RESUMED **[4.46 pm]**

COMMISSIONER: It's 1645, and I welcome Alastair Brown, technical director from INS Transport Experience.

MR JACOBI: INS is a wholly owned subsidiary of the Nuclear Decommissioning Authority in the United Kingdom. In addition to providing a wide range of consultancy services relating to the management and transportation of irradiated fuel, it undertakes international consignments of specialist nuclear cargo and manages the associated emergency response measures. Mr Alastair Brown is the technical director at INS, and has worked in the nuclear industry for 26 years.

Since joining INS 15 years ago, Mr Brown has held both operational and technical roles and participates in the UK delegation for intergovernmental negotiations in relation to nuclear transportation. He is also a director of the World Nuclear Transport Institute (WNTI). The Commission calls Mr Alastair Brown.

COMMISSIONER: Mr Brown, thanks for joining us, particularly so early in the UK. Could I start with just a very general question. We've heard in the introduction some of the services provided. I would like to understand the end to end services that INS provides and then get a sense of what the world market is at this particular time.

MR BROWN: International Nuclear Services provides a complete transport service in that we have the capability to actually design the transport packages as well as carry out transport operations. Our main specialty is in marine transport, but we do also through contractors organise road transport and rail transport usually to meet up with a sea transport aspect. For sea transport, we own and operate a fleet of INF 3 class vessels, which are typically used for shipments of irradiated nuclear fuel, high level waste, and plutonium products.

Our main transport operations historically have been between the utility sites in Japan and Europe, and also from European utilities to the UK, but more recently we've also been involved in a number of global threat reduction initiative transports, which is the US program for repatriating materials to the

United States to reduce the global threat.

COMMISSIONER: And your major competitors?

MR BROWN: For international sea transport, there are only a very small number of operators who have INF class vessels. There is a company in Japan which primarily carries out domestic transport within Japan, there's a company in Sweden that does something similar, and there are one or two Danish companies that officer INF transport as part of a wider more general service. I don't believe there's anyone else in the world at this moment in time that offers the full armed guard high security transport that we provide for category 1 transports.

COMMISSIONER: I know we want to get that a bit later on, but can I just conclude. Are you the largest player in the market?

MR BROWN: Yes, we are.

COMMISSIONER: Thanks.

MR JACOBI: Can I just pick up, and I think we've got a slot that picks this up, in terms of what is the relationship between INS and any if its subsidiaries? We've heard a little bit about PNTL in some of the submissions we've received.

MR BROWN: Yes, I think on the second slide of the pack that you've been provided with there's a very simple organogram. International Nuclear Services itself is 100% owned by the UK's Nuclear Decommissioning Authority, which in turn is a non-departmental public body which is part of the Department for Energy and Climate Change within the UK government. The two main subsidiaries that we have that are relevant to transport is Pacific Nuclear Transport Limited, and this is a company that was set up in the 1970s to undertake transports of spent fuel and high-level waste and MOX fuel between Europe and Japan.

INS actually operates the company and owns 68.75% of the shares. The remaining shares are held by some of the Japanese utility companies and trading houses and our French partners AREVA. We also have a one-third interest in the World Nuclear Transport Institute, which is an organisation set up to represent the wider interests of the radioactive materials transport industry, primarily at the IAEA and the IMO.

MR JACOBI: I just want to come to the issue of the regulatory arrangements that govern ocean transport, and it might be a useful to start to explain what this INF classification is and its particular origin.

MR BROWN: Yes, the INF classification. It stands for the - I haven't got it exactly in front of me, so I'll paraphrase, but it covers irradiated nuclear fuel, high-level waste and plutonium. Any of those products need to be carried on ships that meet particular standards that are governed by the INF Code. There are three levels defined within that code: INF 1, which can carry the least amount of material; then there's INF 2; and then INF 3, which is the highest category. That ship can carry unlimited quantities of those materials. The regulations themselves set out specific requirements for the construction of the ship and its operation to ensure safety, and that code was developed through the IMO in the 1980s and 1990s and came fully into force around about 2001.

