ROBIN RIGG OFFSHORE WIND FARM (NAVIGATION AND FISHING) (SCOTLAND) BILL COMMITTEE

Tuesday 11 March 2003
(*Afternoon*)

Session 1

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ROBIN RIGG OFFSHORE WIND FARM (NAVIGATION AND FISHING) (SCOTLAND) BILL COMMITTEE

† 3rd Meeting 2003, Session 1

THE CONVENER

*Mr Tom McCabe (Hamilton South) (Lab)

THE DEPUTY CONVENER

Colin Campbell (West of Scotland) (SNP)

COMMITTEE MEMBERS

*Mr John Home Robertson (East Lothian) (Lab)
Mr Jamie McGrigor (Highlands and Islands) (Con)
*Mr Mike Rumbles (West Aberdeenshire and Kincardine) (LD)

*attended

THE FOLLOWING ALSO ATTENDED:

Mr Marcus Trinick (Counsel for the Promoters)

WITNESSES

Mr Dan Badger (Offshore Energy Resource Ltd)
Mr John Beattie (Anatec)
Mr Alan Cubbin (Maritime and Coastguard Agency)
Mr Jerry Eardley (Royal Yachting Association and Solway Yacht Club)
Mr John Gallagher (QinetiQ)

CLERK TO THE COMMITTEE

David Cullum

SENIOR ASSISTANT CLERK

Alison Campbell

ASSISTANT CLERK

Zoé Dean

LOCATION

Committee Room 1

† 2nd Meeting 2003, Session 1—held in private.

Scottish Parliament

Robin Rigg Offshore Wind Farm (Navigation and Fishing) (Scotland) Bill Committee

Tuesday 11 March 2003

(*Afternoon*)

[THE CONVENER *opened the meeting at 17:04*]

The Convener (Mr Tom McCabe): Good evening and welcome to this meeting of the Robin Rigg Offshore Wind Farm (Navigation and Fishing) (Scotland) Bill Committee. I welcome in particular those members of the press and public who have joined us this evening.

We have received apologies from Jamie McGrigor and Colin Campbell, who are not present due to exceptional circumstances. The situation is compounded by the unusual time of this additional meeting and the unexpected requirement for it.

Item in Private

The Convener: It is suggested that we take in private agenda item 3, which concerns the committee's consideration stage report on the bill. Is that agreed?

Members *indicated agreement*.

Robin Rigg Offshore Wind Farm (Navigation and Fishing) (Scotland) Bill: Consideration Stage

The Convener: The main item on our agenda is to take further evidence on the bill at consideration stage. The meeting has been arranged because the committee felt it necessary to reconsider some of the evidence that has been submitted, especially the evidence regarding collision risks and the proposed emergency management system.

It is fair to say that the committee is concerned, to say the least, that this additional evidence-taking session has been necessary. The procedures that the Parliament has set down for dealing with private bills are important. It would be serious if the committee had to form the view that anyone who gave evidence to the committee under oath was less than conscientious when giving that evidence. Later this evening, when we consider the approach that we will take in our report, we will take into account the reasons that witnesses offer for this further evidence-taking session's being necessary.

At previous meetings, I have explained that evidence given at consideration stage of a private bill is somewhat different from evidence given in other circumstances. The promoters of and objectors to the bill are allowed to cross-examine each other and are represented by counsel. The promoters are represented by Marcus Trinick. Mr Jerry Eardley will represent the Royal Yachting Association and the Solway Yacht Club.

I remind witnesses that the committee operates in a quasi-judicial form. Before they give evidence, each witness will be asked either to take an oath or to make an affirmation.

Today's meeting is restricted to consideration of the two issues to which I referred earlier: collision risks and the emergency management system. The first witness on behalf of the promoters is Mr John Beattie, senior risk analyst with Anatec.

MR JOHN BEATTIE *made a solemn affirmation.*

The Convener: Would you like to make an opening statement?

Mr John Beattie (Anatec): I have submitted my precognition for members to read and am happy to take questions.

Mr Marcus Trinick (Counsel for the Promoters): At the end, I will deal with the reasons for this meeting and offer the appropriate remarks. I thank the committee for agreeing to

meet at such short notice. It is extremely regrettable that that has become necessary.

Mr Beattie, your supplementary precognition has been submitted, so I will not ask you to read it. I would like to take you through five short points relating to the precognition.

I refer you to paragraph 7. I would like to peg down the basis of your comment that a 2-knot drift rate is more realistic than a 4-knot drift rate. I think that it will be enough for you to provide support for that remark, but you might be asked questions about it.

Mr Beattie: The remark is based on the Kirk McClure Morton report, which presents tidal current data for the area of the wind farm.

Mr Trinick: I will stop you there. That report is before the committee as RR/03/1/19/A.

Mr Beattie: Table 8 in the report presents a range of peak tidal current velocities at flood and ebb tides. The right-hand side of the table has speeds that would occur once in 50 years—the typical speed is 1m per second, which equates to 2 knots. Given the data, it is conservative to use a worst-case figure of 4 knots and a more realistic figure of 2 knots.

Mr Trinick: The worst-case figure, which is in the right-hand column of table 8, is 1.144mps. More precisely, what is the worst-case figure in knots?

Mr Beattie: Roughly, to change the figure to knots, one multiplies it by two, so the figure would be 2.2 knots or 2.3 knots.

Mr Trinick: I believe that you wish to make a correction to table 1, which is on page 2 of your precognition, and a correction to table 2, which is on page 3.

Mr Beattie: I have spotted one correction in table 1. At present, for the 18m to 20m range, the table states that the average air draught is 20.5m. In fact, that figure should be one row further down—the figure of 20.5m should be in the greater than 20m range. That means that there is one vessel in the Solway Yacht Club fleet with a mast height of greater than 20m.

Mr Trinick: So we should transpose the figures that are second from the left in the bottom two rows.

Mr Beattie: That is right.

Mr Trinick: Does that have any effect on your subsequent analysis and conclusions?

Mr Beattie: No. It is simply a typo in the precognition.

Mr Trinick: I believe that there is also an alteration to the heading of the second column from the left in table 2.

Mr Beattie: Yes. The footnote to the heading explains that we assumed a conservative air draught. For example, in the range 10m to 12m, we assumed a maximum of 12m. From that point of view, the figures are not an average, but a conservative estimate, based on the top vessel in the range.

Mr Trinick: We will quickly go through a mixture of paragraphs 19 and 20 and table 3. The middle figure in the bottom row is 15m, which is the assumed clearance above mean sea level, with a blade clearance of less than 16m.

Mr Beattie: That is correct.

Mr Trinick: I understand that the reason why you picked the figure of 15m is that it is just less than 16m.

Mr Beattie: That is right.

Mr Trinick: There was no other reason.

Mr Beattie: No.

Mr Trinick: If the figure were 15m, that would correspond to the +7m above mean sea level that is referred to in paragraph 19.

Mr Beattie: Correct.

Mr Trinick: I am sorry that I am leading you, but I want to clarify that, in those circumstances, if the figure were +7m, the figure in the bottom right of table 3 would be 0.01 per cent.

Mr Beattie: That is correct.

Mr Trinick: I want to be clear that we all understand the evidence in the second and third lines of paragraph 32, which state:

"the blades will be orientated at right angles".

Imagine one is looking at the full face of the blades of the wind turbine. Was it your assumption that yachts would always approach the full face of the blades?

Mr Beattie: That is right. No matter which direction the yacht approaches from, we assumed the worst case, which is that the blades present the widest target.

Mr Trinick: My final point arises from Mr Eardley's supplementary precognition, which was prepared for this meeting. In the final sentence of paragraph 7, Mr Eardley makes a comment about the quality of the data, which relates to location and the limited time. I believe that you wish to reply to that.

Mr Beattie: Yes. We took the last four years of available data on recreational craft incidents. The data were from the Marine and Coastguard Agency's search and rescue database, which includes almost 50,000 incidents over the four years, just over 10,000 of which involved

recreational craft. The reason why there have been so few incidents near to the wind farm reflects the fact that activity is low, whereas if you look at the Solent, for example, you will find many more incidents—hundreds of incidents over the four years. The fact that there have been only three incidents in four years within 4 nautical miles of the wind farm reflects the yachting activity in the area.

17:15

The Convener: Mr Eardley, do you have any questions?

Mr Jerry Eardley (Counsel for Solway Yacht Club and Royal Yachting Association): Yes, I have a few questions. I will do my best with the analysis. I have only had it for a couple of days, and I find it quite difficult. I am not a mathematician. Let me check whether I have understood the main premises on which the analysis has been based. Do correct me if I have got this wrong. Is it correct that it is based on four parameters? First, is the probability of a theoretical vessel in difficulties having a certain mast height based on the proportion of vessels in the Solway Yacht Club fleet or the proportion in what I call the international rating club fleet?

Mr Beattie: It is based on the Solway Yacht Club fleet.

Mr Eardley: Secondly, is the probability of the actual clearance that is available for such a casualty based on the regular movements of the tide and the likelihood of waves of certain heights culled from oceanographic data?

Mr Beattie: That is correct, with the wave height data being conservative, because the measurement is at high water.

Mr Eardley: Is it assumed that, in the future, casualties will occur with the same frequency as they did in the study period of 1998-2001 within two miles of the wind farm and four miles of the wind farm, respectively?

Mr Beattie: That is correct. We used the best available current data, but included conservative assumptions in our model to take into account the uncertainty of future conditions.

Mr Eardley: Finally, is it assumed that casualties that occur further away than those distances will not result in collisions with a turbine within the array because, in practice, vessels will be rescued and towed away in time?

Mr Beattie: That is correct.

Mr Eardley: That is one of the assumptions in the analysis.

Mr Beattie: It is. As I explained, we used the worst-case tide data—that is, 4 knots for one of the runs—which means that significant time will be available.

Mr Eardley: Let us consider the marine incident data that you used. The data are all culled from past events.

Mr Beattie: Correct.

Mr Eardley: So it gives us a picture of the future, only to the extent that we assume that there will be a similar pattern of events in the future.

Mr Beattie: Correct.

Mr Eardley: In paragraph 8 of your precognition, you state:

"The frequency of a yacht getting into difficulty … was identified from the HM Coastguard Management Information System … This comprehensive database covers all the incident events which could lead to a yacht being in difficulty"

and becoming a casualty.

Mr Beattie: Correct.

Mr Eardley: Is it not the case that that conclusion is correct only if the pattern of casualty events that occurs in the future is the same as has happened in the past? The database is not exhaustive, but you state:

"This comprehensive database covers all the incident events which could lead to a yacht being in difficulty."

Mr Beattie: That is correct.

Mr Eardley: Are there not other situations that could cause a yacht to get into difficulty that are not covered in the database?

