

TRANSCRIPT OF APPG ON SHALE GAS REGULATION & FRACKING

14TH DECEMBER 2016

Kevin Hollinrake

Good afternoon everybody – sorry I'm late, but you might have heard that the bell just rang for votes. I am the Member of Parliament for Thirsk and Malton and Chairman of this APPG. A couple of formalities.

Apologies

James Duddridge MP

Dr. Daniel Poulter MP

Lord Inglewood

Alan Whitehead MP

Lord Haskel

Lord Putnam

Lord Hylton

Today we're going to talk about waste water, something that is key to making sure the environmental side of shale gas exploration is done in an appropriate manner. Just to explain for people who haven't attended our APPG before – this is not about whether we should frack or not. This is very much about if shale gas exploration goes ahead making sure we've got proper planning and proper regulation for those activities. We have a good line of speakers – welcome everybody.

John Busby

I'm a retired engineer – I used to work in the chemical industry and in the dairy, brewery and food and drink industry as an engineer. My activity now is writing on energy matters which I publish on the web.

Dr. Jim Marshall

I'm from Water UK. Water UK is an association that represents the statutory water and waste water companies. I'm one of the policy team there and I take the lead within the organisation on shale and the impacts of shale on water and waste water.

Dafydd Williams

I'm from Yorkshire Water, one of the regulated water and sewage companies so Yorkshire Water are potentially a final receiver of waste water from the fracking process.

Mark Ellis-Jones

I'm the Programme Executive at the Environment Agency running the Onshore Oil and Gas Programme so the Environment Agency is the environmental regulator in England, not just of the shale gas sites but indeed of the waste water industry as well.

Laura Grant

I'm Policy Advisor at CIWEM – which is the Chartered Institution of Water and Environmental Management so we represent individuals who are engineers, scientists and environmentalists in the industry.

Kevin Hollinrake

Just to explain – this meeting is being recorded and we do put a transcript of the recording and the actual recording viral on our website. Our intention is, once we've collated our evidence and we're close to having done that, with a number of enquiries across all the main areas of concern, we intend to produce a report which should be available and published early next year.

So I invite anybody who wants to, to say within two minutes any concerns or any thoughts they have in terms of the waste management of waste water resulting through this process. Would you like to start John?

John Busby

Yes indeed. I mentioned I was an engineer in the chemical, dairy and food industries. I did have experience in commissioning a reverse osmosis water treatment plant for a dairy in the middle of the Saudi desert so I have some experience in waste water treatment. In the United States flowback and produced water from fracking is stored in huge open pits and subsequently injected into deep, underground wells. Both these practices are prohibited in the EU and in the UK. In the UK fracking waste water is stored in double skinned tanks prior to being sent to treatment. The operator of the treatment plant has to have a written agreement with the company with a permit to treat and dispose of its waste, but operations have to cease if there's no treatment facility available. Every well location will have a different waste water analysis, dependent on the chemicals added to the production water before the fracking and the mineral content below the ground. Until there's flowback an analysis cannot be performed but there is a published analysis of Cuadrilla's waste water from a nearby drilling in 2011. It is on the web but I have a copy of you want one.

Gas comes back with the flowback and also volatile organic compounds and on the well pad there will be a separation plant to divide the gas from the liquids, but this is not 100% efficient. And so in the waste water there will be explosion from the dissolved methane and the health risk from the volatile organic compounds – this has particularly been the case in the States where they have open pits. There are high levels of total dissolved solids which can be around five times that of sea water. Clearly it can't be discharged into rivers unless its concentration is reduced which requires evaporation, crystallisation or a massive amount of dilution. Ultra filtration and reverse osmosis are inappropriate because the osmotic water pressure would be too high. The content of the waste water – one where there's waste water is 22,000 m cubic – and this contains 30 tonnes of suspended solids, 4,000 tonnes of salt needed to be transferred to landfill, due to the toxic metal salts and radioactivity content. The solids contained 400kg of barium, 290kg of iron, 46kg of manganese, arsenic, nickel, copper, cadmium, lead, chromium and cobalt and there are traces of silver, vanadium, mercury and zinc and in some cases radioactivity known as NORM. There are also chlorides, nitrates, sulphates and fluorides – pretty nasty stuff. It would take about 300 well drillings per year to provide 15% of the UK's gas consumption. When you multiply these figures by 300 it leads to over a million tonnes of landfill a year for the salt.

We need to define the discharge standards. The define the necessary process plant at the treatment works there needs to be a standard to define the waste water discharge parameters – for dissolved as well as suspended solids . Of the four nominated plants by the EA only Bran Sands is coastal – this is on the River Tees. It has currently no contractual arrangement to take in fracking waste water. It will need the actual analysis of the input once that is known and also require discharge standards to be able to establish a price per cubic meter for it to be treated and exceptionally discharged into the sea. If Cuadrilla need to proceed with test fracking they are required to contracted treatment works. Also the implications of full production need to be taken into account. My conclusion, looking at it is that the imposition of the UK regulations will make fracking for gas in the UK non viable.