MR JACOBI: Are the distinctions between the categories driven by materials and quantities in the main?

MR BROWN: They are, yes.

MR JACOBI: We've heard a little bit about INF 2 and INF 3. Perhaps you could explain to us what the distinction is precisely between the boundary between those two classes of vessel.

MR BROWN: Yes. The difference between the two is an INF-2 class vessel can carry - again, sorry, I'm working from memory here. I believe it's 10^6, so 10 becquerels of activity, and one order of magnitude less than that if it is plutonium, whereas for INF 3 there isn't an upper limit. To set that in context, if you consider casks of high-level waste, which might typically contain 28 canisters, you could probably carry around three of those on an INF-2 vessel. If you wanted to carry any more than that, then you would require an INF-3 vessel.

MR JACOBI: Can I just pick up the upward linkage? This is between the regulatory schemes. You mentioned a linkage between the code, which sets out these classes, INF 1 through 3, and you referred to it being developed at the IMO level. I'm just interested in the linkage between that and what the Commission has come to understand as, I think, SSR-6, which is the publication that's issued by the IAEA, and whether you could explain the linkage through the chain of the regulations.

MR BROWN: Yes. This is actually quite an interesting part of the regulatory framework, because the basis of transport regulations at IAEA is that the safety within the package, is provided by the package, and is really independent of the mode of transport. However, in the 1980s, there were a number of coastal states raised concerns about whether that was really applicable and valid for sea transport, and through discussions at the IMO, the IMO set up a separate set of regulations that governed the ships that carry, as I said, irradiated nuclear fuel, high-level waste and pluton. So it's regulated separately by the IMO for those categories. Any other radioactive material, any other class 7 material, has no particular modal requirements on ships. It just has to comply with SSR-6.

MR JACOBI: So I'm right in understanding that the packages themselves that are being carried on the vessels, they're governed by SSR-6 and the requirements it sets out and the - - -

MR BROWN: That's absolutely right, yes.

MR JACOBI: And the particular vessels and their class, they're defined by a separate operational framework, which describes the physical and operational characteristics of the vessels.

MR BROWN: That's correct, yes.

MR JACOBI: I'm just interested now to come to the acceptable mobile forms of linkage to sea transport. To an extent, it's always going to be necessary to transport the flasks across land. I'm just interest in the extent to which INS can integrate with the different modes of transport that might be used.

MR BROWN: Yes. Our vessels are all lift-on-lift-off. There are some vessels in the world, and indeed, in the past we've operated some vessels, that have a roll-on-roll-off capacity, but currently our vessels are all lift-on-left-off. So our requirements for intermodal transport is really a port that can take the ship and a crane that is capable of lifting the packages on and off the ship. Within that, then whatever connects to that port is a suitable mode of transport, whether that’s rail or road.

MR JACOBI: We've got a video that's been supplied in terms of time lapse in terms of loading. I'm just wondering whether it might be an appropriate time to address that, and perhaps you can take us to key aspects of that, but we're interested in the process of loading a flask onto a vessel.

MR BROWN: Okay.

VIDEO PLAYED

MR JACOBI: So can you tell us where we are and we're looking at?

MR BROWN: Right. What you're looking at is the Barrow Marine Terminal in the UK, which is operated by INS. That is our home port for the vessels and is also the port that is used for almost all of the international transport that goes between Sellafield and customers overseas. With the video tape, which I don’t have the benefit of seeing exactly what you're looking at the moment - - -

MR JACOBI: We're at the point of a crane being lowered in and having left what appears to be a hatch off.

MR BROWN: Right. The construction of the ships is that each hold has two decks which are capable of carrying these heavy casks. So the crane will first of all lift off the hatch cover, which is obviously in place when the vessel is at sea, and it then lifts out the pontoons of the intermediate deck, and that allows access then to the lower deck so that the crane can access the lower deck and load that with cargo.

MR JACOBI: In terms of the hatches themselves, am I right in understanding that they're a large concrete hatch?

