to get signed up for it—that is for sure.

Q62 Chair: What about you, Mr Spence? Do you think that there would be

some benefit to having an approach in the UK consistent with that in your export markets?

Andy Spence: Absolutely. Germany is probably our largest customer, and they are ahead of the game. Alignment would definitely be beneficial to us, as a manufacturer. I struggle to work out how you would differentiate between the two anyway. The fill that we put into the extinguisher is only one fill, so it has to meet that one exacting standard.

Q63 **Chair:** I am not sure if you answered my question previously. Are there still products on the market that include PFAS, or has the entire sector moved away from them?

Andy Spence: As far as I am aware, we are the only British manufacturer that has moved completely away from it, but a number of manufacturers import PFAS products, because they are still allowed to sell them. They are looking at a derogation period of five years for products brought to market once a ban does come into force. They are thinking, "Well, by five years' time they will have discharged the extinguisher anyway, so it goes away."

Q64 **Chair:** Do you find, when you are trying to sell against competitors, that being able to say that you are PFAS-free is a benefit?

Andy Spence: Absolutely. Definitely, yes.

Q65 **Chair:** Dr Rajapakse, do you have concerns about liabilities arising from continued use, such as potential legal cases or anything like that?

Dr Rajapakse: It is clear that there are risks of liabilities there for companies using PFAS. There is evidence of that in the US and elsewhere.

Q66 **Barry Gardiner:** Mr Hirlam, and indeed all of you, may I echo what the Chair said about coming and giving evidence to us—Mr Hirlam in particular? We had approached another company that makes the plastic cups that I am drinking out of. I notice you are drinking out of one of your Delipac cups—yes, ostentatiously advertising it on screen! We note that. It is one of the companies that refused to come and speak before the Committee, but it does say that it has no added PFAS—the quote that I think you used. Is that not rather like me, as a politician, saying there is no added cynicism to me?

Mark Hirlam: You are right; indeed, in many respects, they have given you a political answer. May I suggest that, through our UK-based cup converting partners, we produce some Delipac paper cups for the House of Commons on the basis that you can be reassured that you will not be drinking out of a paper cup that contains PFAS?

Q67 **Barry Gardiner:** You are doing a wonderful marketing job here, Mr Hirlam, but that is not the purpose of this. However, you do lead me on to something I wanted to ask you about. When Parliament procures its cutlery—we have wooden cutlery, takeaway boxes, and so on—would it not be a good idea, and perhaps one the Committee might recommend, to at least ensure that our procurement, public procurement, is PFAS-free?

Mark Hirlam: I think that would send a very good signal.



- Q68 **Barry Gardiner:** It certainly would send out a signal, yes; and of course, all other companies might be able to go through the OJEC procedures and apply that way, rather than just Delipac.

What challenges does your company face? You said, "We didn't know whether we had and we had difficulty finding out." How difficult was it for you to track down the supply chain to make sure that you really are PFAS-free?

Mark Hirlam: Don't forget that we are talking about the humble paper cup, which has to be sent to ISO institutes, which then analyse the material for PFAS content. In the paper world, that is not very difficult. I am not sure how difficult or otherwise it would be for the other two gentleman you have on the panel today, but certainly for paper products, it was not difficult at all. Of course, it is difficult if you know that your chemistry does contain PFAS. It suddenly becomes a question of, "What can you do about that?", because there is no point in getting it tested for PFAS if you know that your product has PFAS in it.

- Q69 **Barry Gardiner:** Indeed, but what one could do, I suppose, is to regulate to at least insist on transparency, so that if the public is looking to purchase a product, then they can either go to Mr Spence and get his PFAS-free fire extinguisher, or they can go to another product that specifically says, "We contain PFAS". They can then at least have the benefit of transparency to make an informed choice.

Mark Hirlam: That could work, but do not forget there is another component here, which is public opinion. You cannot open a newspaper these days without reading a report about the rivers in which high concentrations of PFAS have been found and the fact that the rain in London now contains PFAS. I think there is a level of public expectation that you guys are going to do something about this; and, given that other regions in the world are doing something, when you are perceived as not doing anything, then I am sorry to say that you are seen as left wanting.

- Q70 **Barry Gardiner:** Spoken like a true Yorkshireman, if I may say so. Thank you very much. That was robust and helpful.