Mr Beattie: In considering collisions with the wind farm, we assumed that the yacht would have to be in difficulty. The RYA has written scenarios in which a yacht could get into difficulty. Those are matched by the coastguard incident data. I have listed those scenarios in the bullet points in paragraph 5. The database is comprehensive. For example, it includes hoaxes, when the coastguard has been required to respond to a hoax call. We believe that the database captures all the incidents that could lead to a yacht being in difficulty near the wind farm such that it is unable to recover from a collision by its own means.

Mr Eardley: It seems to me that you are asking us to accept that the database of past events can reliably be projected into the future and predict safely the pattern of events in the future. As the database is based on very few incidents in the area of the wind farm, I suggest that that projection is rather thin.

Mr Beattie: For the reasons that I explained in response to the earlier question, I believe that the database is comprehensive. It has nearly 50,000

incidents and covers the whole of the United Kingdom. About 10,000 of those incidents involved recreational craft. If you considered incidents in the Solent or around Anglesey, you would find that many hundreds of incidents involved recreational craft. The reason why the data for the Solway firth near the wind farm are, as you say, thin is that activity in the area is low. I base that belief on a review of the activity data. Because the activity is low, one would not expect a high number of incidents.

Mr Eardley: In paragraph 9, you state:

"Within a 2nm radius there was 1 incident in the 4 years, giving a rate of 0.25 per year."

What would be the effect on your analysis if, during those four years, there had been either no incidents or 10 incidents?

Mr Beattie: Had there been 10 incidents, the rate would be factored up by that proportion. We would calibrate our model to 10 incidents if the historical data showed that instead of the one incident in four years.

Mr Eardley: Am I right in saying that the number of incidents on which the analysis is based is a straight factor, as you put it, in the results? If there had been no incidents, would your analysis conclude that there would be none in the future? If there had been 10 incidents, would the probability of an incident taking place be roughly 10 times what you have predicted?

Mr Beattie: That is not quite true as regards no incidents. For example, in choosing 4 nautical miles, we took quite a conservative view. Only one incident took place anywhere near the proposed wind farm. At 4 nautical miles, there happened to be another two. We were conservative in choosing a range of 4 nautical miles, as that gave us three incidents. However, there was only one incident at a range of 3 or 3.5 nautical miles. In our choice of ranges, we tried to take quite a cautious, conservative approach to reflect the number of incidents that had taken place.

Mr Eardley: Am I right in thinking that the analysis is sensitive to the number of incidents that you have traced from the coastguard database as having happened during that period of time?

Mr Beattie: Yes, that is a factor in the model.

Mr Eardley: The incidents that have been recorded in the coastguard database took place without the existence of a wind farm at Robin rigg. Is it possible that future incidents or casualties—other than the incidents or casualties to which you have referred in your analysis—might arise as a direct result of the presence of the wind farm?

Mr Beattie: I considered that. Our view of the problem was that, as a vessel that was competently skippered would not want to collide with the wind farm, it would have to be in trouble to do so. The only scenarios in which that could happen would be if a vessel suffered machinery failure, so that it did not have control over its navigation, or if it got lost in bad visibility, for example. The wind farm should improve that situation, because it will be marked effectively in bad visibility and will have a foghorn.

I took into account the fact that the existence of the wind farm could change the risk profile. However, it is still true to say that those incidents that led to a vessel being in distress would also be the incidents that might lead to a vessel that was in distress subsequently colliding with the wind farm.

Mr Eardley: I am suggesting that, just as a vessel might be disabled in the future for the same reasons that vessels have occasionally been disabled and needed help in the past, a vessel might also be disabled because of circumstances that are the direct result of the presence of the wind farm, such as error in navigation or collision in fog. Such circumstances cannot be projected into the future on the basis of your database, because the wind farm is not there now.

Mr Beattie: I would say the opposite. We got feedback in relation to another wind farm location in Liverpool bay. The local yachting representative whom we consulted commented that a wind farm would make it easier for vessels to identify their position, as it would provide a useful navigational marker where there had been nothing before. I would consider that, in the scenario of being lost in bad visibility, the presence of the wind farm, if it were marked effectively and had a foghorn in periods of bad visibility, would improve a vessel's chances of realising its position.

Mr Eardley: Is not it possible that although, in fine, clear weather, a wind farm is clearly visible and, to some extent, represents an aid to navigation, in poor, difficult conditions, the reverse might be the case? In other words, rather than a wind farm being of some assistance in such conditions, might not it be more likely that an incident would occur?

Mr Beattie: That comes down to the marking arrangements that the Commissioners of Northern Lighthouses will decide on. They have said that they will take into account leisure craft usage, which is the main usage by mariners near the area of the proposed wind farm. I know that the promoters will consult the local yachting associations. If we assume that effective marking is provided, there will be lights on the wind farm and a foghorn will be sounded during periods of bad visibility. Without the wind farm, there would be nothing there. With the wind farm, there will be a good chance that skippers will be able to reckon their position relative to the wind farm.

Mr Eardley: My final point is completely neutral. I have read a number of the risk analyses for commercial shipping. As far as I can remember, the conclusion that seems to be reached in all cases is that the likelihood of collision is very small and can be expressed as one in a very large number of years. Given our mortal lives, that is effectively never, as we will not live that long. How do you assess the accuracy and workability of such analyses in practice, given that we know that maritime collisions—sometimes quite serious ones—happen? How do you test such analyses against reality when they come up with conclusions such as one in 1,000 years or one in 500 years?

Mr Beattie: The model description indicates everything that we looked at. We considered a scenario in which a yacht was unable to control its navigation and was in difficulty—we have good historical data on such matters. We consider physical aspects such as blade clearance, different sea conditions and mast heights, at local yachting clubs as well as nationally. We also consider the wind farm's geometry—that is, the width of the wind turbines and the exposed collision length that they present to a yacht that might be in difficulty. We have considered the proportion of time that a drifting yacht might be on a collision course and could strike—

Mr Eardley: I understand that, but there is a general point behind my question. Without reference to the exercise in question, but generally speaking, how do you try to assess whether the conclusions from your analyses for wind farms or in other commercial contexts are realistic?

17:30

Mr Beattie: Modelling and making sensible assumptions are a big part of such assessments. We do a lot of work on the risks of commercial ships colliding with offshore oil and gas platforms. We found that one of the main factors is the density of shipping in the area—that is, the number of passing ships and the closeness of their normal routes to offshore oil and gas platforms—and that bad visibility is a big causation factor. Ultimately, we will calibrate our model on the number of collisions that have occurred and the exposure time—that is, on the number of platforms in the North sea and the number of years that they have been there. Using historical data, the model can be calibrated to give information on the number of collisions. It is then up to the modeller to make sensible assumptions about the influencing factors—the density of shipping and bad visibility. In the yachting model, the density of activity in the area would be a big factor—we have taken that into account in our model—together with the exposed length of the turbines in different sea conditions and mast heights. We have tried to include all the influencing factors in the model.

Mr Eardley: You seem to be saying that such work is entirely model based and that there is no way of tying it to future events. The model's client or user must make the best possible judgment and that is it.

Mr Beattie: We have found the assumptions to be sensible, in that the amount of activity in an area will be a big factor in determining the likelihood of collision. Certainly, we have found the assumptions to be sensible in respect of the risk of commercial ships colliding with offshore oil and gas platforms. Platforms in the southern North sea, where there is the greatest shipping activity, have been collided with. It is sensible to assume that there will be a direct relationship between the level of activity of crafts in an area and collision risks.

Mr Mike Rumbles (West Aberdeenshire and Kincardine) (LD): I am struggling a little with this. I have heard everything that has been said and have paid careful attention. Please correct me if I am wrong.

Paragraph 9 of paper RR/03/3/10 states:

"Within a 4nm radius of the wind farm perimeter there were 3 incidents between 1998 and 2001, giving a rate of 0.75 per year. Within a 2nm radius there was 1 incident in the 4 years, giving a rate of 0.25 per year."

A mathematical model is used to reach a conclusion that:

"A best-estimate blade/mast collision return period of 1 in 17,750 years was calculated. Assuming a 20-year operational life of the Robin Rigg Wind Farm, this indicates a 1 in 887 probability of a blade/mast collision".

My concerns are similar to those that were expressed in the questions that you have just answered. You use a mathematical model that produces a detailed and exact mathematical solution—that there is a one in 887 chance of a collision. I listened carefully and wrote down what you said to Mr Eardley. You talked about assuming that the modelling is correct and, more important, that sensible assumptions have been made. I want to ask you about sensible assumptions and the assumptions that you have made for the mathematical model.

Having a mathematical model indicates a certain exactness. However, we do not already have 60 turbines anywhere around the coast, so we cannot go on past experience. We have to look into the future. It does not seem logical to use the statistics relating to accidents in open sea to argue the case for locating a 60-turbine wind farm somewhere, as if nothing was there, and coming out with a probability ratio of 1:887. That assumes that there will be no change in the water, but there will be 60 turbines there.

Whether wind farms are sited on land or at sea, people who are in favour of them argue that they are an attraction that will bring tourism to an area. I assume that that will be the case for turbines that are sited in water, and that they will generate activity. What calculations have you made to take into account the attractiveness of the 60 turbines? That factor does not seem to have been taken into account.

Mr Beattie: We have used cautious best estimates in a lot of the assumptions. We have taken the accident data directly from the best available historical data. However, we have applied conservative assumptions in other areas, such as the water levels giving the blades clearance, the mast heights—we ran the figures for two sets of mast heights—and the active management system. We have said that the active management system would be successful only three times out of four; I consider that to be conservative.

We tried to make the model transparent. If there was twice the activity, which might lead, in the future, to twice the number of accidents, the frequency of a collision with the wind farm would, indeed, double. However, the probability is low—one in 17,700 years is the best estimate—and if it were doubled, it would be one in 9,000 years.

Mr Rumbles: You said that you are making commonsense assumptions, but the problem with common sense is that it is not terribly common. I am only a lay person who does not know the detail of the methodology that you have used. If there are three or four accidents over four years in an area where there is no wind farm but only open sea, I cannot believe that the probability of an accident is one in 887 if 60 turbines are sited in that same area. That does not seem logical and I have difficulty in accepting it.

Mr Beattie: The historical data show the likelihood of a vessel getting into difficulty. In paragraph 5 of my precognition, I have listed some of the reasons for such a failure:

"● Machinery failure

● Sail/mast/rigging failure

● Taking in water

● Meeting adverse conditions

● Lost in bad visibility".

Assuming that the yacht was competently skippered, those are the reasons why a yacht may be in difficulty and unable to avoid a collision.

Mr Rumbles: I am not questioning the technical detail: I am going back to the fundamental question whether you have made a sensible assumption in using the statistical record of accidents for areas in which there are no turbines. It is a matter of common sense. Anyway, I have asked the question and you have given me your response. Let us move to another question. What is the maximum height that the sea will be at any time above mean high-water springs and how often will that occur?

Mr Beattie: I refer you to figure 1 in paragraph 19 of my precognition. I have not worked out the maximum height at any instance in the future, but I have worked out the percentage of the time that the water level plus wave height would exceed mean sea level plus 7m, 7m above mean sea level being 3m above mean high-water springs. That would occur 0.01 per cent of the time. Although the level could be higher with an extreme, one-in-100-years wave or one-in-100-years water level, the water level plus wave height would reach 7m above mean sea level only a tiny percentage of the time.