Dr. Jim Marshall

The only opening comments I would make is – from a water company's points of view, from a statutory water company – the primary function of our treatment works is for the treatment of human waste, so sewerage. That's our primary purpose and that's what we need to operate within. But some of our treatment work sites are capable of handling industrial waste from a range of industrial sources under licence – this is called trade effluent and that's managed according to the capability of the site, the volume of the material and that's managed on a commercial basis under a regulation and the trade effluents. The exact capability of each site is driven by the treatment options of the works – by the volume of the water coming in but also the volume of water available for potentially diluting any of the substances that might be in there – salinity is one that doesn't get treated as such, it simply gets diluted. On the downstream discharges – outside of the treatment works there will be liquids that come out that have to meet environmental standards before they can be discharged and more importantly, in some cases it's a solid waste as a sludge that comes out and the use of that as a fertiliser and needs to be considered when we take on a trade effluent.

Waste water from shale gas extraction is going to vary by site and we heard the contents there from the Cuadrilla drill, but that's likely to be very different depending on where the site is within the country depending on the geology, on the amount of recycling that takes place within that site and pre-treatment that might be taking place. Our conclusion from when we looked at the waste water and the impact on municipal water companies is that at this stage it is unlikely that we will be in a position to take untreated waste water to waste water treatment plants, especially during exploration phases. I think if we got into production we may well see the commercial benefits of being able to scale up a number of works to deal with that, but at the moment we don't plan on taking unprocessed waste water from fracking sites.

Dafydd Williams

From a Yorkshire Water perspective – so this is taking us into the specifics now because obviously Yorkshire is an area where fracking is being explored as a process at the moment. The first thing to say is that Yorkshire Water are a municipal provider of waste water treatment services so we already provide waste water treatment for domestic customers but also on a commercial basis for a number of industry and commercial users. The most likely scenario that we would be receiving the waste water from the fracking process is via a third party because Yorkshire Water does not have a licence to receive fracking water, so the most likely scenario would be a company called FCC, who are based in a corner of the site of Nostropp waste water treatment works which we operate which is in Leeds and is the largest of our treatment works in the region and one of the largest in the country.

The most likely scenario that we would be going through is that the water would be arriving by tanker to FCC, they would be the initial receiver of that water – they would go through a treatment process which obviously I'm probably qualified to talk through. They will clean up the water in that process and then they would discharge to us by trade effluent agreements through a dedicated pipe that they have on our site into Nostropp waste water treatment works – the municipal works – and that would then go through the normal processes that we would have for treating water that we would do for any other commercial waste water. By the time that we receive it – having been treated by FCC – it would be in a condition that it would be very, very similar to waste water that we receive on a daily basis from commercial providers from across a number of different industries. We are of course heavily regulated by colleagues in the Environment Agency and the final output that we put through at the end of our treatment process that goes into the River Aire is very heavily monitored and there are strict regulations about what that should be and obviously there can be some discussion about the standards, but I suspect that those standards are unlikely to be reduced, let's put it that way. At the moment our view is that subject to the water arriving being not that different from the commercial waste that we receive on a regular basis, then we do have the capacity to treat that water.

Kevin Hollinrake

That's assuming it's been through this FCC treatment ?

Dafydd Williams

We do not have a licence and we're not looking to explore a licence to be the first receiver of that water at the moment.

Kevin Hollinrake

From what you're saying, Dr. Marshall, you think that FCC can treat this water to a standard that Yorkshire Water could deal with quite successfully?

Dr. Jim Marshall

I'm not a scientific expert on the treatment process but the fact that FCC have got the licences and the permits in place and that there's the final check on the trade effluent connection into Yorkshire Water – that will be measured there – then if permitted to do so I'd take it that they are capable of doing so.

Mark Ellis-Jones

As I said in my introduction, the Environment Agency is the environmental regulator in England. We do that by issuing environmental permits, not just to the shale gas operators but indeed to the waste treatment – so as you've heard we also regulate colleagues in Yorkshire Water, but of course many other industrial processes that UK Plc rely on. We've done a thorough risk assessment of the shale gas industry and indeed the supply chain – we are confident that the risks associated with shale gas – the extraction itself on the well pad, but then all the way through the waste stream, can be managed. We think that we have the right regulatory tools to do that and we're confident that the waste waters in particular can be treated to a safe level. I can go into a little more detail around that. As John highlighted there are expected to be naturally occurring radioactive materials in flowback fluids, otherwise known as NORM. There are four sites in England that are permitted specifically to handle that waste – those are in the public domain – Castle Environmental in Stock, FCC Nostropp in Leeds, FCC Ecclestone in Sheffield and Bran Sands as John mentioned.

We have four sites already in England that are permitted to receive NORM waste. But actually there are a number of other sites across England that, if the industry is scaled up and if this a waste stream that is going to increase in the UK, would be able to deal with this waste stream, so that capacity in the market can be responsive to a growing shared industry, if indeed it's an industry that does grow. As has been highlighted, it's likely that flowback fluids and waste from shale gas sites will need to go in the first place to an industrial waste treatment works like the ones run by FCC Environmental, those are not municipal sewage treatment works like the ones run by Yorkshire Water, but they are dedicated industrial waste treatment works. So these are sites that are geared up for dealing with – already waste streams from heavy industry really – so some examples would be electro plating, pigment manufacture, circuit board manufacture. They deal with heavy acids, heavy alkaline – they are used to dealing with heavy metal deposits and indeed of course naturally occurring radioactive materials – the NORM wastes. They are permitted by us, they are regulated by us, they have to check the waste as it comes into the sites – so it's likely it does arrive by road tanker – they have to batch check the waste, so they have to make sure that they are holding the right permit for the waste that they are receiving. Usually that's done in a kind of pre-commercial operation, so before a site becomes operational they would agree with the operator that they can take that waste.