MR BROWN: On the modern vessels they are a large steel hatch that has polythene shielding. In the original class of original vessels that we operated prior to about 2010, they were concrete filled. That's for shielding to protect the crew onboard the ship.

MR JACOBI: In terms of the weight of those hatches, are you able to give a broad idea about how heavy they are?

MR BROWN: Yes. The hatches vary in weight depending on the both the size and the position on the vessel, because the ones nearer the accommodation have a greater amount of shielding on them. So the heaviest ones are around 50 tonnes and the lightest ones are around 20, 25 tonnes.

MR JACOBI: In terms of the vessels themselves, do the vessels have an onboard crane that would be capable of lifting those hatches off, or does it require a crane at the port?

MR BROWN: It requires a port crane. Again, the original vessels we had were able to handle their own hatch covers, but partly for security improvement, when we built these new vessels between 2008 and 2010 we chose not to put deck cranes on board, which obviously increases the security because it makes it more difficult to get to the cargo.

MR JACOBI: We're looking at one of the holds being open. I'm just interested to understand the extent to which these vessels are designed to carry cargo other than the flasks that we're talking about or whether they carry such cargo.

MR BROWN: They really aren't very well suited to carrying any other cargos. We can carry up to 20 of those casks or a similar number of ISO containers. So we're really not into container shipping but if we get a nuclear cargo that is in a container then we can handle that as well.

MR JACOBI: So am I right in understanding that these are purpose-built ships for this purpose?

MR BROWN: They are, yes. They are purpose built for this. Certainly these vessels I can't recall ever using them for any other purpose.

MR JACOBI: We're watching the crane lift the flasks off. I'm just wondering whether you could give us an estimate of the weight of both the cask and I think their associated gantry.

MR BROWN: The cask itself will weigh around about 110 tonnes and the all-up weight when it's on the transport frame is it is nearly 120 tonnes. That crane that you can see in the pictures is capable of lifting a load of up to 150 tonnes.

COMMISSIONER: And the tonnage of the ship? This is obviously a Class 3.

MR BROWN: Yes, they're about 5000 tonnes.

MR JACOBI: I was hoping to pick up in terms of the vessel itself in terms of its other characteristics. I'm just interested not only to understand the specifics of this vessel but the specifics or characteristics of the vessel that it must have in order to be classed as INF3.

MR BROWN: The main requirements of INF3 is to meet certain stability requirements that are laid down in the INF Code. While it's not absolutely mandatory, the most straightforward way of achieving that is to have a double hull, which gives you additional buoyancy. Again, if you look to the slide pack, I think on slide number 12 there is a cut-away diagram that shows the main features of the ship. As I said, the main feature is this double hull where one-fifth of the width of the ship on either side is given over to either a void space or it can be used for fuel or ballast tanks, but basically it's not the cargo space. The cargo is only carried in the centre three-fifths of the width of the vessel.

Those spaces are also subdivided along the length of the vessel such that in the event of a collision, it's only a relatively small area of the vessel that would flood and the vessel is well equipped to be able to cope with that. That's technically how it's defined, is that it has to be able to withstand those types of collisions and have enhanced buoyancy to be able to deal with that.

MR JACOBI: I'm interested, looking at the slide, to the extent to which the other features that are described with the vessel are also themselves requirements of INF3.

MR BROWN: The rest of the requirements are a mixture of ones that are required by the INF Code in that there is a requirement to have additional emergency generators, additional power supplies but beyond that there are other things that INF and PNTL have provided. For instance, it's not actually necessary for them to have twin engines but our INF3 ships all have twin engines to give that increased reliability so that if you have a fault with one engine you can take it offline and maintain it while still being able to safely navigate the vessel.

Also, the collision reinforcement that we have in this vessel, we have around three to four hundred tonnes of additional steel in the sides of the vessel. That isn't strictly required by the INF Code but again we have built that in to give extra protection in the event of a collision.