Mr Rumbles: In the bill, the blade clearance above high-water springs is 22m. How much will that reduce when the sea is at its highest?

Mr Beattie: If the height above mean high-water springs was 22m, the height I have just mentioned—7m above mean sea level, which is 3m above mean high-water springs—occurs a tiny fraction, or 0.01 per cent, of the time. If we take away 3m from the 22m above mean high-water springs, that would be 19m. In other words, 0.01 per cent of the time, it would be above 19m.

The Convener: I have an illustration here on water levels and turbine blade clearance.

Mr Beattie: I think that Mr Badger drew that.

The Convener: Do any of the heights that are shown correspond to what you would describe as still water levels?

Mr Beattie: Mean sea level is measured at still water. It does not take wave height into account. We have added on wave height to assume that the yacht would be on the crest of a wave when it was under the turbines. That is the average still water level over 18 years, or however long we measure it to get the average.

The Convener: I would love to say that I understood that, but I did not, which is probably my fault rather than yours. If it is not shown in the illustration, can you tell us where still water level should appear in relation to mean sea level? Are you saying, in effect, that it is the same thing?

Mr Beattie: The water level changes due to the tidal range over 12 hours, from high tide to low tide. Taking into account all those variations of the tidal range, mean sea level would be the average still water level.

Mr John Home Robertson (East Lothian) (Lab): I turn briefly to some notes that have been

covered by Mr Eardley and Mike Rumbles. This goes back to something that I referred to at an earlier hearing about Murphy's law, namely that what can happen will happen. Is your conclusion in paragraph 39 based on the accident statistics that were supplied by the coastguard?

Mr Beattie: That is right.

Mr Home Robertson: So there have not been many collisions there and you have based all your projections on that low record?

Mr Beattie: They are not based on collisions; we include events that are less serious than collisions, but we assume that those scenarios could lead to a collision.

Mr Home Robertson: But obviously the operation of the wind farm will generate its own traffic and, as Mr Rumbles said, other people may be sailing around because they are attracted by or interested in the wind farm.

Mr Beattie: Vessels that are operated on the site by the developer are not considered in this risk.

Mr Home Robertson: And if a collision occurs among the traffic that we are talking about, the statistics that we have been discussing will immediately be altered and collisions will become more likely?

Mr Beattie: We have taken four-year data as a basis for working out the initiating event that could potentially lead to a collision. Other factors are involved—for example the mast has to be a certain height and the sea has to be a certain level. We have based the figures on incidents over four years, which are the best historical data.

The Convener: Thank you very much.

MR DAN BADGER *took the oath.*

The Convener: Do you have anything to add to the precognition that you supplied?

17:45

Mr Dan Badger (Offshore Energy Resource Ltd): I wish to tell members how extremely apologetic I am for the evidence that I presented at the last meeting, as a result of which we are here again today, and to explain quickly how that came about, because I am sure that there is a question mark in members' minds.

As members know, once we heard the RYA's objection on the basis of collision risk, we instinctively felt that it was objecting to something that was extremely unlikely—we used such words in our testimony at our first meeting. It was clear to the committee and to us that it would be a good idea for us to try to go beyond using words like "extremely unlikely" and to attempt to quantify what we meant, so I sat down to attempt to develop a model to do that.

Obviously, with hindsight I should not have attempted to do that myself, but should have asked someone like Mr Beattie, who is already experienced in assessing collision risk, to take on the job. Nevertheless, I came up with my own approach, which made sense to me at the time. I showed it to my colleagues and to someone who is an expert in bird collision risk assessment, who said that they used a similar method to assess bird collision risk. On that basis, I felt that the approach was sensible, albeit it was based on the assumption that mariners would never take any evasive action, as members know. The conclusions that I reached based on those calculations also corresponded with my instincts, so I did not bother to look at the model as closely as I should have done. In the days leading up to the presentation, we talked about my model—my colleagues quizzed me on it and we thought more and more about it, but it still seemed to make sense.

Following the meeting, and having thought about the model for quite some time, I asked myself a few simple questions and changed some simple assumptions. I realised that the results that that model produced were plainly wrong—in fact, they were absurd. I then realised—as I described in my letter—that the logical assumption that one can multiply the percentage of the area within which a collision could occur by the percentage of the area that a vessel would pass through in one year was not an appropriate way to calculate the probability of a collision. It was on proving that to myself and in talking to other colleagues that I realised that the model was not an appropriate way of making the assessment. It was simply the result of self-invented analysis, and for that I am truly apologetic and extremely embarrassed.

The only point that I wish to underscore is that the part of my analysis that is not affected is the analysis of vessels with masts lower than 15m, because my analysis in that respect was based solely on water levels, in which I have not found any flaws. However, my analysis of risks involving masts of above 16m was definitely not an appropriate way of looking at the problem.

The Convener: What qualifications or expertise do you have in the field of navigation risk assessment?

Mr Badger: My only qualification—I put that word in quotation marks—is the fact that I studied statistics as a graduate for two years. I would not for a moment argue that that qualifies me to do the kind of work that Mr Beattie does.

The Convener: You employed Mr Beattie, who is an expert in his field, to carry out a navigation

risk assessment but you did not contract him to assess the risk of blade collision. Was there any specific reason for that decision?

Mr Badger: Following the committee meeting in Dumfries, at which you requested that we expand Mr Beattie's navigation risk assessment work to include recreational vessels as well as commercial vessels, I felt that he had quite enough on his plate. The issue of blade collision risk involves other issues, such as water levels and rotor movements, which I was as qualified to investigate as he was. We chose to take an independent approach, with Mr Beattie focusing on what we call the hub—the hull-tower—collision risk and me focusing on the blade-mast collision risk. In retrospect, that was not a very wise course of action.

The Convener: When we met in Kirkudbright, you stated:

"The figure for mean high-water springs is 3.7m."—[*Official Report*, *Robin Rigg Offshore Wind Farm (Navigation and Fishing) (Scotland) Bill Committee*, 24 February 2003; c 105.]

Do you stand by that figure?

Mr Badger: No. That was an incorrect statement. The figure should have been 3.925m—I was confusing it with another number.

Mr Rumbles: You say that you believe that 18m is a safe minimum clearance level, given the system that you propose, the scarcity of vessels with masts in excess of 16m that cruise the Solway and the high likelihood that the few vessels in that class that cruise the Solway will intend and be able to stay well clear of the wind farm site. As I mentioned to the previous witness, the supporters of wind farms talk about wind farms being tourist attractions. Do you believe that people will stay well clear of the wind farm? Your letter to the committee states:

"I also take comfort from the Anatec conclusion that the worst-case probability of a hull/tower collision for all classes of leisure craft is 1 in 155 years".

You are basically saying that there is no risk at all. Does not that fly in the face of common sense?

Mr Badger: I would never try to tell you that there is no risk at all. The basis of our approach to the issue has been to identify acceptably low risk and to weigh risk against cost. I agree that the wind farm will be an attraction and I expect an increase in the number of vessels that will navigate around it. However, I would be surprised to see an increase in the number of vessels with masts in excess of 16m round the wind farm, especially if we do what we should do, which is to advertise the fact that, under extremely unlikely circumstances, vessels with masts in excess of 16m had better watch out. Vessels with smaller masts will be able to navigate round the wind farm whenever they want at no risk, and I expect them to do so.

Mr Home Robertson: We are all human and we make mistakes. I do not want to be vindictive; however, it is perhaps fortuitous that this little problem has come to light in the context of our consideration of your assessment of the risk of accidents happening. You took a slight risk when you gave that evidence to us, did you not?

Mr Badger: Yes.

Mr Home Robertson: Most people would think it rather unlikely that the promoter of a private bill would, in describing a risk assessment, lead incorrect evidence before a parliamentary committee, would they not?

Mr Badger: The next time I decide whether to give evidence, I will have a risk assessment done first.

Mr Home Robertson: I return to my point: what can happen may well happen, and it is not totally improbable that at some time during the life of the wind farm, a vessel with a tall mast could get into trouble among the turbines.

The Convener: Finally, Mr Badger, for the purposes of clarification, at the lowest clearance, how likely is it that weather conditions will be such that the turbines will be stopped at the 12 o'clock, 4 o'clock and 8 o'clock positions? When the blades are stopped in those positions, do you still maintain that there will be an additional 25m clearance?

Mr Badger: Yes. I will provide the committee with the exact number. When I was asked that question at the last meeting I pulled a number out of the back of my mind. I have done the calculation, and I believe that the clearance is more than 25m; I am quite certain that it is not less than 25m. I will give you the exact number and the basis for it.

The Convener: We need it very quickly.

Mr Badger: I will give it to you before we leave the room.

The Convener: That is quick enough, because we are not coming back again, if I can put it that way. Do you have any questions, Mr Trinick?

Mr Trinick: I have no questions, convener.

Mr Eardley: I would like to ask a brief question, which relates to Mr Badger's sketch, which colleagues have helpfully shown me, and to the information that I tried to convey through my precognition at the last hearing. I do not know if I am permitted to do this, convener, so I will be guided by you. I have prepared the same information but I have had it re-presented by our technical people, so that it shows the numbers of

boats in the sample fleet against their air draught. It has been redrawn so that the air draught is in 1m gaps rather than 2m gaps, which I hoped would give a slightly better curve. If you will permit me to, I will show the graph. You have not seen it yet, so I will pass it to you. The data are the same; they have just been presented in a slightly different way.

Mr Trinick: Convener, may I see a copy before the question is asked?

Mr Eardley: I apologise that the graph was not provided previously.

I want to ask two fairly obvious questions. The clearance-height sketch that Mr Badger drew shows that there is, at the highest water level that is possible on site, a clearance of 15.925m between that water level and the lowest tip of the revolving blade. If we look at the data that I presented, and, on the x-axis, at the nearest we can get to 15.9m, how many boats in this sample fleet of 3,178 are shown as having that—

Mr Badger: It is everything from the column headed "372" and above, so you would have to sum all those numbers.

Mr Eardley: If we take the clearance height that would be defined in the bill—that is, below the lowest point of the rotating blade and the level of still mean high-water springs of 18m—and we look on the data diagram at 18m, where does that put us in terms of the number of boats within the fleet that would just scrape by?

The Convener: Mr Trinick wants to make a point.

Mr Trinick: I understand why Mr Eardley asked that question and I do not criticise him for doing so. However, Mr Beattie gave detailed evidence on the issue and Mr Badger has withdrawn from the fray. I think that Mr Beattie should answer Mr Eardley's question and I am happy for him to do so.

Mr Eardley: I put the question to Mr Badger only because I understood that he constructed the sketch. If am wrong about that, I will withdraw the question.