They then have to check that that is the waste that they are receiving. They then process that waste and I can go into a bit more detail on that if you want me to. But essentially they process that waste and then they have to meet a discharge consent – so what they then discharge back either into the environment or into a municipal treatment works like the one in Yorkshire, has to meet certain standards. And then obviously, as my colleague from Yorkshire Water said, in that case it then goes through a second treatment process and we obviously regulate Yorkshire Water's site – and then what is discharged ultimately into the environment has to then meet those again very strict, tightly controlled discharge consent. So really the regulatory process is actually quite robust from when the material is being generated on site, how that is then transported to the site, how it's then processed at the industrial sewage treatment works, possibly then the municipal works and then discharged into the environment. I think we are really confident that there is a regulatory thread that runs through, from the creation of the waste to when a discharge is made into the environment.

In terms of the overall capacity in the markets – and this is something that has been a question to us a number of times – we think that there is the capacity in the existing waste industry to deal with the waste as the sector is at this stage. Bearing in mind that this is an industry that has yet to do the initial explorations and to ascertain whether or not there is indeed a resource that they want to exploit into production, we are still at the very early stages of nascent industry. If the industry decides that this is a resource they are going to exploit and move into production, then it will be for the market to respond to that, so there have been lots of questions for the Environment Agency, there have been lots of questions to local planning authorities around where is the strategic planning done for waste capacity and really that's for the market to determine. I'll just point to an MOU that Water UK have with the UK Onshore Operators Group that really commits the two industries – the water treatment industries and the oil and gas industries – to really work together to make sure that that capacity comes on stream as the same time to do that. In the event that that didn't happen, or in the event that a shale gas operator couldn't get their waste to the waste treatment works, they would simply have to stop operations so they would have to shut in the well - their permits allow them to store waste on site – there are conditions around (as John highlighted) that needs to be kept in double skinned containers in bunded areas and they have a certain limit of the amount of waste that they can keep on site at any one time. In the unlikely event that there isn't an output for this waste stream, or indeed they can't get it then actually the operators would then store it on site.

Laura Grant

We've been working on shale gas since 2012, producing a number of policy statements and reports, the latest being our in depth report we imaginatively entitled Shale Gas & Water – produced in January this year. As Mark has outlined we do think that the regulation on then waste water side is strong and we don't really have any concerns of risks to the environment from waste water treatment. We actually think that because we've got such a strong regulatory regime in the UK from the EU that actually the biggest impact will be on the cost to the industry and meeting and that could limit growth of the industry, whereas in the States it has been quite loosely regulated on the waste water side, so they've been able to inject untreated waste waters into the ground. That won't be allowed here – they'll have to pay for that treatment and have it done properly.

As colleagues have said, we've got high salinity, we've got NORM in the waste water so these are going to require pre-treatment technologies. Also one way to get round the salinity is to discharge to an estuary but there is limited waste water treatment plants able to do that. You also have the issue of the salinity affecting municipal treatment works – as we've said we will pre-treat it before it gets to that stage. At CIWEM obviously we are into integrated water management so we would like to see the re-use of water as much as possible so we're not using up valuable resources – so much more re-use on the site and we do think this is an area where technology is growing rapidly and we're seeing more mobile treatment and on site treatment in other countries that we could use that technology over here.

We think there is enough capacity at present to cope with the industry as it is in its infancy, but as it grows we are going to need more capacity – more supply chain to grow and as Mark said hopefully someone will see that as a market and step in and provide that service. There is also another concern – there is limited disposal capacity for low level radioactive materials as is the case for all industries, so that is another area that we need to work on. If enough effort is put in... Our only concern on the re-use and re-injection – we're not too keen on re-injection for disposal – we've seen in the States issues with seismicity with too much water from back down the well and that has had impacts. So we would like to see that really well regulated with a proper assessment on any re-injection.

Kevin Hollinrake

Can I just ask one question on that point: you mentioned the EU and the UK, so where do our regulations come from on this? Are they from the UK or from the EU.

Laura Grant

We have the EU Minor Waste Directive, which means that once it comes back up to ground it's classified as waste therefore it needs to be treated, but we've also got the regulations that the EA have put in which will also require similar levels. I'm not entirely sure.

Mark Ellis-Jones

Most of it is EU derived, but obviously it's transposed into UK legislation so it's in the environmental permitting regulations and it derives from European directives.

Kevin Hollinrake

Obviously most people will have noticed that we have decided to leave the European Union – which I guess in time we will do – so what happens then? Will you expect a change in terms of those levels of regulation or do you expect those to be maintained?

Mark Ellis-Jones

We would expect them to be maintained, so as people will be aware there is a commitment to bring all the great repeal bill into EU kind of aqueous into UK legislation. I think the general commitment from the Government is that they want to leave the environment in a better position than they found it. I think that the feeling from us as the environmental regulator is that the regulations we have are fit purpose. Industry, both in terms of the water industry and the shale gas industry, are familiar with the existing regulatory framework so I'm not hearing anything about changing the current regulatory approach as the Environment Agency.

John Busby

I couldn't find the standards of discharge for the dissolved side. What I found for Bran Sands – for their sewage plant they have something like 250mg a litre for suspended solids and of course this is coming from domestic sewage and so there isn't the problem of dissolved solids in the water. But if this analysis is somewhere right then you've got 170,000 mg per litre. It's almost impossible to dilute that down but I'm not too sure that this is a standard for the dissolved solids. Now I've discovered that some of the toxic metals are soluble in water so there may be toxic metals in the dissolved solids stream and I can't see the standard anywhere which says at what level would that be reduced. If it had to be considerably reduced it would have to be evaporation.