I wanted to ask you about the way in which PFAS may be being reintroduced into the environment through biodegradable or compostable materials. We can perhaps look not only to you, Mr Hirlam, but to others to talk about the way in which some products are marketed as compostable. Actually, if they contain PFAS, we are compounding the problems in the soil in the watercourse.

Andy Spence: I have one comment on that. When we look at disposing of all the PFAS that we are taking back and the £2,800 bill that we have to pay to dispose of it, this is going to incineration. We have done research, and there are apparently only two incinerators—to my knowledge—that can do this. Apparently, there are over 10,000 tonnes waiting to be disposed of, so there is a backlog already—this is prior to any ban that comes into action. But when you look at incineration, surely that is going to go into the atmosphere and then end up back in the water table, so



why are we looking at this and why is it so costly? I don't know. Perhaps you could look at some R&D into removing PFAS from the water—a typical fire extinguisher, for example, has 6 litres of water. An average extinguisher has 3% AFFF—aqueous film forming foam—in it, as you have said. If you could remove that 3% and make the 6 litres, less the 3%, clean, surely that would be of benefit to everybody and would be a lot less to dispose of.

Q71 Barry Gardiner: Indeed; that would be prevention rather than cure. Dr Rajapakse, you speak as a scientist and you have been involved in this. Does incineration actually get rid of the PFAS? Does it break it down? We have been told that these are incredibly persistent chemical compounds.

Dr Rajapakse: The evidence available—the US EPA has done quite extensive work on this as well—is that if you achieve a certain temperature above 1,000°C and a residence time of over a second in those temperatures, you are completely mineralising the PFAS to carbon and fluorine, so you should not get emissions of what is known as PFAS into the environment.

Q72 Barry Gardiner: That would be a heck of a lot of energy used to get rid of some of the materials in compostable paper cups.

Dr Rajapakse: Indeed. There are incinerators that routinely achieve those temperatures—not specifically for PFAS, but for the management of hazardous waste.

Q73 Barry Gardiner: What lessons do you think we can learn from other countries that have successfully reduced PFAS in their consumer goods, Mr Hirlam?

Mark Hirlam: I think the ban, particularly in places like Denmark—let's not forget that Denmark was first out of the trap on this one—has driven a change in behaviour. People have simply been forced to either fall into line or lose the business, and this is a very compelling argument. What do you do: do you drive PFAS out of your product, or do you lose the business? I would be the first to accept that while we have developed a technology that is PFAS-free, and while that has come at a particular cost in terms of R&D, that is something that we have been able to do. I would also accept that, in other areas, there could be an argument that PFAS cannot be taken out of the product because it is a component that is actually needed. But I am a firm believer in where there's a will, there's a way.

Q74 Barry Gardiner: Perhaps only if the Government set those very clear regulatory targets will that way be found.

Mark Hirlam: Correct.

Q75 Barry Gardiner: Mr Spence, I saw you nodding. Did you want to add to that?

Andy Spence: I want just to say that it is very difficult when you start on the journey that we took in transitioning from PFAS to PFAS-free. The testing that we had to do was phenomenal. Replicating the British



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standard test for firefighting capability was almost impossible in some respects. In fact, we dropped three of our product lines and went to market without them just because we could not meet them, but we did not want to have PFAS in our facility or in our products. We took the decision to do it while we reinvented some different products.

We moved away from foam completely on one line to a water mist-based system as well. It is just pure water—de-ionised water, I hasten to add. The problem you are going to find as well is that British Standards, which does the tests, has no capacity. It is absolutely full to the brim, because people are trying to change already—it is not just firefighting products; it is other products—and the labs are full.

Q76 Barry Gardiner: That is very interesting. The Government therefore have a role to play in ensuring that there is capacity to get this right.

Andy Spence: Correct.

Q77 Sammy Wilson: Before we move to the questions, I wanted to ask this. Mr Hirlam and Mr Spence, in developing the new products that you are talking about, are we likely to find in the future that, because you have had to change the nature of the product, there might be equally damaging components in the new products that have not been identified at present, or whose harm has not been identified at present, but which may become apparent in the future?

Andy Spence: We worked with our German manufacturer of the firefighting chemical. You cannot rule it out completely, but we have gone through everything that we could physically know. I realise that there have been issues before, but that is also why we went to a water mist product as well. We moved away from firefighting foam to misting. There is more technology in the nozzle of the extinguisher than there is in the actual content of the agent that does the job. That is why we moved away from that.