Mr Trinick: Could you explain the relationship between the sketch and—

The Convener: Our understanding is that the sketch is about sea levels rather than masts. I would be grateful if someone could clarify that that is the case or correct my statement if it is wrong.

What has been suggested, Mr Eardley, is that your question may be more appropriately directed to Mr Beattie rather than to Mr Badger.

Mr Eardley: Perhaps another way of proceeding is for me, when I give evidence, to draw conclusions on the basis of the sketch, which I understand is accepted as a pictorial representation of various sea levels in relation to the wind farm's power. However, I am a bit at sea evidentially because I am not sure what the status of the sketch is. I asked Mr Badger the question because he happened to be giving evidence.

The Convener: I think that the sketch attempts to summarise evidence that we received at the Kirkcudbright meeting.

Mr Eardley: I have no further points.

The Convener: Do committee members want to seek any clarification?

Mr Home Robertson: I am not sure what Mr Eardley was driving at. I think that his point is that if we add up all the figures from the column headed "372" to the right, it appears that, under certain circumstances, about 970 vessels would be at risk of colliding with the lowest point of the rotor.

The Convener: Mr Eardley will give evidence later, so perhaps you could address a question on that issue to him then, having given advance notice of it.

Thank you, Mr Badger. I suggest that we have a brief, two-minute break.

Mr Trinick: I want to be helpful to Mr Eardley and what he has produced, so I will have a chat with him and we will ascertain whether there is a way in which his graph can be made helpful to the committee.

The Convener: Okay.

18:02

Meeting suspended.

18:10

On resuming—

The Convener: The next witness is Mr John Gallagher, who is the technical director of electromagnetics at QinetiQ—I will pronounce that correctly eventually. The word is spelled peculiarly.

MR JOHN GALLAGHER *made a solemn affirmation.*

The Convener: Do you have any opening remarks?

Mr John Gallagher (QinetiQ): No.

The Convener: At the conclusion of your evidence on 24 February, you confirmed that, as long as a vessel was moving, it would still be able to identify other vessels in the wind farm. Does that remain your evidence?

Mr Gallagher: Essentially, yes.

The Convener: Could you be a wee bit more precise?

Mr Gallagher: If we are talking about the shadow moving, the fact that the vessel is moving will change the shadow position. If the target vessel that was being looked for moved out of the shadow, it would become detectable, so essentially what was said is correct. If the vessel remained in the shadow, detecting it would be difficult.

The Convener: How big is the shadow?

Mr Gallagher: We mentioned 7m and an extreme of 10m before. That is the range for the shadow width. The committee might remember that the shadow extends about 2km to 3km behind the wind turbine and is about 7m to 10m wide.

The Convener: Does that 7m to 10m gap apply to each turbine?

Mr Gallagher: Yes.

The Convener: When that is multiplied across the farm, does that have any detrimental effect?

Mr Gallagher: The overall area that is available for detection purposes will be reduced, but that is a small percentage in relation to the wind farm's total area. The shadow area moves—it is not fixed, as long as the vessel with the radar moves relative to the wind farm.

The Convener: At the risk of asking the obvious, if a vessel were less than 7m in length and it remained behind a turbine, would it remain undetected?

Mr Gallagher: The chances are that it would.

Mr Home Robertson: I will move on to very high frequency communication. Will you explain what you mean by the turbine's shadow? Will that create a communication black spot where signals could not be sent or received?

Mr Gallagher: The shadow effect will reduce the signal strength from what it would be if there was no turbine, so there is a loss of signal strength as a result of the shadow effect.

Mr Home Robertson: Right, so the signal gets through but it may be diminished in the shadow. Does that shadow affect transmission and reception in every direction?

Mr Gallagher: In terms of VHF, antennae tend to be almost omni-directional, so if the substation at Caldbeck was in line of sight with the transmitter and there was a turbine in between, a shadow would be cast towards the Caldbeck direction. That would cause a problem with reception in that direction either at Caldbeck or back at the transceiver.

18:15

Mr Home Robertson: How will it be possible to test the effectiveness of VHF communications in the Robin rigg area?

Mr Gallagher: The calculations that were given in the precognition that was delivered for the Kirkcudbright meeting predict the attenuation factor that would exist behind the turbine. There are a number of factors in determining what that actually means as far as the Caldbeck station is concerned. If a transceiver was taken into the Robin rigg area and a signal was transmitted towards Caldbeck, Caldbeck would receive the signal, because there is no obstruction.

However, the attenuation as a result of a turbine being in the way of the transceiver has already been predicted, so the attenuation factor is known. If a transceiver was taken out into the Robin rigg area and the transmitted signal was attenuated to simulate what would happen in the presence of a turbine, it would be possible to determine at which point signal strength was lost for a given attenuation level. One could model directly what would happen with the Robin rigg wind farm by communicating directly with the Caldbeck substation. That would quantify where there would be a problem—that is, at what distance from the turbine the signal would be lost.

Mr Home Robertson: I think that I understand that. You have now placed on the record how that could be done. Finally, at what proximity to a turbine will VHF on a typical small fishing vessel be affected?

Mr Gallagher: We had this discussion before. The conservative judgment was that there might be concern within about 100m of the wind turbine, but in order to determine the true value, one could carry out a measurement and determine the actual effect, as the attenuation of the signal as a result of the turbine is known. The whole process could be simulated and one could come up with hard evidence to say what would actually happen.

Mr Home Robertson: At what sort of distance from a turbine would the type of vessel with the type of equipment that we are talking about find that its VHF became ineffective?

Mr Gallagher: As I said before, I would expect it to be ineffective at about 10m. There is a grey area between 10m or 20m and 100m. It depends on how the transceiver is configured and on propagation factors towards Caldbeck, but I put a conservative figure of 100m on that. My feeling is that it is likely to be less. I do not think that it is likely to be any more than 100m.

The Convener: I would like to return to radar. In your evidence to the committee on 24 February, you referred to "typical marine radars" that are in

wide use. What types of vessels use the Raytheon Pathfinder X-band surveillance radar?

Mr Gallagher: Many Royal National Lifeboat Institution boats use the Pathfinder radar. The RNLI also uses the Furuno radar. All those radars have similar characteristics. The RNLI uses BridgeMaster radars in some of its ships and other types of radar in other classes of ship.

The Convener: So you would stand by your statement that Pathfinder is

"A typical marine radar in wide use".

Mr Gallagher: Given the size of the scanner, larger ships would use that radar. Mr Cubbin commented in his letter to Dan Badger that it was a radar that would not typically be used in the Solway area—I agree with that. However, that does not affect the analysis that I have carried out with respect to the shadowing and forward scatter in that area, which was not dependent on whether a Pathfinder radar with a 12ft scanner was the one in use.

The Convener: Obviously, committee members are not experts in this field—I think that there are few such experts, as the evidence is technical to say the least—but if the analysis had been done using the type of radar that is in common use on the type of vessels that inhabit these waters, that might have provided additional reassurance.

Mr Gallagher: Yes, but it would have made no difference to the results—the results do not depend on the radar. That radar was used because it had been used in a previous analysis. It was a convenient starting point for the modelling process. However, in no way do the results depend on whether the radar is a Pathfinder radar with a 12ft scanner.

The Convener: In summary, the type of radar that we are discussing is more commonly found in larger vessels, but you feel that it makes no material difference to the outcome.

Mr Gallagher: That is correct.

Mr Trinick: Mr Gallagher, on the convener's point about the typical radar, in paragraph 15 of your precognition at the previous meeting, you said that

"A typical marine radar in wide use is the"—

and so you went on. I want to be clear, because you may not have fully understood the convener's question. His question was directed to the physical radar—the bit of kit installed on a vessel—and not to its performance qualities, in terms of the issues before this committee. In that sense, I think that you will probably agree that it would have been better to have used as an example the bit of kit that is actually installed on search and rescue vessels—I think that that is the point being made—or to have made the position clear in your evidence. I am your advocate, but you are under oath and I want to make the position clear to the committee. That is the point that is being made.

Mr Gallagher: Doing that would probably give more confidence to the analysis process, but I still submit that it makes no difference to the results that are generated.

Mr Trinick: I will address that point in closing.

On a further point raised by the convener, if a wind turbine remains where it is—and presumably a turbine remains where it is—a vessel less than 7m in length in the shadow area behind the turbine will remain in shadow. Would you consider that position by reference to what might be searching for such a vessel, for example a vessel with a search radar? I cannot lead you too far, but will the position alter by reference to the radar on the search vessel?

Mr Gallagher: As the search vessel moves, the shadow that the stationary vessel is sitting in will move with respect to the direction in which the search vessel is looking, so it is likely that that shadow will move from the position where the target vessel is sitting. The target vessel will therefore be exposed and available for detection.

Mr Trinick: So a constant shadow position depends on three objects being in a straight line. If one of those objects shifts position, the shadowing effect of the turbine will change.

Mr Gallagher: That is correct.

Mr Trinick: Thank you. Let us turn to paragraph 4 of your supplementary precognition—no, we have dealt with that point. Let us turn to paragraph 15. Paragraph 15 has been the subject of an exchange of e-mails between you and David Cullum, who was seeking clarification of one point. There are some words—I will not say what they are; you must tell the committee—which, if you add them to the third line of paragraph 15, as you are going to do, may further explain the position to the committee.

Mr Gallagher: I think that the confusion has arisen from the wording in the second sentence in paragraph 15 of my precognition. The issue is the interpretation of that sentence. I shall read the second sentence of paragraph 15 and add three extra words that may clarify the meaning of the sentence:

"It is clear from the discussion that there will be some resolution problems and that these will occur"

for target vessels

"close to the turbines."

Mr Trinick: So what you are envisaging in that sentence is not a radar search vessel, but the radar target vessel.

Mr Gallagher: That is correct.

Mr Trinick: Thank you. In paragraph 17, you envisage the position with regard to a Furuno 1833C radar with a 2ft scanner. In reference to paragraph 3 in the radar section of the MCA's letter of 26 February, you could be asked why, given that the smallest radar envisaged in that paragraph was 18in, you did not test the position by reference to an 18in scanner rather than to a 2ft scanner. I think that you can offer the committee a comment on that.

Mr Gallagher: Yes. As I searched through the data on the different radars, I found the characteristics of the Furuno radar and I used those characteristics to carry out the analysis. In essence, I used the figures that are referred to in Mr Cubbin's letter. He refers to the 18in scanner having a beamwidth of 3.9 deg. I used those figures and the range resolution figures for the small Furuno radar, which has a similar performance to the one that is suggested in the letter from the MCA. Therefore, the analysis should be broadly similar to what one would get if one used an 18in scanner. There should be almost no difference.

Mr Trinick: Hearing the words "broadly similar", I put the question this way: would the results of your analysis for the 18in scanner be different from those for the 2ft scanner to an extent that should concern the committee?

Mr Gallagher: No. There should be no significant difference that would cause concern.

Mr Trinick: I have a couple of supplementary questions arising from the helpful exchange of e-mails with David Cullum. I am not sure whether the committee has received copies of them. If members have not, I shall put the question in a different way and ignore the e-mails.