Violia is building a vacuum evaporation plant in West Virginia costing \$275m and it's next to a pit where the salt is deposited and it's the sheer volume of the salt that is in this water – I can't see how without some sort of evaporation you could put that into a river – you would kill everything living in the river – you would kill everything living within sea water and this stuff is five times more concentrated than sea water. What I discovered in the States is there have been attempts to build evaporation plants but one of things is that there is a very heavy chloride content in the fracking water and this attacks stainless steel, so that the evaporation plant would probably have to be made in titanium. Before this session I emailed Viola and I asked them to state the energy per cubic litre of water there and they failed to answer this.

Kevin Hollinrake

Your point is that, obviously in the UK this process hasn't happened on any kind of scale before. You mentioned a few times in your earlier submissions that UK regulations were tighter than US regulations in various areas, but you can't use the US as a direct parallel - so what you see in the US, you feel they're not treating this water properly or that we can't ?

John Busby

What happened was Dick Cheney brokered what's called the Haliburton Loophole and the EPA regulation was set aside for fracking to get the industry away. There have been attempts by the Obama administration to put tighter regulation on the industry – this has been resisted by the States and Mr. Trump now wants to scrap most of the controls to the oil and gas industry by the EPA. So I think the industry got away in the States because of the lack of regulation. For instance the open pits are subject to lightning strike and caught fire and the health risks that come from the volatile organic compounds which have evaporated from the open pits. Now we won't have that. They also have this direct injection and my view is that the only economic way of dealing with this would be to directly inject it underground.

Kevin Hollinrake

The question you've got is you feel in the US this waste water is not being disposed of correctly. I don't know if people have had time to read the EPA report which came out a couple of days ago. In talkin about waste water in the exec summary – it does say that radium has been detected in stream sediments or near waste water treatment facilities that discharge inadequately treated hydraulic fracturing waste water. So clearly things are going totally according to play in the US from a number of aspects in this report. If I could just paraphrase what Mr. Busby says: he doesn't feel that despite the assurances that we have the capacity or the knowledge, I guess, of this process to deal with this water even on a small scale and certainly not on a large scale.

Mark Ellis-Jones

I'll start. We say time and time again that the US is not a useful analogue for the UK experience – the regulatory framework just is so different and as we were just discussing, the regulations

Kevin Hollinrake

Have you got any examples of an area that is good to compare it against? This is pretty new stuff ..

Mark Ellis-Jones

I would say that the comparison is happening in our country right now. We have industrial processes that are producing certainly comparable waste streams – the ones I mentioned earlier were mine waters, electro plating, printed circuited board manufacturing, wood processing, pigment manufacturing, photographic operations - on the plan of a chemical, the heavy metal chemical content. In terms of naturally occurring radioactive materials, this is a waste stream that comes from hospital, universities, pharmaceutical companies, power stations, factories and of course the existing conventional oil and gas sector, in things like produced waters from the North Sea.

These are waste streams that have similar compositions and that we are regulating so the sites like the industrial sewage treatment works that FCC and others operate, are designed exactly to deal with these waste streams. I'm not a technical expert on industrial sewage treatment but I'll say a little bit about how that process works if that would be helpful. Essential industrial sewage treatment processes use what's known as a physio chemical process to manage these wastes, so they very often add lime to precipitate out the metal solids, including the NORM, that is then passed through a filtration process which removes all the solids and means that the liquid waste that then comes of that will have been stripped of the heavy metals and the NORM. The solids then containing the heavy metal and the NORM will be disposed of appropriately, so it forms a kind of solid waste in a similarly permitted waste facility and then the liquid effluent needs to meet the (as I said in my introduction) effluent discharge limits of the waste treatment works and then go either directly into the environment or into a site like Yorkshire's site. So these processes exist already – we're using them already for heavy industrial waste streams and we're doing it safely – I'll let my colleague from Yorkshire talk about the improvements in the local water quality in Yorkshire. We've been discharging from these industries into the local environment and seen the return of otters and salmon. We can meet our environment requirements.

Kevin Hollinrake

In those other industries that you mentioned that produce similar types of wasteyou must have had incidences where things haven't always gone to plan for example. Have there been issues recently, or in the last ten years, where there has been some environmental damage – I'm not trying to put you on the spot.

Mark Ellis-Jones

I couldn't give you any specific examples from those sectors, but part of the permitting process – part of our assurance process when we are issuing environmental permits – is to make sure that the operators themselves understand what it is they're handling, the processes that they are undertaking and that they've got the right management plans and indeed the kind of accident or incident recovery plans in place to do that. And so part of our permit determination process is to make sure that we don't issue a permit to an operator that doesn't have the adequate controls in place. Then it's our job as the environmental regulator to check that those systems and controls are being kept up to date, indeed that they're meeting the environmental controls and the emissions limits that we put on them.

In the case of an incident, which does exist – industrial sectors do have spills or things do go wrong – the important thing is how they then respond to that and making sure that they have the right management systems in place – the right controls, for example like double skinned tanks and bunding that control any spills so that there isn't pollution to the environment. We're comfortable that the way that we as the Environment Agency regulate industrial processes is fit for purpose in that respect.