MR JACOBI: Can I move away from the vessel itself and come back to the focus of the IAEA regulations and the packages themselves. I'm just interested to the extent to which they provide relevant security and that's integrated into where they're located within the vessel to ensure that there's not exposure to the fuel.

MR BROWN: Typically a cask for spent fuel or high-level waste, as I've said, will weigh of the order of a hundred tonnes and maybe a bit more than a hundred tonnes. So part of the security really is so it wouldn't be very easy certainly not to lift that out of the vessel without the type of crane that you saw in the video clip. Added to that, the casks themselves, the lids are securely bolted onto the cask and then there are shock absorbers bolted on over the top of the lid. So in order for someone to actually get access to it you'd have to take those items off, and each of those items weighs several tonnes in its own right. So any attempt to get at the material would be quite challenging.

MR JACOBI: Can I move to the extent to which the flasks themselves provide a safety precaution, putting security to one side, and the extent to which that's integral in ensuring that there's the safe transport of the spent fuel. That is, putting aside the ship, to what extent do the flasks contribute to that safety?

MR BROWN: The flasks really are the primary safety feature of these transports. The same casks are obviously used on the rail or on the road without the sort of protection that the vessel affords so they have to be able to be suitable for transporting in the public domain. Typically these are known as Type B packages because of the amount of material that they contain and those have to pass a series of regulatory tests which involve impact tests, fire tests and emersion tests. The impact tests are a sequence of tests in terms of a drop onto a punch in the most damaging orientation, at a drop from nine metres onto an unyielding surface. Again, I think there's a slide within the packet, number 10, that gives a sort of graphic of those tests. Once the package has been through the drop tests, then it needs to be subject to a fire test, which is an all-engulfing fire at 800 degrees C for 30 minutes. Then separately to that, there are immersion tests. The package must be able to withstand 15 metres of water for eight hours and 200 metres of water for one hour in the tests for these types of packages.

MR JACOBI: The Commission this morning has heard some criticism of the realism of the scenarios that are reflected in the Type B standards and I'm just interested in your view as to the extent to which they represent a realistic range of the scenarios to which a flask might be subjected if it was on a vessel such as the vessel you've just shown us.

MR BROWN: I think the impact tests are very much bound to what is likely to happen, not least because the impact tests are onto an unyielding surface, whereas any impact of a vessel or of a cask being dropped onto a vessel - the very fact that it's in water, the vessel will move. So it's not as onerous a situation. The fire test the - - -

MR JACOBI: Sorry, can I just stop you for a minute. Can I just pause you on impact, and that is is there a question about where the flasks are placed on the vessel in terms of them being subjected to a direct impact?

MR BROWN: The casks are placed within the holds of the vessel which, as I've said, is within the centre three-fifths of the vessel. So there is one-fifth of the width of the vessel - that's about three metres of steel and these are sort of 20-millimetre thick steel plates with, as I say, 400 tonnes of additional steel there for reinforcing. It would be very difficult for a collision to actually penetrate into the hold and hit the cask with any force. I know there has been some criticism that the original tests were against a class of ship that is much smaller than the vessels that are at sea these days but when the studies have been repeated with larger vessels, such as a very large crude carrier, what has been found is that the nature of those vessels is that they have such a wide bow that they just push one of our smaller vessels sideways. So they don't actually impact any more than a smaller, sharper-bowed vessel would.

MR JACOBI: We've just dealt with the question of impact and I'm just interested in this question of the realism in your view. Could you speak to the realism of the fire scenario that you're talking about there, 800 degrees for half an hour.

MR BROWN: The IAEA test is recognised that it may not absolutely represent real world fires in as much as you might have a fire that is hotter than that for a short period of time. You might have a localised fire that is hotter or you might have a fire that smoulders at a lower temperature for a longer period of time. However, the IAEA's view is that overall this all-engulfing fire where the entire package sees 800 degrees say for the full 30 minutes is representative of a fire in the real world's situation, not least because fires would normally be fought within that sort of period of time.

MR JACOBI: I'm interested to come to the fire control systems that would apply in the hold of one of your vessels. Could you give us an outline of the fire protection systems that are built into those vessels and their holds?