You use various terms in your evidence, two of which are "horizontal beamwidth" and "azimuthal beamwidth". I will not go into those. However, I would like to know whether, as a poor layman, I understand the position clearly. If I hold out my arms like this and I am the radar and the ends of my fingertips are—let us say—450m apart, which is the figure that you use for cross-range resolution in your evidence, is it the case that the horizontal beamwidth and the azimuthal beamwidth are precisely the same: 450m?

Mr Gallagher: That is correct.

Mr Trinick: And if I stand and look at a flat plane and I raise my eyes to a certain point, that is a vertical elevation.

Mr Gallagher: That is correct.

Mr Trinick: Thank you.

You have given an update on VHF. I would like to expand on that. Why not test the VHF position at Blyth?

Mr Gallagher: I believe that there are a number of factors associated with propagation in the Solway firth area that cannot be duplicated in the Blyth area. There is a different environment in the Blyth area and the propagation characteristics of that environment will be different from those in the Solway firth area. It seems perfectly reasonable to try to duplicate the performance of the communications channel in the area where it is going to perform, rather than in some other area with different characteristics.

Mr Trinick: Okay, but if I were Mr Cullum, I would probably say, "Yes, but what then?" If the VHF transmitter is taken into the wind farm and transmits towards Caldbeck, you can determine signal strength. I understand that you can then factor in through the use of a model the likely attenuation in respect of that signal because of the wind farm's presence.

18:30

Mr Gallagher: The signal can be physically attenuated to take account of what would happen in the presence of a wind turbine.

Mr Trinick: Fine—you have done that. The final paragraph on the topic in your e-mail refers to a procedure for VHF communication in the wind farm area. What do you mean?

Mr Gallagher: Having established the distance from the wind turbine at which the communication signal—the ability to communicate with Caldbeck—is lost, we can understand when to advise someone who might be in trouble that they must communicate, which might be at a distance of 20m or 30m. A fixed distance will be able to be given before which communication will have to be made if a vessel gets in trouble.

If a vessel gets in trouble at 30m and the advice is that communication should be made before that, those on the vessel will need to be able to see the numbering on the tower if they wish to communicate it to the coastguard and say, for example, "I am in trouble at turbine 21." The distance will determine the size of lettering that is used on the turbine and provide a procedure for handling the situation if a vessel got into trouble.

Mr Trinick: That is helpful; thank you. More questions might arise from that.

The Convener: I would like some clarification about VHF communication. You said that the propagation characteristics were different between the two areas. Will you explain that?

Mr Gallagher: Propagation depends on several factors, such as the state of the sea and the land on which the substation sits. The physical environment will affect the signal that is propagated. Another site, such as Blyth, will present a different set of physical characteristics to deal with, which will have a different impact on the signal that is propagated.

Mr Rumbles: In answer to an earlier question from the convener, you said that boats under 7m in length would be in shadow and would not be seen, but in answer to questions from Mr Trinick you said that, when the search vessel was moving, it would of course be able to identify boats. I want to understand that. Are you saying that all boats can be identified, as long as the search vessel is moving?

Mr Gallagher: All that I am saying is that the shadow moves out from where the target is. If the target moves into an exposed position, that can be eliminated by the radar. In the supplementary precognition, I analysed the resolution of the radar and its ability to discern a target when it is in the vicinity of a wind turbine. In a particular area round the turbine, there is difficulty in detecting the target, as a consequence of the size of the radar resolution cell.

Mr Rumbles: I am still confused. I am asking a layman's question. Are you saying that not all boats can be seen even when the search radar is moving?

Mr Gallagher: There are two factors.

Mr Rumbles: Can you keep it simple and straightforward?

Mr Gallagher: I will try to do that. The original question was the effect of the shadow on the detectability of targets. We said that the shadow extended for 2km or 3km beyond the turbine. If a target is sitting in that shadow, it is difficult for the radar to detect it. If it is out of the shadow, it starts to become possible to detect it. If the target is close to the turbine, there is a minimum range from that turbine in which there will be difficulty in detecting that the target is separate from the turbine.

Mr Rumbles: Use of language is important. You used the word "difficulty", but will you answer the question whether at any time there will be boats there that cannot be detected? I would like to know—yes or no.

Mr Gallagher: Yes, there will be.

Mr Home Robertson: Mr Trinick described the situation with a stationary casualty, a stationary turbine and a moving search vessel. You have just explained that, provided that the search vessel moves within a certain amount of time, it will be able to eliminate the turbine and identify the casualty, because if it moves it will be able to see round the stationary turbine. However, we are not just talking about one turbine; there are a lot of turbines. We discussed this issue previously. Am I right in understanding that the picture will be quite cluttered? If there is a casualty among the turbines in the wind farm, in the sort of scenario that we are describing—we are not just talking about one turbine—it could be genuinely quite difficult to identify and locate that casualty. I think that you are confirming that.

Mr Gallagher: There will be a region round the turbine where there will be a problem—

Mr Home Robertson: Round each turbine?

Mr Gallagher: Yes. There will be a region round each turbine where there will be a problem in separating the vessel that is in difficulty from the turbine. In the supplementary precognition, I calculated that area relative to the 4ft scanner and the smaller scanner of yacht-type radar. For instance, in the down-range direction it is possible using a very short pulse to discern targets that are separated by 25ft. If the vessel in trouble next to the turbine is within 25ft, one will not be able to discern the vessel's position or indeed that there is a vessel. If the vessel is beyond 25ft, one will be able to detect the vessel separately from the turbine. That is in the down-range direction.

Mr Home Robertson: I am sorry to interrupt, but is that based on the assumption that you are not in the unfortunate circumstance where another turbine has got between you and the casualty?

Mr Gallagher: If it is in the shadow of another turbine—

Mr Home Robertson: The thing multiplies.

Mr Gallagher: You have to move that shadow away from the target to expose it to illumination.

The Convener: I am sorry to push you on this, but the issue is becoming fairly complex and it is important. Are your assumptions based on a stationary vessel in trouble and a moving search vessel? If the assumptions have been made on the basis that the search vessel is moving, is that vessel moving at an average speed given a series of conditions and is it within or outwith the wind farm? If it is outwith and moving, do other turbines block its ability to find the vessel in distress?

Mr Gallagher: My thinking was that the search vessel is outside the wind farm and that the shadows from the turbines—the strips that run from behind the turbines—will be moving, because the search vessel is moving. Detection of a vessel at that time is excluded in a small percentage of the wind farm's total area—about 1 or 2 per cent.

The Convener: Have you anticipated the maximum time for which a search vessel would be unable to detect a vessel that was in distress?

Mr Gallagher: No.

The Convener: Could that calculation be done?

Mr Gallagher: Yes. Making some assumptions about motion, speed and direction would be fairly straightforward.

The Convener: Did I understand you to say that if a vessel in distress was within 25ft of any turbine, it could not be picked up?

Mr Gallagher: That is correct.

The Convener: In no circumstances can such a vessel be distinguished.

Mr Gallagher: That is correct. The signature of the return from the vessel merges with the turbine return, so the turbine masks the vessel.

Mr Eardley: I have one or two quick questions. Might sea conditions, weather or any other physical factors affect the ability of those who operate search radars to detect casualty vessels?

Mr Gallagher: The sea state affects a radar's operational performance. In the normal course of events, that would have to be taken into account in any radar performance calculation.

Mr Eardley: By what factor might performance be affected? Could the figure be 1 per cent, 10 per cent or 20 per cent?

Mr Gallagher: That relates to the sea state and the size of the radar signature or of the scattering from the radar target, which can vary. Large vessels that have a radar signature size of more than 20 sq m, 30 sq m, 40 sq m and up to 100 sq m should be fairly visible in the majority of sea states.

Mr Eardley: If we assume that we are talking about a relatively small search and rescue vessel searching for a relatively small casualty vessel, is it possible that the sea or weather conditions might markedly affect the factors that you have described?

Mr Gallagher: Which factors do you mean?

Mr Eardley: The problems of shadowing, of identifying vessels in some places in the array and of distinguishing a target from the array and from any other clutter that might arise.

Mr Gallagher: If the target is in the shadow, that will have an effect. The sea state will probably make a small but not significant difference. The sea state would probably not make much difference to the size of the radar resolution cell—its ability to discriminate the target from a tower. I think that that effect would be small.

Mr Eardley: I move to testing your predictions about the effect of radar shadowing and VHF shadowing—I correct myself. We are dealing only with testing the VHF shadowing predictions. Whether that might be done by using one of the only two turbines that have been built as a test area or whether such testing might be better done on the site, as you suggested, has been discussed.

Am I right in thinking that we are talking about two different kinds of test? If a test were conducted at the Blyth turbines, for example, the existence of a turbine would be real, but the local geography, the receptor station and other factors would not be real. There would be one reality but not the other. If a test were done in the local area—the Solway firth—it would involve the real receptor station, but the attenuation that was predicted from one's calculations would have to be simulated. Have I got that right?

18:45

Mr Gallagher: Yes.

Mr Eardley: So we are not talking about the same kind of test.

Mr Gallagher: No.

Mr Eardley: You would prefer the local test, which would be based on predicting attenuation and degrading—I hope that that is the right word—the signal from the test VHF transmitter using the actual topography and the actual receptor station.

Mr Gallagher: Yes.

Mr Eardley: Could that test be done using the kind of VHF transmitter sets that are used on small recreational craft?

Mr Gallagher: I expect that it would be possible to carry out the test with such sets.

Mr Eardley: I ask that because you indicated that the person who conducted the test would make changes to the set so that the signal would be attenuated. I wonder whether it is possible to do that. In other words, is it possible to simulate a yacht or recreational vessel attempting to make a distress call from a place where the wind farm would be—it is not there yet—rather than using a piece of test-bed equipment?

Mr Gallagher: I would approach matters by putting a switchable attenuator in the transmission line that fed the antenna in the transceiver. I would have that calibrated in such a way as to allow me to make an accurate determination of what the radiated attenuation levels were.

Mr Eardley: Do all the predictions that you have made about the possible effects on VHF transmissions apply to the small, low-power sets that are likely to be found on recreational craft to the same extent that they apply to the sets on search and rescue craft, larger commercial craft and fishing boats, for example?

Mr Gallagher: Yes. They are applicable to any handset or transceiver set because they are field calculations of the field intensities or the loss of signal strength.

Mr Eardley: Whatever the set's power?

Mr Gallagher: Whatever its power.

The Convener: On a number of occasions, you have given an answer that involved the phrase "broadly similar" and, in answer to Mr Eardley, you said, "I would expect that it would be possible". Will you qualify those answers? If you would expect something to be the case, does that mean that you know for certain or that you are simply offering a view?

Mr Gallagher: It means that I am fairly confident that it will be the case. It represents my best judgment, based on the knowledge that I have, without going out and carrying out the detailed verification experiments.

The Convener: I wanted to clarify that, in the light of previous experience. Thanks for that—it might be useful.