Mark Hirlam: We are not reliant solely on PFAS certification. Our technology and materials are underpinned by the analysis of EU REACH. EU REACH, if you are not familiar, has 263—I believe that is the number—different elements that could be contained in a material, and that ranges from heavy metals to all sorts of other nasty chemicals. Where our materials are concerned, we are not introducing into the formula of our materials something that is, or could be, just as harmful as PFAS. We are making sure that our product is underscored by EU REACH, but it is also underscored by European material agreements on how they are used both in the UK and Europe, and indeed the FDA in the United States. To be able to cross the bar to sell your products successfully for food and drink packaging, the bar is already high from the elements that might be contained in that material.

Q78 Sammy Wilson: Obviously, there are still companies that use materials with PFAS in them. Why do they continue to do so? Is there a cost element? What is the difference between producing the kinds of goods that you produce and the PFAS packaging that is used in other products?

Mark Hirlam: My sense is that they are heavily invested in the production technology that they have got right now, and that production technology may well rely on introducing elements such as PFAS into the whole production process. Quite often, people do not want to change these heavily invested production processes until they are actually mandated to do so.

Q79 **Sammy Wilson:** Because of the costs involved?

Mark Hirlam: Yes.

Q80 **Sammy Wilson:** Dr Rajapakse, you gave us a couple of examples of the products that your company is engaged in and why it is essential to use PFAS in them, because there are no alternatives. We have heard about products such as school uniforms and packaging where there are alternatives, but to what extent are there goods, technologies and production facilities that require PFAS and there is not an alternative? You have mentioned using it where there is high heat or friction. Can you give us an idea of the range of products where there is no alternative to PFAS?

Dr Rajapakse: For us at the moment it would be in the fuel cell and electrolyser space. We have seen no evidence, from the work that we have done or across the sector, that alternatives for PFAS in those materials are commercially viable. In industrial equipment, it is across the piece. The European chemicals federation Cefic surveyed 111 of its members across 1,400 sites. They all cited the fact that they rely on industrial equipment that contains PFAS.

To Mr Gardiner's earlier question, there is a lack of transparency in the supply chain of equipment about the presence of fluoropolymers or PFAS, because there is no requirement to communicate that up the supply chain. This is based on the information that the industry had. There is a difficulty finding suppliers of equipment that do not contain those fluoropolymers in the seals, the gaskets and the piping. We see it in PPE. It is critical to personal protective equipment for fire safety personnel, who might need to respond to incidents on plants. From Johnson Matthey's perspective, that is where we are finding it most difficult to find alternatives and phase out fluoropolymers.

Q81 **Sammy Wilson:** In terms of common consumer products, are there any that you can identify that use PFAS and there is no alternative?

Dr Rajapakse: That would be outside of my expertise, I am afraid.

Andy Spence: To come back to your question about the cost and the alternatives that are still out there, we mitigated that cost by improving the product. We looked at the whole-of-life cost and the sustainability. We went to Heathrow and developed a product for them that enables them to save over £1 million in servicing costs. It also meant that they did not have to discharge their extinguishers every five years; they can do it every 10. That limited the amount of trade waste that they are going to have, as well. Yes, there is a cost increase, but if you look at the whole-life cost of the product, it is well worthwhile.



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Q82 Sammy Wilson: Once again, Dr Rajapakse, you touched on some of the qualities of PFAS that made it essential to products. Could you elaborate on the logistical and technical constraints that there would be if you did not have these products available to you?

Dr Rajapakse: If, at this time, there were no fluoropolymers available to be used in the hydrogen technology sector, that nascent sector would be significantly impaired. The proton-electro membrane technology is seen as a critical part of the net zero transition. I believe it is understood that you cannot achieve net zero without the hydrogen sector. Hydrogen has a key part to play there. You would not be able to market fuel cells or electrolyzers that function and meet the key performance indicators of the end manufacturers. If we had to phase out fluoropolymers and fluoroelastomers from industrial equipment, it would require chemical plants to identify those alternative equipments and invest time and effort to shut plants down while maintenance is done to replace those parts. You then have to dispose of those parts appropriately, which means finding the high-temperature incinerators that can manage that.