Lord Truscott

I understand that re-injection is not going to be allowed in the UK unlike the United States, but nevertheless I wonder whether the panel and the representative from the Environment Agency could explain how a lot of the waste water is going to be transported, because there are going to be hundreds of wells – the waste water can't all be treated on site. What they've looked at in the States is that they will actually have to move a lot of the waste water by lorry – that will involve an awful lot of lorry movements which concerns the local community and can also affect the economics of shale. What are your views in terms of the transportation of the waste – the environmental impact, the logistics of that and the overall cost ?

Mark Ellis-Jones

I can talk to part of that. We would certainly anticipate in this stage of the industry's development that the waste waters would be moved by tanker, so by road. That's been a part of a discussion as part of the planning consents, so really it is for the local authority to look at the impact of increased traffic movement on a local community or a local sector. From our point of view we require confidence that the operator of the site is using a licensed waste operator, so under what are known as Duty of Care regulations, that operator will then pass the duty of care for that waste to a logistical company – and there are lots of specialist waste water companies that move this industrial and effluent from source to the treatment works – and then they hand that duty of care to the permitted industrial waste treatment facility when they arrive. In terms of the immediate near term, we will definitely see the waste moved by tanker. How the industry gears up to production I think is a separate question. I think we will need to see – the industry will need to work with the waste water industry about how they do that. We have some conventional production facilities that are dispersed over quite a large geographical area, for example Wytch Farm in Dorset is Europe's largest onshore oil and gas facility. They are bringing waste water to producer waters from offshore, from wells that are onshore to a gathering station and they are essentially using pipelines to move both the oil and the produced waters.

Lord Truscott

Would that be feasible, do you think, in the development of shale to have pipelines rather than tankers?

Mark Ellis-Jones

I don't think I would want to comment on the feasibility because I don't know how a production facility might be configured, what the space between well pads are, but I suppose I'm using the conventional sector as an analogy – they have disparate well pads, a central gathering station and it's all connected by pipeline and I think if the industry can do it for the conventional industry then there's no reason why they shouldn't be able to do that for the shale gas industry. We haven't seen any proposals of that scale and I think, as you say, there will be an economic incentive probably for the industry to do that as and when they start.

Lord Truscott

I think the intention is to use tankers at the moment to use it, because the infrastructure you would need for a pipeline complex to deal with it would probably be pretty expensive.

Dafydd Williams

The likelihood is that it would be moved by tanker, certainly in the short term, but as a way of reassurance, tanker movements in the waste water industry are very, very standard procedure so within our company we manoeuvre waste water around through tankers and indeed associated materials, so for example sludge gets moved around by tanker a lot because we have certain sites that are set up to process sludge and other ones which just receive it and then move it on. That's quite a standard procedure, particularly if we're looking at the complex at Nostropp which is a potential receiving site in the Yorkshire region.

Lord Truscott

Has there been any estimate of the sort of average number of lorry movements that you would need to service the average drilling site. What sort of volumes are we talking about here per site – how many average lorry movements – any calculations on that front?

Dafydd Williams

I don't have that data I'm afraid. But what I would say is that if we're receiving it at Nostropp it's an industrial site – there are lorry movements going round for lots of other associated industries across different sectors.

John Busby

There are some figures for this Mr. Chairman. The previous ... of water was 8,000 cubic meters and that took 300 tanker journeys to take it to the Manchester Ship Canal. If it's 22,000 cubic metres a well then about 900 truckings and if goes to Bran Sands it's 130 miles over the Penines from Cuadrilla, so the transport of the waste water is no small task.

Kevin Hollinrake

I think Ineos said earlier this year between 1,000 and 2,000 lorry movements per well. We believe we've got the ability to treat this water and you are assuring it will be fine, but what if there is a spillage into ... a river or a stream or whatever – what do we do then?

Mark Ellis-Jones

I suppose it depends on who is responsible for that spillage and whether or not it has occurred at the source - on the well pad – or if it's happened from anywhere between there and reaching a municipal treatment works. Each of those parts of the supply chain are covered by an environmental permit which is legally enforceable document so ultimately the Environment Agency has the powers to either stop operations or to prosecute the company. We respect my colleagues in the water industry – we will take water companies or chemical companies to court where they will be appropriately fined if there was an in appropriate discharge.

Kevin Hollinrake

That's probably a small consolation if people feel that their water supply is then contaminated. It's about the environment not about the fact that you are able to fine one of the water companies.

Mark Ellis-Jones

Indeed and I think that's why the focus of our regulation is to prevent any incident in the first place and we put in the controls to make sure that even if there was an incident, actually its likely to be a managed incident.

Kevin Hollinrake

The question I asked was what if it does happen – that's what people are understandably uncertain about.

Mark Ellis-Jones

I don't think the Environment Agency or any industry would say that industrial operations are not without any risk. We're into the realms Mr. Chairman of 'what if'. I suppose it depends how big the spill is, what the impact is of that and that will be down to how we enforce the conditions of an environment permit. So if there is an impact to the local environment then it will need to be cleaned up by the operator – they will need to remediate the local environment so they will need to make sure that whatever the spill is they do that. We'll then require them to review how they are operating the systems and controls that they've got in place to make sure that doesn't happen again. If we consider it to be a serious breach of their responsibilities we will take them to court. If there is an impact on the environment – if there's a discharge of sewage slurry into a river and it kills fish or harms the environment then you can't put that back but it can be cleaned up.