Mr Trinick: I want to clarify matters in relation to the radar shadowing effect. I refer Dr Gallagher and members to figure 5 on page 11 of the technical report from the previous occasion, which has the reference RR/03/3/3. For the purpose of this question, Mr Gallagher, we have, looking at the page in its correct format, a radar running down from the top to the bottom of the page—shall we call that the search radar? There is then a turbine at cross-range metre 0 and some shadowing behind that, which you discussed on the previous occasion. In the broadest terms, if a boat is in the black, blue, green or—possibly—yellow areas, it may have a problem.

Mr Gallagher: That is correct.

Mr Trinick: The width of that problem is about 7m.

Mr Gallagher: That is right.

Mr Trinick: Hence the questions about a boat of less than 7m. Let us place that boat behind that turbine as shown. We have a search vessel; we have the turbine; we have the target vessel in line. Am I right in thinking from what you said that, for that target vessel to be seen, the search vessel needs to move out from left to right or the other way?

Mr Gallagher: Yes.

Mr Trinick: That is the basic position. Can you give us some idea of scale? Looking at the cross-range resolution of that graph, how far away would the nearest turbine be? Could we see it on the graph or would it be a long way away?

Mr Gallagher: How far would—

Mr Trinick: I must not lead you; that is my problem. We have a cross-range resolution in metres, based on zero and going in one direction and then in the other. Where would the nearest turbine be in the plane of the cross-range resolution? What is the minimum separation distance?

Mr Gallagher: About 450m.

Mr Trinick: We would not be able to see it on the page. It would be out there somewhere. I understand. That is not accurate; it is only an indication. If there were not only one down-range turbine, but two, three or four—there may well be more than that—would the evidence that you have given in relation to a moving search vessel change in a way that is relevant to the committee's appreciation of what you describe?

Mr Gallagher: No. It would not change.

Mr Trinick: Okay. If the members want more clarification, I cannot take it any further without starting to lead you horribly.

The Convener: The only clarification that comes to mind is that, as the search vessel moves, there will be turbines in the diagonal. Do those turbines in the diagonal start to block the signal also?

Mr Gallagher: Could you say that again? I did not follow it.

The Convener: If the search vessel's radar is being interrupted by a range of turbines—say, three or four—in a straight line and it begins to move, other turbines could cut across that signal, I would think, at 45 deg, for example.

Mr Gallagher: There is potential for that, but the next turbine would be about 450m to the right. The width of the shadow, if you remember, is only about 7m. We have those strips coming from each turbine in the wind farm. They are narrow strips. It is possible that, depending on whatever geometry we have, we might have two or three shadows alongside each other. We would have to look at the various geometries for that to say what would happen. As we move in distance, the shadows are still moving.

The Convener: Yes, they move in relation to us in effect. If we are in front of the turbine, the shadow is in one direction, but if we move along, it is in another.

Mr Gallagher: If there are three turbine shadows, that is about 21m. Let us say that they are just contiguous to each other and we move those 21m as we move the vessels. The shadows will probably break up as well, depending on the geometric configuration.

Mr Home Robertson: I think that Mr Trinick has drawn our attention to the best-case scenario. If two turbines are directly in line with each other, and the casualty is behind the second one, it cannot be seen. However, if the search vessel is moving along the axis that we are talking about, the two plumes of shadow behind the two turbines—or it might be three turbines and three plumes—will swing round and the picture will become even more obstructed. That is the point that worries us.

Mr Gallagher: The shadow or obstruction will certainly move. The thing to bear in mind is the area of the shadow in relation to the total area available that has to be searched. As each turbine will shadow a 7m width—depending on what our range is—approximately 1.5 per cent of the wind farm may be excluded to us at any particular time.

Mr Rumbles: My point—and I think that of John Home Robertson—is that in effect what is shown is the best-case scenario, because we have one turbine here and another in line, so when the vessel moves round, the target can be seen. What would have been helpful and more realistic is a plot of 60 turbines to allow us to see where signals can be detected. Rather than dancing around the issue, that would have helped our understanding of it. Do you see what I am getting at?

Mr Gallagher: I am not sure that this is dancing around the issue. The reason for putting one turbine behind another was to consider the effects and to observe whether the shadow worsened or got wider or whatever. It was to illustrate that that did not materially effect the shadow in that sense.

Mr Rumbles: I understand that, but, for our understanding of the issue, it would perhaps have been a good idea to have plotted the whole wind farm and shown us, from various directions, how effective the signal was. That would have helped our understanding and I think that it would have shortened the questioning session.

The Convener: Thank you, Mr Gallagher.

MR ALAN CUBBIN *took the oath.*

Mr Alan Cubbin (Maritime and Coastguard Agency): I would like to mention radar, as we raised the point, and I feel that the committee has got slightly the wrong end of the stick. The original precognition from QinetiQ considered a radar using a very large antenna approaching the field. We had no problem with that. There will be radar shadows and there is nothing that can be done about that. However, our concern was with search and rescue procedures if radar has to be used. We asked for more information and, while we have one or two minor technical points that will make no difference to the committee's deliberations, we are quite pleased with the paper that QinetiQ gave to the committee for today's meeting.

According to the procedure that we are trying to put in place, if a vessel gets into difficulties close to the wind farm, it will make a radio broadcast. I would like to come back to radio in a moment. We will pick up the radio signal and will probably dispatch an RNLI lifeboat with a 4ft scanner. The lifeboat will approach the field using the long-range pulse and, according to paragraph 10 of QinetiQ's supplementary precognition, will pick it up at about 12.9km and still be able to see the two turbines. It will approach the field square on, not down the diagonal, because that will mean more and more radar masts coming together.

19:00

The lifeboat will first try to pick up a radio signal from the casualty and, using its directional finder, follow the VHF radio beam down to that radio. In the event that, for whatever reason, the vessel's radio does not work, the lifeboat will look for flares, lights, paraffin lights or any visual sign. If none of those is available, it will go to its short-pulse radar and enter the field. In paragraph 10 of QinetiQ's supplementary precognition, it says that

"when the range comes down to 1.4km the bearing or cross-range resolution is 50m".

The lifeboat will enter the field about 0.7km from one end and go down a channel with its short-pulse radar on. Paragraph 11 of the supplementary precognition tells us that the definition is 25ft. As a result, it will see any vessel that is lying 25ft from a turbine because it will look down each channel. As it moves forward up its first box square, it will look both ways down each avenue. It will then come out, go back into the field 1.4km further up—or further down, I should say, since the tide is down—and take another view up each passageway.

The committee must bear in mind that radar is the fourth and final method of detection after radio, flares and lights such as matches and torches. We wanted to examine that method to find out whether in such a case the craft would be blind if it entered the field. The craft will not be blind, although the method will not be exact; after all, the radar has a range resolution of 25ft.

Our procedure contains a proposal that—as I understand it—the developer has agreed to, which is that pylons should have a facility that survivors can go on to. There would undoubtedly be a problem if a vessel were immobilised completely within 25ft of a turbine. However, we should bear it in mind that there are four levels of detection and that survivors who can make the tower can sit there and wait things out. As a result, we believe that the risk is reasonable.

That is all that I wanted to say about radar. As I have said, we would like to discuss one or two

minor points with the developer, but they make no difference to the information contained in paragraph 11, which is the key one as far as we are concerned.

We believe that the concerns that we raised about radar in our letter to the committee and to the developer have been answered. There is a 25ft space where detection cannot take place. However, in such a case, we would consider carrying out a drift cast, which I mentioned at the previous meeting. In other words, we would try to develop a particular scenario in order to find out where the vessel might have drifted to.

Although I would like to talk about radio, I would rather see whether the committee had any questions about radar.

The Convener: To be perfectly honest, I am a bit confused. After all, in previous evidence, your organisation raised some concerns about the radar situation. I suppose that I am paying you a compliment when I say that you have done a better job than the promoter of explaining the matter to me. Given that you seem to be fairly satisfied about the procedures, why were the concerns raised in the first place?

Mr Cubbin: The original information from the developer dealt with the radar in relation to a vessel that approached the field, but stayed outside it. The information was that there are shadows behind turbines and shadows on shadows behind turbines, which is true, but that it is possible to differentiate between two turbines at a certain number of miles. Our concern was that if a vessel entered the field to carry out a search, the situation with the radar would mean that the vessel would be blind. However, we are reasonably confident that the present information demonstrates that it will be possible to use radar inside the field for the fourth method of search and rescue. The original proposal did not clarify that to our satisfaction.

The Convener: You have cleared the matter up considerably. I will stop you there, in case you say any more and confuse the issue again.

Mr Cubbin: To go back to the beginning, the whole emergency system depends on radio communication. We wanted to establish the distance from a turbine at which the radio signal becomes so weak that we cannot pick it up at Caldbeck and then activate the system. Our first suggestion was to go to Blyth to find out in situ what attenuating effect a turbine has on radio signals. As I understand it from today's meeting, the proposal is that, at a site close to where the Robin rigg wind farm will be built, the developer will, in effect, fit a choke in the line to the antenna in order to turn down the signal. That will allow us to find out when the signal is at such a low level that we cannot receive it.

I understand that suggestion, which is a simple way forward. The outcome will be that we will be able to say that, within a set distance of a tower—it has been suggested that it will be somewhere between 10m and 100m—the signal deteriorates to such an extent that we cannot receive it. We will then ensure that the numbers on the towers and the lights, which I mentioned in the previous meeting, are visible at that distance, or, as we suggest, one and a half times that distance. That will create a fail-safe system—if a vessel gets into difficulty in or close to the wind farm, the person will be able to make a broadcast saying, "I'm close to number 6," and we will be able to activate the system.

There has been much discussion about whether the distance should be 10m or 100m. We are happy for there to be a theoretical calculation using the attenuation method, but the final figure should result from a practical test. We would use a low-level transmitter fitted to a normal pleasure yacht or fishing vessel to determine the point at which the signal can no longer be received. That information will then be used to determine the size of the figures on the towers and the lighting level.

As I said, we are happy to have the attenuation figures as developed by QinetiQ, but at the end of the day, there must be a practical test to ensure that the figures are correct. The downside is that the developer cannot decide on the size of the numbers or the level of the lighting until after the practical test, although I must be truthful and say that I imagine that the numbers will not be put on the towers until the farm is finished.

The Convener: To clarify, I am not terribly aware of the weather conditions in that area, but how would fog affect the situation? Could dense fog reduce your ability to operate effectively?

Mr Cubbin: That is why we said that the numbers and lights should be visible from one and a half times the distance at which the signal cannot be received. Whatever happens, if an operator has a problem in dense fog, the numbers will make no difference. However, as the foghorn will be sounding, the operator should realise that he is in an area in which there are obstacles.

If the operator loses his engine, or one of the other items that has been mentioned in terms of ship failure mode, he should do something right away. He must not wait until he has hit the turbine before trying to call the coastguard. We will never be able to light the turbines to a level that is acceptable in periods when there is no fog only to cover periods when there is fog—we would prefer to use the foghorn.