MR BROWN: The fire protection in those vessels is a water spray system that covers the holds. There is a really no sources of fire - you know, of fuel - within the holds, so there's nothing there to burn so the fire protection is in the form of just a water spray.

MR JACOBI: Can I pick up and move to the question of how the vessel is secured. I think we've already addressed the question of the hatches and I think you mentioned earlier some of the vessels are armed. Could you give us an outline of the extent to which those sorts of operational security features are put in place with respect to transportation.

MR BROWN: Within the IAEA, under the convention of physical protection of nuclear materials, there are some guidelines provided which, firstly, categorise the material according to its fissile content because these regulations are primarily around non-proliferation and diversion of nuclear materials, plutonium and uranium. For the lower quantities of material, which are things like the high-level waste, it doesn't require armed guards but it does require other protection. For the higher quantities for highly enriched uranium or plutonium, then the recommendations are that there should be armed guards, and that's what we have on our ships for those types of shipments. Common between both is that the holds are locked, access into the holds is strictly controlled and the access into the corridors, if you like, to the holds, is controlled as well and typically there will be alarm systems there as well that give notification of any unauthorised attempt to access the holds.

MR JACOBI: Are there other procedural measures that are put in place, that is before a transportation leaves port or whilst it's en route, that is relevant to ensuring the security of the vessel?

MR BROWN: The main other things that we do is, is we avoid areas of conflict. We stay offshore as far as we can so that we're not in any coastal traffic and close to the shore. So basically we try and keep well out of the way of any pirates, any terrorist threat in that way. We also have routine tracking of the vessel so that we're aware of the vessel's position and communication arrangements such that if there is a concern, they can notify our headquarters and we can notify the authorities appropriately.

MR JACOBI: Are security arrangements also put in place with the relevant agencies of countries where, for example, the vessel is disembarking and embarking?

MR BROWN: Yes, that's all agreed in advance. Again it is tiered according to the type of material. Particularly for the armed guarded shipments there has to be very clear hand-over protocols between the country that the material is leaving to go onto the ship and the operators of the ship, and then similarly at the other end, to ensure that the security is maintained throughout the transport but also recognises national laws in other countries' territorial waters.

MR JACOBI: Just moving back to the topic that we were dealing with before and I've realised I've left it behind and it's the most important issue, which was the question of the immersion testing. The immersion limit, as I understand it, is to test the flask at 200 metres for a period of one hour or to simulate those conditions.

MR BROWN: That's correct.

MR JACOBI: Do you have a view with respect to the realism of that particular scenario to the sort of scenarios that you might expect?

MR BROWN: The 200 metres is intended to reflect what might happen if a cask was lost or if a ship was to sink on the continental shelf. What the IAEA regulations require is that there isn't a catastrophic failure of the cask in that situation such that it can safely be recovered. So it's accepted that the seals would pass and you would get water ingress into the cask at that depth but you wouldn't have a catastrophic failure or a collapse of the cask and then it would be quite feasible for it to be recovered.

Clearly our ships operate in deeper water than that. In those cases, because of the nature of these casks where the walls of them are typically 25, 30 centimetres of steel, it's unlikely that they would collapse in less than several thousand metres of water, and even there it's quite likely, depending on how quickly the cask was to sink or the ship was to sink, that what you would get is an equalisation of pressure inside and out because the seals would pass, water would get into the cask and equalise the pressure.

MR JACOBI: The Commission has also been interested to understand the extent to which there's been real world testing of flasks and I think you've in fact provided us with some videos associated with that.

VIDEO PLAYED

MR JACOBI: I think we're seeing them being dropped.

MR BROWN: Yes, I believe on that video that you're watching the first parts that you see are the regulatory tests, so a drop onto a punch and the nine-metre drop onto an unyielding surface and then the regulatory fire test. It then goes on to show some sort of real world demonstrations that have been carried out; the first one in the United Kingdom where a train was collided with a flask that was positioned on a railway line. The train hit it at over a hundred miles an hour and, as you will see, it's rather spectacular in the effects on the train but the cask was essentially undamaged in as much as it still provided its containment function, albeit a little bit dented on the outside. Then there's a North American example of a truck being driven into a concrete wall at high speed and again the cask retained its integrity.