Dr. Jim Marshall

From a practical point of view I think it's right, there are well tested and well tried out processes in place to bring the appropriate party to task and put the clean-up operations in place. If for example there is a drinking water source that had somehow become contaminated by anything – I make that point...

Kevin Hollinrake

I think a member of the general public would feel all water is a drinking water source. So if it goes into a stream, it goes into a reservoir, it goes into a lake, it's going to end up in the water supply – that's the real worry.

Dr. Jim Marshall

The point I'm trying to make is – there are a number of options depending on what would happen. The first and foremost would be the monitoring that's in place, from the baseline monitoring – so we know the situation before anything happens – to the ongoing routine monitoring of .. waters – water going into works and water coming out of works – so we know exactly the quality of water that is making drinking water standards at the point of delivery into the system. If a source does become contaminated we've got a number of choices. We can abandon it, we can stop using it either permanently or temporarily whilst it's being cleaned up, if cleaning up is capable. There are a whole heap of regulations, particularly around ground water, on what can or can't take place in those zones that are the most vulnerable or most sensitive to spills or accidents in water supply zones – less activity takes place in those areas. We can bring in alternative sources, so the municipal water supply in most cases has resilience built into it so water can be brought round from different places, either locally or in the case of Yorkshire where they've got a big grid system.

We can treat most things, so drinking water treatment, advanced drinking water treatment is available. I hesitate a little bit because that is always the last resort because of the costs of doing so. But it is possible to remove contaminants from drinking water at the point of drinking water treatment. Treatment, abandonment or use of alternative sources would be the options that we would do. But the key would be having that information – good monitoring data to know what happened – to get ahead of an accident or a spill when it happens so that the widest range of options become available.

Dafydd Williams

I think a straight answer to your question is yes, occasionally things can go wrong – in any walk of life things can go wrong where there is an element of risk and in this particular case if it does go wrong it will cause an environmental impact and that could be either very minor or it could be quite serious up to killing some wildlife etc. In the waste water treatment industry when things do go wrong they are almost always recoverable in terms of you can clean up and you can put wildlife back into an area and if you want the evidence for that – just within the Yorkshire region there were a number of rivers that were classified as officially dead 10/15 years ago because of industrial practices and a far less well regulated water industry- we were discharging water that didn't allow rivers to sustain life – that is no longer true and we have rivers that are now very much cleaner. So you can clean rivers up and you can bring them back to process. Of course incidents should try to be avoided and I think what we're trying to say is that to prevent is much better. But if an incident of that type did happen it is possible to recover the situation and as has just been said, particularly within Yorkshire in terms of when you get to the drinking water aspect of that, we probably have the most resilient water supply in the country in Yorkshire because we have a grid system. So we are the only company in the country that connects our water supply across 96/97% of the region. At the touch of a button we can move water from Hull to Sheffield or from Calder Valley up to Leeds – it is possible to move it around, so if there was an incident we can put checks in to ensure that doesn't get into the drinking supply.

Kevin Hollinrake

Laura, before you mentioned about re-injection and I understand at the moment that's not part of our regulations – is that how you understand it – re-injection of waste water for the UK I'm talking about ?

Laura Grant

For disposable – it can only be allowed in certain circles – under permit by the Environment Agency so it has to be where you've got a well or a space in the ground that's not hydrologically linked to anything else – it's isolated.

Kevin Hollinrake

So you feel there might be a possibility in the future that we will allow disposal of waste water by re-injection?

Laura Grant

I don't think the regulations are particularly clear yet on what we might see in the exploration phase, but we're quite loathe that it would go in the ground.

Kevin Hollinrake

Are you concerned about induced seismicity? That's the reason you're concerned. That seems to have been in connection with the US with induced seismicity and re-injection.

Laura Grant

Yes, then you can have more contamination incidents.

Kevin Hollinrake

So you would be against any re-injection?

Laura Grant

For disposal, yes. Only for re-stimulation of the same well.

John Busby

Can I just say something on the injection wells. Basically it's controlled in the United States by the EPA and there are hundreds of thousands of injection wells. What's needed is to find suitable locations, that means you've got to do seismic studies to find out porous rocks underground and they will have to be tested to make sure that when you do put the waste in it doesn't get out. And so there's a whole regulatory structure on the injection wells in the States. They are classified – Class 1 is pharmaceutical waste and things like that, Class 2 is for fracking waste water. The problem they've got is that there aren't sufficient injection wells to meet the demand for the waste water. Secondly it's the injection wells that are causing the earthquakes, particularly in Oklahoma and they've earthquakes – over five. So there a whole lot of problems. To introduce it in the UK we would have to establish a survey – there would have to be geological surveys to find suitable places – and there would have to be a regulatory structure put in to do it. So I don't think we're ever going to get to it somehow.

Kevin Hollinrake

Mark, could you give some clarify on that – re-injection. Would we allow re-injection of waste water – can you see that happening?

Mark Ellis-Jones

We have a very clear position – we don't allow the re-injection of flow back fluid for disposal, so we would encourage operators to re-use flow back fluids for stimulation in terms of water re-use, but not for the disposal of flow back fluids.

Kevin Hollinrake

You don't or you will not ?

Mark Ellis-Jones

As in we will not in the future? Our view is that we are taking a precautionary approach to this and until we understand how the fluids are managed underground in what's known as a minor underground waste facility, we won't allow it.