Q83 Sammy Wilson: Today, and in some of the other evidence we received, we were told that the precautionary approach should be used, and even where, perhaps, we still need to do some investigation into the impacts of PFAS, the Committee should recommend a precautionary approach. If that were our recommendation, and if that were the policy decision that the Government were to make, what impact do you believe it would have on UK industry, net zero attempts and the general economy?

Dr Rajapakse: I will try to avoid hyperbole, but I think that would be fairly catastrophic to the chemicals industry in the UK. The hydrogen sector would really struggle to grow in response to that.

Q84 Sammy Wilson: Mr Spence and Mr Hirlam, do you have any comments on the recommendation or the suggestions made to us today that we should really take the precautionary approach and say, "Let's ban PFAS" because of either the already identified dangers and risks that it presents or the possible risks that it presents?

Mark Hirlam: Is it not possible to look at this in a different way? I think there are different challenges for different sectors. It is interesting that Denmark has banned, for example, PFAS content in food packaging and, I believe, furniture. I think they have done that because alternatives are readily available, so it may be that you folks should look to introduce a ban or the requirement for certification on a sector-by-sector basis, rather than a blanket ban that, as we have heard earlier, could be hugely difficult.

Andy Spence: We took the decision. We do not want any cancer-causing chemicals in our production, and that was as simple as it came. We decided completely to move away from it. As soon as we were aware of the potential risks, we stopped it, and we do not want to get involved with it again.

Q85 Sammy Wilson: At Johnson Matthey, how do you manage the life cycle of

these chemicals from their original use to their eventual disposal?

Dr Rajapakse: That is a great question. Our approach is that we want to ensure we are not contributing to the levels of PFAS in the environment through any continued use of these substances. As I mentioned in my introduction, a key component here is that platinum group metals are in the equipment that we place on the market with the fluoropolymers in them.

It is important economically and in terms of critical raw materials that we recover the platinum group metals, so at end of life there is a process. It is economically of value to our customers to make sure that that equipment is returned to us to refine the material, recover the metal and ensure that we are controlling them at end of life so that they do not enter the waste phase.

Q86 **Olivia Blake:** I want to bottom out completely what alternatives could be considered, because it is quite worrying to hear that there does not seem to be any commercially viable options for you. I want to make sure that I've absolutely understood that.

Dr Rajapakse: That is correct on the basis of the research that we have done.

Q87 **Olivia Blake:** Moving on to research, is there anything we should recommend in the innovation space to support new products or new approaches that you would like to see us asking for from Government?

Dr Rajapakse: My colleagues who track availability of R&D funding have let me know that they have not seen a significant amount of UK funding in the area of research for alternatives for fuel cells and electrolyzers. It would be great to see that potentially change. There are excellent academics in Reading and Coventry, for example, who we collaborate with, and they could benefit from further funding in that space.

Q88 **Olivia Blake:** Are there any specific projects elsewhere in the world you can point to where that funding is being made available?

Dr Rajapakse: We are involved in a Department of Energy project in the US with industrial partners and the University of California to look at the performance of non-PFAS-containing membranes in fuel cells and electrolyzers. There are other examples elsewhere in the world.

Q89 **Olivia Blake:** Given the difficulty of disposal—and I appreciate your answer to the last question—what does safe disposal look like for you as an organisation?

Dr Rajapakse: At the moment, safe disposal would be incineration. To recover the platinum group metals, it goes through an incineration step first and that achieves the temperatures and residence times that we talked about. We have analysis from the third parties that we utilise confirming that. In our annual report two years ago, we published a novel technology that we have piloted, which allows us to recover the fluoropolymers in a form that we can reuse in manufacturing new fuel cells

and electrolyzers. We hope to be moving towards a truly closed loop in that respect.

- Q90 **Olivia Blake:** Going back to research, do you have an order of magnitude figure that you imagine would need to be invested in this to get new products available to the market? Is it very much primary research, or are we closer to a solution than that?

Dr Rajapakse: We are not that close to a solution is what I am told. As I mentioned, tens of thousands of hours of operation time of these pieces of equipment require lengthy qualification testing. It takes time and investment to achieve the level of confidence that the materials are robust enough.

- Q91 **Olivia Blake:** Is it probably on the larger side of R&D funding?

Dr Rajapakse: I am afraid so, yes. I do not have numbers, I am afraid.

- Q92 **Martin Rhodes:** Mr Spence, you set out earlier that one of the challenges in moving away from the use of PFAS was around the standards, testing and so on. Were there any other challenges that you faced in that process at all?