MR JACOBI: I think leaving testing to one side, I'm just interested in the extent to which IMS and - I'd be interested to understand before a vessel leaves port loaded with spent fuel or a similar material, the extent to which there needs to be planning of the overall route and approvals being obtained both with respect to the port of departure and the port ultimately of destination.

MR BROWN: We always plan our shipments from end to end and would expect to have everything set up. The time table would be agreed with all parties, we wouldn’t ever set off if we didn’t have authority to enter the port of destination, so all of that has to be planned in advance and agreed in advance.

MR JACOBI: Does that also include the authority to enter other ports along the way, if it’s necessary to either fuel the vessel or provision the vessel in any way?

MR BROWN: The vessels are designed to be able to carry out the shipment to Japan by any route really, without having to stop. So we have no planned port calls. The only exception to that is if we go through the Panama Canal, which is a route that we do take quite regularly. Clearly we then also liaise with the authorities of the Panama Canal Authority in order to transit the Canal.

But apart from that, we don’t have any port calls en route, so we haven’t made arrangements for that reason.

MR JACOBI: The Commission’s heard in reports that, and it’s not clear whether it’s the case, that it was, in fact, possible or might’ve been possible in the past for a vessel loaded with spent fuel to travel or embark without, in fact, having an approval to enter a destination port. Is there any substance to that?

MR BROWN: I'm certainly not aware of that ever having been done. The only thing I can think that maybe you're referring to is that there was one occasion with a high level waste shipment to Japan where all of the approvals were in place, but when we reached Japan, for political reasons the local Governor held the vessel off the port for three or four days. There was some internal debate at a political level in Japan that did cause a slight delay before we were finally allowed to enter the port, but it wasn't that we set off without approval, it was something that came up as a political argument when we were almost at Japan.

MR JACOBI: Can I come to the question in terms of contingency planning, and that is the extent to which plans are put in place to address potential risks that might arise whilst you're en route. Could you give us an insight into the sorts of contingency management and planning that you undertake?

MR BROWN: Yes. The first contingency is actually the ship's crew themselves, they are all trained to fight fires. From a radiological protection point of view, we have instruments on board and some of the officers are trained to use them so that if there is any concern, they can take radiation measurements and advise the office in the UK so that we can provide advice to them on what might need to be done.

Beyond that, in the UK we have teams on call 24/7 when we have shipments being undertaken, and we have contracts with providers of both fixed wing and rotary wing aircraft so that we would be able to deploy that team anywhere in the world. Naturally, to get to the other side of the world would take some time, and we actually undertook a desktop exercise a few years ago at the IAEA during a meeting with coastal states, when we were tasked to get a route to get us from the UK. We contacted our providers and they came up with a schedule that would've taken just over 24 hours to get the team there.

COMMISSIONER: Mr Brown, you also have a first response vessel?

MR BROWN: No, no I'm not sure what - - -

COMMISSIONER: Okay.

MR BROWN: The response is essentially a team of experts, we don't have a vessel to respond, that would take too long, we'd need to fly the team there. What we do have is some additional equipment that is stored in salvage contractors' premises around the world. We have one in Panama, we have one in New Zealand, Singapore, Houston, so we have some strategic stocks of some emergency equipment around the world as well.

COMMISSIONER: Okay. That's what I thought I remembered. In evidence earlier today, there was a statement made that I'd like to read to you, just to get your view. And it was a statement made in 1999, and it said,

> "The general erosion in quality control, maintenance, respect for procedure and regulatory oversight, which is manifest stems both from an increasing need on the part of the nuclear industry to cut costs, and from a complacency which has resulted from the excessive and unjustified confidence the industry has in its own safety record. This is an extremely dangerous trend which has serious ramifications for the safety of the systems for shipping RAM by sea around the world."