Kevin Hollinrake

(The report from the EPA) obviously this does talk about situations in the US where contamination has occurred quite clearly and the way I read it it's very much general bad practice and about learning from past mistakes – but will the bodies here be responding to this, because much as you may say the US is nothing to do with the UK, I think where else can people look to see whether this is going to be a safe process or not. I think yes, to point out the differences between our regulation and our geology or whatever else in terms of why we might expect it to be different in the UK – people will be very concerned about this. So will there be a response from yourself ?

Mark Ellis-Jones

I can't commit to that I'm afraid. Part of the reason I come to events like this is exactly so I can respond to it. I think the Environment Agency is happy to set out what our role is as a delivery body for the Government. We're happy to explain how the UK regulations differ from the US ones, but I don't think it is our role to release public statements to counter reports done by overseas agencies, but I'm very happy - if you have specific questions. There is nothing in that report that we haven't said – we don't allow open pits for the storage of waste waters. It talks about radium with NORM being present in effluent, being discharged either straight into the environment or into municipal works – well I've just told you that we won't allow that, it has to go to a permitted treatment works that can deal with NORM. One of the big issues around ground water protection is well integrity, so how the well bore is constructed – in the States there's some really bad practice around essentially just unlined bore holes. The Health & Safety Executive just wouldn't allow that in this country. We have absolute world class regulations for the design of bore holes that creates an absolute barrier between the formation and the ground water bearing strata.

Kevin Hollinrake

I think you always give us great confidence, when you come to these sessions, about how our regulation works and I would very happily write to your Chief Executive to say I think there should be a response to something like this.

Dr. Jim Marshall

I'm still working my way through it to be honest. We've got a duty to assess our positions based on the scientific knowledge of the day.

Laura Grant

There is an interesting point – I've just looked at the waste water section because that's what we're talking about today. Just looking at the graph of how waste water has changed over time since 2009 – I think it's quite illustrative that actually things are improving.

Charles Metcalfe – Frack Free Balcome Residents Association

It's been great to hear from these water experts and Mr. Ellis-Jones as regulator, about the strength of the UK regulations and some thoughts on what could be done if disasters and accidents do happen. I was very struck by one of the things that Miss Grant said in her presentation, which was that great limits on fracking here is going to be the cost of these treatments. Now these treatments – OK, they exist but they will cost money and she made that very sensible comment. One of the things I think which doesn't differ between the UK and the US is the profitability of extraction of onshore gas. In the US at the moment the cost of this gas is so low that fracking companies are going out of business. We, with our tighter, more extensive regulations to safeguard our environment – does mean that it's going to be even more expensive to do here and if so are these extraction gases going to result in any profits for any companies ? I would be interested to hear what anyone has to say about that.

Kevin Hollinrake

I would say – and I suppose this may be ignorance here – I suppose if it's not profitable nobody will do it. What I would say is that from my point of view, would I advocate lower regulation to make it commercially viable? No I wouldn't. Quite the opposite. I think we need to improve regulation not make it easier for people to use gas that we may have under the ground. I think it's either they can make it profitable or they can't. In the US they did think that more companies would go out of business but obviously by efficiencies they have managed to produce gas efficiently at 14 qualified dollars at current prices, which has obviously brought oil prices down around the world... To be fair the US haven't lowered their regulations - they've tightened the regulations – but their regulations are not as strong as they are in the UK.

Laura Grant

We have a section in our report on the economics – it's only a quick one pager – you can take some comfort because of the additional cost here it's not going to be a runaway industry like the US.

? Is there going to be an industry at all?

Zacary - Green Peace

I have a question in relation to disposal of waste water – the practice of dumping it in the sea – it seemed to be indicated that that is a process that Ineos was thinking about doing. There was an observer report earlier this year with emails where they discussed. I didn't really know very much about it..

Mark Ellis-Jones

I can't comment on the detail of Ineos' proposals but I think it is fair to say that one option – so the Bran Sands plant that we were talking about earlier – is that because of the high salinity of the flow back fluid you could foresee where somewhere like Bran Sands would treat – you would still need to treat the flow back fluids, so we're not just talking about dumping flow back fluid into the sea. It was a bit like the reports that said that Cuadrilla wastes were dumped in the Manchester ship canal, which again were deeply misleading. We're talking about treating the waste waters in exactly the same way as I have already described and then if they met the discharge consent – and that would be permitted by us and there would be very strict limits on what that discharge into an estuary or into the sea would be – then that would be one way of discharging the waste effluent back into a receiving water that was already saline. We absolutely for the record would not allow just the dumping of flow back fluids into anywhere.

Kevin Hollinrake

Just to be clear on that: no special rules at all – you would deal with that situation like you would any other waste that would go into the sea.

Mark Ellis-Jones

It would have to meet that strict discharge consent and the limits we put on that. As I said Bran Sands does discharge into a saline receiving water but we certainly haven't had any proposals for a bespoke waste treatment works ...

Question from the floor

I think the big question left hanging here is how the pre-treatment done and what I'd like to ask all of you here is if you could possibly find out from Nostropp what exactly they would do in terms of treatment – how they would get rid of these totally dissolved solids and salinity – what kind of equipment they would use. And also what the cost of that might be and what the cost in terms of energy – what kind of energy are we putting in here? What amount of energy are we already putting into the extraction of the gas in the first place and then all that transport, all that treatment, that pre-treatment and then further treatment. What is the balance then of energy.