Andy Spence: There is always a price challenge when it is something new—absolutely—but I think it was mainly down to the firefighting capabilities. Everybody knows that AFFF is a fantastic firefighting agent, and all the previous tests and parameters that had been set were so high because they knew what it could do. Now trying to achieve the same results with a lesser chemical is very difficult. That is all, really.

- Q93 **Martin Rhodes:** In terms of those issues around performance, what was the response of customers? What was your interaction with them? What was their feedback? What was their reaction?

Andy Spence: Customers want to move away from it. Once you educate them and explain what is happening, they are all for it. In particular, our bigger customers, such as the NHS, Sainsbury's, Heathrow and so on, are all well engaged with it already and were looking for an alternative. They are all on board and have bought into it as stakeholders.

The time it took to do it was the biggest key problem for us, because we had to keep going back saying, "We've had another test, and it's failed; we have to do another one", and so on. You are reverting to nozzle technology, which takes time. As I was saying, British standards are not at the capacity to do all this testing, so you could get a successful test done and then wait three to six months for the certification to come through.

- Q94 **Martin Rhodes:** You mentioned performance; is cost an issue as well? You mentioned earlier improving the quality and performance to mitigate costs. Is cost a potential issue for customers?

Andy Spence: On the waste side, to get rid of what they already have, absolutely. It is now around £17 a unit for disposal. It was £2 previously, and you can probably buy an extinguisher for £20, so it is nearly as much to dispose of one as it is to buy one.



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Q95 **Martin Rhodes:** You mentioned the capacity for testing and certification. Would it be helpful if there were more resources within that, not just for your own company but for the industry more generally?

Andy Spence: Yes, absolutely. We are great innovators at Britannia Fire and always have been. We were the first to go to market with a completely service-free product, because that is what the customer wants; they do not want recurring revenue costs all the time. But yes, absolutely, if there is something that can be provided—some testing facilities to help us—that would be absolutely great.

Q96 **Alison Taylor:** Thank you to all the panel, and congratulations, Mr Spence, on being able to move away from what seems like a very dangerous product. I would just like to ask you a few last quick questions about the disposal of end-of-life products. Would you say that there is sufficient capacity in the UK? What are the current options for disposing of these end-of-life products? Is that something you get involved in?

Andy Spence: Yes. When we take them back from the customers' premises, we cannot even recycle the steel extinguishers coming out because they have been contaminated with the chemical. You cannot refill them; they have to go to be squashed and what have you. Going back to the incineration, there are two incinerators that we know of that are capable of doing this, and the waste-management treatment company that we use is citing that as the reason for the cost going up.

Q97 **Alison Taylor:** Just finally, is there support that you need from Government to ensure the safe and legal disposal of these products? Do you have any recommendations that the Committee could consider?

Andy Spence: I think the biggest win for anybody and everybody would be to take away the PFAS from the liquid. If you can separate the two liquids, you are on to a winner. When you are disposing of a one-tonne IBC, 970 litres is water; it is just the infected water. If you could remove that chemical from it and separate it—maybe Johnson Matthey could help on that, I don't know—that would be beneficial for everybody.

Alison Taylor: Thank you very much, and thank you to the panel for all your contributions.

Q98 **Chair:** Finally, Dr Rajapakse, you referred to the need to incinerate product to prevent PFAS ending up in the waste stream. Have you made any assessment of the amount of airborne PFAS that results from that, or do you believe that, as a result of the heat at which it is incinerated, there isn't then PFAS disappearing into the atmosphere?

Dr Rajapakse: I will preface this answer with the complexity: the analysis of PFAS is very challenging, but the data that is available to us is that PFAS is fully mineralised into its constituent elements of carbon and fluorine, so we expect no PFAS to be coming out of the incinerators.

Q99 **Chair:** What sort of temperature does it have to be incinerated at to achieve that?



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Dr Rajapakse: Above 1,000 degrees, we are told.

Q100 **Chair:** So there are obviously substantial energy costs associated with that process.

Dr Rajapakse: That is exactly why we are investing in the technology to recover and recycle the ionomers and fluoropolymers so that they can be reused, rather than incinerating them and wasting that resource.

Chair: Excellent. Thank you very much. Dr Rajapakse, Mr Spence, Mr Hirlam, thank you very much for the evidence you have provided us with today. It has been very helpful.