Mr Trinick: I am grateful for Mr Cubbin's clarification. Nothing arises from the points that he made apart from one question: is the practical test the Blyth test?

Mr Cubbin: No. If the attenuation method is going to be used at Robin rigg, as was suggested earlier, we would like that method to be confirmed after the wind farm is built by means of a practical test at the wind farm.

Mr Trinick: In order for the committee to be clear on the matter, do you advocate using the Blyth test as a calibration or back-up to the test that has been offered by the promoter?

Mr Cubbin: I would be quite happy to accept the attenuation test. In due course, the practical test will take place. When Robin rigg is finished, we will test the whole of the emergency procedures—we are bound to do that.

Mr Trinick: Thank you.

Mr Eardley: You may have answered this question, Mr Cubbin—please forgive me if you have. In respect of the practical test and the possible interference with VHF signals, can the practical test be done only after the wind farm has been built?

Mr Cubbin: Not quite. There seems to be agreement that there will be an effect on the signal at a point somewhere between 100m and 10m—the developer says that the distance would be closer to 100m. I am saying that I do not know if that is so, but that I need to know.

If the developer does the attenuation test and it comes out at 50m, when the Robin rigg wind farm is finally finished, we would test whether the figure was 50m or 60m. We are talking about that kind of fine tuning. I would be very surprised if the practical test came out at 200m and I suspect that the developer and QinetiQ would also be surprised by such a figure. I think that the figure is of the order of 50m or 60m.

Mr Eardley: Mr Gallagher said that he thought it advisable to tell people who might have to use a VHF radio to call for assistance if they got into difficulties of the need to bear in mind the distance at which the signal could be lost. It seems that you are saying something similar. Is it practical to do that and, if so, how would the information be conveyed?

Mr Cubbin: The information is conveyed not by telling an operator, "Call us if you are more than 30m from the wind farm," but by deciding on the size of the numbers on the turbines and the power of the light.

The operator would see the number on the turbine—or the light if it is lit at night—one and a half times further away than the point at which they would lose the ability to transmit the emergency message. If the signal were lost at 50m, then we—or whoever—say that the numbers or the light would have to be visible 75m away. If the engine fails on the vessel, the operator can see the light before he is close enough to lose the signal.

I accept the fact that, if the engine fails within 25m of the wind farm and the vessel drifts behind a turbine and stops, there is nothing that can be done until the vessel drifts out from behind the turbine again. That is true of all marine casualties; there are certain times when we cannot communicate with the vessel.

Mr Eardley: Let us return to Mr Beattie's evidence and the way in which he conducted his probability analysis. As I understand it, he conducted that analysis on the basis that a search and rescue vessel—a lifeboat—would always reach the casualty within an hour of receiving a mayday call. I think that you agree with that. Can you confirm whether you do?

Mr Cubbin: Yes. In paragraph 6 of his precognition, Mr Beattie says that it is assumed that a vessel will be recovered

"after one hour of alerting the Coastguard."

We activate an emergency response within five minutes and we are on site within 45 minutes. The assumption of an hour is quite acceptable.

19:15

Mr Eardley: Could there be circumstances in which the skipper of the rescue vessel, or whatever other vessel was called in to effect the rescue, would deem it wise to evacuate personnel from the casualty but not to attempt to rescue the vessel itself?

Mr Cubbin: Our policy is to save lives first and vessels second. Yes, there probably could be instances in which people would be taken off a vessel and placed in a place of safety—the lifeboat. It could well be that the casualty vessel would be left.

Mr Eardley: In that situation, the vessel would continue its drift for more than an hour. As time went on, the vessel, left to its own devices, may come in among the turbines—if that is its direction of drift—and may or may not be struck, depending on other factors.

Mr Cubbin: Do you mean that the blades would strike it or that it would strike the turbines?

Mr Eardley: That would depend on the circumstances, the kind and size of the vessel and other factors. It may strike nothing; it may strike a turbine tower; or, if it were a large vessel, a rotating blade might strike it. There would be nobody on board.

Mr Cubbin: But the lifeboat crew would make an assessment of that risk. If they had rescued the people and the vessel was drifting downwind

towards the wind farm, they would assess what—if anything—they could do about that. If they could divert the vessel, they would attempt to do so. Nevertheless, there could be circumstances in which the boat would continue to drift. In such circumstances, the lifeboat crew would contact the coastguard and the wind farm would be closed down. The crew's next priority would be the prevention of pollution, although such pollution may be only minor. Their final priority would be to save the property. They would address matters in that order. They would tell the coastguard that the vessel was drifting into the wind farm, with the possibility of causing pollution. In such circumstances, the wind farm could be closed down.

Mr Eardley: So, measures might be taken in that order of priority: life first, pollution second, property last. However, time would continue to elapse before a vessel from which the personnel had been evacuated, but which had been left to drift for safety reasons, might be recovered or diverted by other means.

Mr Cubbin: Yes.

Mr Eardley: Therefore, the radial distance in those circumstances would be greater than the distance that a vessel would drift within the hour.

Mr Cubbin: I am not sure that I understand the question. I find it difficult to agree with that. Once the people were rescued from the vessel, they would be in a safe place and there would be a means of communication between the rescuing vessel and the coastguard. I suggest that that could cover any follow-up scenario.

The crew could tell the coastguard to close down the wind farm. If the vessel were to hit the turbine there might be some damage to the turbine or the vessel, but there would be no likelihood of a catastrophic accident, would there? Either I have lost the plot or I do not understand the question.

Mr Eardley: I am just exploring what might happen in the situation that I have suggested.

Mr Cubbin: Will you clarify whether this is to do with paragraph 9, and the 4 nautical mile radius and the 2 nautical mile radius?

Mr Eardley: Yes. I will try to put the question more simply. That analysis seems to be based on the assumption that the casualty vessel would always be rescued by the rescuing craft. I wonder whether there might be circumstances in which that might not happen.

Mr Cubbin: There will be circumstances in which, when a vessel gets into difficulty close to the wind farm, the people will be rescued and the vessel will be cast adrift.

I want to make another point about that paper. There is a reference in paragraph 8 to the coastguard management information system. That is probably the most comprehensive database in the country for incidents on the coast. It is historic, but we use it as part of a risk-based approach. That does not mean to say that it does not change—it changes slowly over time. The point that I think that Mr Rumbles was making was that the appearance of a wind farm would change the data. The only question that I would have asked concerned the sensitivity of the risk model to a change in the figure given in paragraph 9. I am not sure whether I am allowed to ask that question. Does the effect of changing the figure by 10 per cent or 20 per cent dramatically change the risk level? What is the sensitivity? That is what we usually check up on in risk models.

The Convener: That has previously been answered.

Mr Cubbin: It has? Okay.

The Convener: Thank you.

Our next witness is scheduled as Mr Eardley, on behalf of the Royal Yachting Association. Do you wish to go ahead, Mr Eardley?

Mr Eardley: I am quite happy to make a couple of points then take questions. I imagine that it will be fairly brief, though.

The Convener: It would be appreciated, but it is up to you.

MR JERRY EARDLEY *took the oath.*

Mr Jerry Eardley (Solway Yacht Club and Royal Yachting Association): I have some general discursive points in response to the latest evidence that has been presented here. I am conscious that I do not really have anything new to add, although I would mention a point that I did not explore in great detail last time, which is my view of the possible impact of the future round of development applications on the way in which the risk assessment process is addressed.

I pointed out that, in our organisation, we have quite a different perspective on risk to that which the developers have looked at thoroughly in this application. I pointed out, although this is historical, that our concern has increased over the past year or so as it has become clear to us that the original figures on clearances that were given—in my view, somewhat misleadingly given—by the industry are completely erroneous.

I turn to the point on static clearances that I rather clumsily attempted to make earlier. I stress that it is a very simple static point. In view of evidence that has been given, it is fairly obvious. Nevertheless, I will make it to drive it home. I make no comment about the probabilities of collision, but simply state that a collision could happen if a tall-masted vessel were to find itself below an operating turbine in various states of the tide.

The sketch from Mr Badger that has been distributed this evening illustrates that clearance. During the suspension, Mr Beattie said to me that he had approached the matter on a different basis. However, in the diagram, we have illustrated the mean sea level at data of nought, the height of water by which the section in the bill is defined—that is the clearance at still mean high-water springs—and the developers' assessment of what the highest water on the site is likely to be. The clearance in the latter category is a fraction under 16m and the clearance at still high-water springs, is 18m, as we know.

I pointed out and point out now that, by reference to the data, which are the best that we are able to provide, illustrating a population of pleasure craft—

The Convener: Are you now referring to the graph?

Mr Eardley: Yes. I have not put a number on it. It is a slightly new presentation of the data that I produced for the last hearing, which tabulates or explains graphically the air draughts—which is the distance between the water level and the top of the mast, disregarding any equipment that is on top of the mast—of boats in a sample fleet of just over 3,000. Those are boats that have been measured for racing, as it happens.

If we take that population of just over 3,000, which is small in relation to, but nevertheless representative of, the total number of boats that are in use, the number of boats whose air draught approximates to 15.9m—a fraction under 16m—is somewhere between the bars on the graph that represent 435 boats and 372 boats. That is, it is well up into the main field.

The number of boats whose air draught is 18m is lower. It is somewhere between the bars representing 228 and 99 and is in a population whose number is falling proportionately. Although the figure does not appear on the sketch, it is worth pointing out that the original intermediate clearance figure of 22m at mean high-water springs, which we said was acceptable together with the management system, shows that the population is at the tailing-off part. That is why we have previously said that that was the minimum acceptable clearance.

19:30

That is our view, put simply and without any attempt to put any probability theory on it. I am perfectly aware that when such a theory is used—depending on how the calculations are made—the probability of a collision between a boat in that population and a moving rotor blade is slight, but nevertheless, for safety purposes, that probability should not be ignored.

One reason for saying that is that, over the past year or so, we have tried to bear it in mind that the Robin rigg wind farm is not the only development that we have dealt with. We have dealt with a dozen or so around the country. Many more such sites will be proposed, because of a clear and major Government policy. I said briefly in my latest precognition that the Government is encouraging developers to bid for development rights chiefly in three strategic boxes. The Solway firth falls into one of those boxes. I cannot predict whether more applications will be made for developments in the Solway firth, near it or a few miles away, but more applications are likely for developments in that box, around the coast in the other strategic boxes and perhaps outside them.

It would be desirable for developers to understand that it is sensible to base their design calculations on factors such as clearance height, which affects one class of stakeholders, rather than to attempt a detailed, complicated and somewhat controversial calculation—not only for the Solway firth, but for the many other sites, of which there might be hundreds—that is based on local data, an attempt to work out the number of vessels of different categories that use the area and local factors. Such a process would be complicated, time intensive and possibly unrewarding.