Kevin Hollinrake

Is there a net gain – is that what you're saying?

Question

Yes - how much energy are you wasting and how much really are we getting from this whole shale gas operation, if you are using masses of energy in order to treat the waste?

Mark Ellis-Jones

I can answer some of that in as much as I've been to FCC Nostropp – I've been round the site. I wanted to satisfy myself – as the Head of the Environment Agency's dealing with this regulation – so I visited there and the processes that they use, that I outlined earlier – physio chemical processes, the adding of lime to get chemical reaction, so solids, heavy metal and the NORM and the heavy solids drop out. The water again goes through a water treatment process I can't describe it in more detail than that.

Question

How can we find out more detail?

Mark Ellis-Jones

There is already a lot of detail there and I hope we reassure people that the environmental conditions that we are putting on the permits and the discharges in the environment - which is essentially what we are concerned about here – that the levels of environment protection are more than satisfactory – they meet the requirements of environmental permitting. It's not for me to describe the commercial processes of any industrial waste treatments – it's my role to make sure that we regulate..

Dafydd Williams

I can talk about the process in terms of the energy consumption that we would use on a municipal waste water treatment works we operate. You're right that it is a high energy user but it's also a high energy generator and in fact most of our waste water treatment works at Nostropp is fast becoming self –sustaining.. So we have a produce that we create at the end of it which is sludge – the sold material we take out of it – and we are using that sludge to generate energy. We also take gases off the process and use that. We also have a very large wind turbine on there as well and also hydro. Many of our large waste water treatment works – they sustain themselves ... essentially we have a very high energy level and we want to get that down and we're using green energy in order to do that.

John Busby

What we've been talking about is the sewage sludge that is put into anaerobic digestion. But you couldn't put the toxic waste from fracking into anaerobic digestion because you wouldn't be able to put the digestate onto the land afterwards. So those processes have to be separate. You would poison the anaerobic digestion. So having got the slurry off – the suspended slurry you have to treat that entirely separately and it would have to go to landfill – you wouldn't be able to generate methane from anaerobic digestate.

Steve – UK Onshore Oil and Gas

Waste is only waste. What we have to recognise here is oil and gas industry has been managing water and waste for many, many years –our first well in the UK was drilled in 1950 – so actually we've been using water as a resource since then. What we have to recognise is that we have an opportunity to look at water as a resource – you don't need to throw it away. What we should be doing is finding opportunities to recycle or re-use virtually all of those fluids and substances we get back. So what's the scope for that to occur in the regulatory structure we have and the general enthusiasm to look at water as a resource?

Mark Ellis-Jones

As the environmental regulator, particular for water and the environment, we would thoroughly encourage it. We would expect operators – particularly as operations scale up into production facilities – to be really actively looking at water re-use technology. I was fortunate enough about eighteen months ago to go to Canada to look at the Canadian oil and gas industry and shale gas industry and I have to say that it is incredibly impressive that they have associated water recycling infrastructure – a little bit like Wytch Farm, where all of the well sites in production are re-using the flow back fluid that had been treated, cleaned up, re-injected into the well site – so there is an active water re-using, recycling culture developing in Canada the associated infrastructure around that. I don't think from a regulatory point of view there are any obstacles. I think at the moment the only barrier is around where the industry is at in terms of scale. I think the industry needs to prove the resource – they need to work out whether or not this is something that they need to exploit – can exploit – and once they've made a decision to do that they would bring forward well pads and we would begin to see infrastructure supporting that industry so they should re-use the water...

Julian

I've been taking an interest in the Environment Agency its operations on and off since the days of the National Rivers Authority. You talked about the world class environmental regulations of the Agency. Four or five years ago, when those tremors happened in Lancashire – the impression given was that you were being kept rather in the dark – so much so that you had to place a ban on fracking .. for at least a year ... What assurance does the public have that the same will not happen in relation to fracking waste water in future, especially as you seem to not want to think about the United States very much, purely on the grounds that their regulation is not very good.

Mark Ellis-Jones

I didn't say I didn't want to think about the United States, I just said it was a poor analogy. I've been in Canada exactly to learn some of the lessons from our North American counterparts so I think we can learn lessons. Indeed we do a lot of local engagement in Yorkshire and around the country, where we answer questions from members of the public and very often those questions stem from where people have rarely understood what's happening. I'm sure also over the next weeks and months be answering questions and we'll happily do so.

In terms of your direct question, I think the Environment Agency – you were right on regulatory approach. In October 2013 we were very clear about that. Last August we published sector guidance for this industry which really looks at our whole regulatory role in terms of applying our advisory guide in the planning system – all of the environmental permit permissions that an operator is required to have. I think I've set out quite clearly in this session how the Environment Agency regulates from where waste water at the source, from the well pad, all the way through from when it's transported from that site to waste water treatment works, all the way through to it being discharged. I'm an environmentalist so I take this issue very seriously and I don't think there is anything that I've set out that I would describe as being complacent or negligent.

Kevin Hollinrake

What people have mentioned to me lots of times is that the regulations may be great, but what about the regulators – is there a pro-activity within the Environment Agency that's going to make sure that you've got the frequency of visits, the no notice inspections – have you got the capacity to properly hold these producers to account?

Mark Ellis-Jones

Yes – I can say hand on heart that this sector – if and when a shale gas operator starts their operations – the Environment Agency, both in terms of the national team but also the local teams who are living in the communities – there will be local drop in sessions – we will be on the ground.