Do you have a view about whether that's an accurate statement in 2015, of the industry?

MR BROWN: I don't believe it is an accurate statement of the industry, however I suppose you would have to recognise that there have been accidents in the wider nuclear industry over the years. I think some of the key findings from the Fukushima accident, for example were that there was a perception of safety that perhaps had too much trust put in it, without enough challenge.

One of the things that we have done following on from that is actually revisit our procedures, both for tsunamis, which could obviously effect one of our ships, and also more generally to see if there is any learning. So I actually believe that the industry is trying to learn from those incidents that have taken place. There is not a culture of complacency, there's a culture that recognises that we need to continue to review any incidents, however minor those are, and to learn from them and to continue to improve.

COMMISSIONER: There's also evidence that some of the written submissions that we've received about reports on Atlantic Carrier - Cartier I think it is.

MR BROWN: Yes.

COMMISSIONER: What was the circumstances behind that particular accident?

MR BROWN: As I understand it, that's a general cargo vessel that carries containers, and it caught fire in Hamburg. It happened that among its containers it did have some containers that carried, I think it was uranium that was being carried.

COMMISSIONER: All right.

MR BROWN: Uranium solid. Beyond that, I'm not really in the best place to comment, it's not the type of shipping that we undertake particularly, but I do understand that the fire was due to some other dangerous goods cargo that was being carried.

COMMISSIONER: In terms of your ships though, and the number of years operating them, have there been accidents, and if so, what type of accidents and what were the outcomes?

MR BROWN: We've had some incidents over the years, never any that have given any real cause for concern in terms of the cargo, and certainly none that have given any release of radioactivity. Typically, we have had minor bumps with quaysides when we've been docking, which perhaps caused a little bit of denting of the hull. We've had a couple of occasions when our ships have been at anchor and have been hit by yachts when a single-handed sailor has perhaps been down below and not been keeping a proper lookout.

We have had a couple of incidences of very minor fires. Typically, we've had a couple of cases in dry dock when people have been working on the ships and no cargo on board, they've perhaps been doing some welding and we've had a small fire in some rubbish.

Probably the biggest even we had was with the Atlantic Osprey. She'd undergone some renovation work which had included taking out an oil heater, or decommissioning an oil heater that was in the exhaust system, a heat exchanger. Unfortunately, that wasn't properly drained and as a result there was a fire in the residual oil, which had to be dealt with. Because we were in the Manchester Ship Canal at the time we actually had to disable the ship and fight the fire with carbon dioxide. So we did hit the bank on that occasion. But that was essentially a voyage that was recommissioning the vessel, there was no cargo on board, we were carrying out trials, and then covered something that hadn't been completed properly in the dry dock. So it's part of our systems that when we undertake work, we undertake recommissioning trials, we test the vessel, and on this occasion we found a problem.

MR JACOBI: Can I just finish up with the topic of insurance. I'm just interested to understand, in terms of the consignor and the - I guess the sharing of risk between the consignor and the shipping company - who ultimately bears the responsibility for the risks associated with ocean transport of spent fuel and other substances?

MR BROWN: Insurance falls into two categories. We have all of these sort of conventional insurances that you would expect for operating ships, hull and machinery insurance, P and I insurance, which covers all the conventional hazards of collisions, of pollution from oil, and so on. Then there is the nuclear liability insurance, which typically is taken out by the consignor to cover any risks from the radiation and from the materials being carried. So that's just split between ourselves as carriers and the consignors as the owners of the material.

COMMISSIONER: Mr Brown, I think that exhausts our questions. I thank you very much for getting up so early in the UK to help us with our inquiry. I wish you the best of luck, and we will now adjourn until tomorrow morning.

MR BROWN: Thank you very much.

COMMISSIONER: Thank you very much, Alastair. Time for a coffee.

MR BROWN: Yes, I think so.

MATTER ADJOURNED AT 5.32 PM UNTIL WEDNESDAY, 18 NOVEMBER 2015