Our sector prefers the more straightforward, easy-to-understand approach that, wherever they are, wind farms ought to be built with a minimum clearance that ensures that the serious potential accidents that we have described cannot happen to vessels that, up to now, have had every right to use and have used the sea areas in which the wind farms will be built and in which I think more wind farms will be built.

I hesitate to speculate as to whether there will be substantial numbers in waters within the jurisdiction of the Scottish Parliament. There are, however, encouraging words for developers in the Scottish Executive's policy paper, which was published for consultation last August. It stressed that, in Scotland, a broad approach to renewable energy is being considered and that, although many sources of alternative energy are being considered, offshore wind will nevertheless form a significant part of that programme. It seems quite likely, therefore, that there will be further wind farms in Scottish waters. The UK Government's paper on the subject mentioned another project that is being developed on the east coast.

That is a general description of how our sector sees the situation. Although we understand the assessment that the developers made in this case—that the chance of a serious accident is slight—it seems to us that the reduction of height that is proposed leaves open the possibility of

such accidents and we would prefer it if that possibility did not exist.

Mr Rumbles: I would like some clarification on the graph that you gave us earlier. Is the graph based on an estimate of all boats in British waters or only of the boats that are registered with the Royal Yachting Association or what?

Mr Eardley: The population is clear. It is a relatively small number of boats whose physical dimensions have been accurately measured for the purposes of assessing their handicap for competition. The boats are listed on a database, which is where the information for the graph was gathered.

Mr Rumbles: Are you confident that the sample is accurate?

Mr Eardley: Whether it is an accurate sample is not so clear. We believe that the sample is as accurate as we are able to make it. The rating system is intended to appeal to a wide selection of boat owners and involves a wide variety of just over 3,000 boats, from the high-tech, state-of-the-art racing boat to the family cruiser. It is designed for use at club level and at higher level racing. It is a universal system that everybody understands and which enables people to mix fleets and race on equal terms. The system is successful. Therefore, it is our view that the population that the graph uses is a reasonable approximation of the characteristics of the boats in general use that have not been measured.

In my previous precognition, I suggested that we would have to apply significant multipliers to get an idea of the total number of boats. The multiplier might be calculated by taking a best estimate of the total number of boats afloat when that was last calculated, which was about 10 years ago, when there were about 10,000. That figure was the result of a serious attempt by the British Ports Federation to calculate the numbers of boats that would go into General Lighthouse Authority waters.

The assessment was made for a different purpose from the one that I am using it for, but data are difficult to find. The data are the best that we can do to indicate the total number of boats that are in use around the UK coast and their characteristics in respect of the distance between the water level and the tops of their masts.

The Convener: How many of those boats race in the Solway?

Mr Eardley: I am afraid that I cannot tell you.

The Convener: Can you give us a best guess?

Mr Eardley: I have left matters relating to local boat data completely to Mr Copland of the Solway Yacht Club. I thought that he might be here tonight, but he is not.

The Convener: Just for clarification, does the graph relate to the number of racing boats in the UK that are members of the RYA?

Mr Eardley: They are not all our members. The graph is based on the data to which we could get access.

The Convener: So those boats would not necessarily use the area that we are talking about.

Mr Eardley: Not necessarily. The graph deals with the characteristics of boats that are in use around the coast. I have no reason to think that the population of local boats around here is substantially different from other populations of local boats.

The Convener: When you refer to boats that are in use around the coast, are you talking about the UK coast rather than the coast of the Solway firth?

Mr Eardley: I am talking about the UK coast.

The Convener: So there is no way of determining the average population within the Solway from the figures.

Mr Eardley: No. I think that Mr Copland has provided estimates of the number of boats that are in use in the area, but I do not think that he has attempted to correlate those estimates with any particular dimensions.

Mr Home Robertson: I am trying to work out what conclusions should be drawn from the graph. It is an analysis of a representative sample of the vessels that you know about around the coast.

Mr Eardley: The conclusion that I would ask members to draw from it is that a substantial proportion of boats in general use around the coast would be at risk of rotor strike if they found themselves underneath a moving rotor, given the clearance height to which the developers wish to build the farm.

Mr Home Robertson: So every boat to the right of the 16m to 17m columns would be at risk of collision.

Mr Eardley: Yes, when the water clearance happened to be—

Mr Home Robertson: According to my appalling arithmetic, just over a third of the sample would be subject to such collisions.

Mr Eardley: I have not added up the figures, but a significant proportion of the sample would be affected. That is why I have attempted to distinguish between that significant proportion and the proportion that would be at risk at the higher clearance, which would be small but acceptable, given that the height must be put at some level.

Mr Rumbles: So the sample is a UK sample and you cannot tell us whether it is representative of the Solway firth.

Mr Eardley: I cannot, but the view that I have taken throughout my written and oral evidence is that, on questions of safety, risk should be addressed more widely than simply considering a local population.

19:45

Mr Rumbles: But we cannot do that; we are here to consider navigation rights in the Solway, and that is what we must focus on. I am questioning the applicability of the statistics in the graph that you have provided. How useful are they for the issue that we are examining?

The Convener: Some of your points would perhaps be more appropriate to a public inquiry into wind farms in the water than to this committee.

Mr Eardley: I acknowledge that the Solway firth is an area of coast that, in comparison with other areas of coast, is relatively lightly used for recreational boating and yachting, although I understand that those activities are gradually increasing in popularity. The reason why I have suggested my graph as an alternative simply to using the local population of boats in Mr Copland's club is that it seemed that the area could be used by vessels of all kinds, of which this is a typical population spread. We are talking about the effect on the public right of navigation, and the design of new equipment such as this—new types of development—ought not to be based simply on a relatively small local population.

The Convener: You referred to the Solway Yacht Club data on the different types of boats and the different air draughts. According to that data, one boat with an air draught above 16m operates in the area.

Mr Eardley: It is a relatively small local club population, and the boats that are in use in the club are relatively small. There are one or two bigger boats, but there are boats that use the firth from the Cumbrian side and there are harbours there that, I understand, are in the process of long-term development. There are plans to improve the facilities and to attempt to attract boats to the new marinas and refurbished docksides that are being planned on the Cumbrian coast. That is another population that, in my view, ought to be taken into account in considering the future use of the area.

Mr Home Robertson: I am a complete land-lubber, but am I right in thinking that a vessel with a tall mast of 16m or more would have quite a deep keel?

Mr Eardley: I do not think that the draught of vessels whose air draught we are considering is a limiting factor when it comes to getting in around the wind farm.

Mr Home Robertson: But the water there is pretty shallow water, is it not? Am I right in thinking that a vessel of that scale, sailing in such shallow water, would probably have run aground long before it was able to collide?

Mr Eardley: No, I do not think that that is the case. Generally speaking, it is true that the larger the vessel, the greater its water draught. However, water draught is never a high figure. My boat has a draught of about 4ft, but, depending on its keel configuration, a larger boat might have a draught of 2m. The waters that we are talking about are not that shallow. Draught is not a limiting factor.

The Convener: Earlier, you seemed to suggest that a third of the boats in UK waters have air draughts of 16m and above. Is that correct?

Mr Eardley: I must confess, I have not done the arithmetic.

The Convener: I am basing my question on Mr Home Robertson's calculation of the figures to the right of the point on the graph that stands for boats with masts of 16m.

Mr Home Robertson: There are 970, I think. That is just less than one third of 3,178, which we are told is the number of boats on which the graph is based.

The Convener: If the figure that John Home Robertson has just mentioned is correct, that means that one third of the total boat population has air draughts of 16m and above.

Mr Eardley: I had not thought of it in that way. My understanding, based on discussions with colleagues who provided the information, is that the graph represents a reasonable approximation of the measurement characteristics of the boats that have been measured. The data are the best that we could find; we have no other data to go on. I am trying to provide a picture that has a national rather than a local flavour. It is important that the national element is brought into the picture to balance against the local population.

The Convener: I understand that that is your view, and you are entitled to it. However, you are outlining not the population that would be in the wind farm area but the population in the whole of the UK.

Mr Eardley: That is correct.

Mr Trinick: I have but one question. It relates to the extent of your evidence—and I mean evidence, not surmise—about the population of local vessels that might be at risk because of their air draught in the circumstances that you and Mr Beattie envisage. Am I right in saying that the evidence that is available to us in that regard is the

evidence from the Solway Yacht Club that is detailed in table 1 of Mr Beattie's supplementary precognition—as I am sure you recall—which shows that there is one vessel within the relevant size classes, and the data in committee document RR/03/4/4, which was also provided by the Solway Yacht Club?

Mr Eardley: Yes.

Mr Trinick: Can you offer any further evidence—and I mean evidence—of local usage of the Solway firth by vessels with relevant air draughts? I have pressed you very precisely.

Mr Eardley: I do not have any evidence of my own that I can give about local usage.

Mr Trinick: Only you are giving evidence. Do you have any evidence to offer beyond that which I have just canvassed with you?

Mr Eardley: No.

Mr Trinick: Thank you. I have no other questions.

The Convener: Mr Trinick, do you want to make a closing statement on behalf of the promoters?

Mr Trinick: It is 5 minutes to 8 and the committee has the evidence. That evidence is extremely recent and I wish to say nothing whatever about it. However, in closing, I would like to deal briefly with one or two issues that arise from the reason why we are here.

There should never be excuses for incorrect evidence. I apologise on behalf of the promoters and the witnesses who inadvertently misled the committee—I stress that they did so inadvertently. In respect of Mr Badger, there was a real mea culpa piece of evidence. He meant what he said, which I commend to the committee. Mr Gallagher might have slightly misunderstood the question about the typical marine radar point. On behalf of the promoters, I say that that was regrettable, but the phrase "typical marine radar" was used without specifying precisely what it meant, which should have been done.

On the evidence in general, I ask the committee to bear it in mind that, for all of us, after 25 years of advocacy and more than 400 inquiries, the evidence that we have had to put together for the inquiry is new. There has been a startling level of complexity in respect of radar and VHF information. That is not an excuse; it is a reason. We will try to do better next time. I apologise to the committee on behalf of the promoters of the bill for the errors that have arisen.

The Convener: Mr Eardley, do you want to make a closing statement?

Mr Jerry Eardley (Counsel for Solway Yacht Club and Royal Yachting Association): No. I have given a pretty discursive and descriptive view of our general approach in my evidence.

Perhaps I should emphasise that I am conscious that we cannot give the committee any hard and precise data on the use of the area by recreational craft—indeed, I have never attempted to give the impression that we could do so. I am conscious that that is a weakness in our position, but I have attempted to state a general principle, which we think is important. When designing and placing new developments and new equipment in UK waters for the first time, a cautionary approach ought to be taken to safety matters, at least until some years' experience has been gained. That should be done against the background of the strong likelihood—if not inevitability—that there will be many such developments around the UK coastline, with all the complexities that that will bring.

The Convener: Thank you.

That concludes consideration of agenda item 2. I thank everybody for attending the meeting. The committee hopes to issue its report on Friday. Following that, it will meet to consider any amendments on Wednesday 26 March.

19:58

Meeting continued in private until 20:07.

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