COMMONWEALTH OF AUSTRALIA

Official Committee Hansard

HOUSE OF REPRESENTATIVES

STANDING COMMITTEE ON INDUSTRY, SCIENCE AND INNOVATION

Reference: Long-term meteorological forecasting

TUESDAY, 14 JULY 2009

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HOUSE OF REPRESENTATIVES

STANDING COMMITTEE ON INDUSTRY, SCIENCE AND INNOVATION

Tuesday, 14 July 2009

Members: Ms Vamvakinou *(Chair)*, Fran Bailey *(Deputy Chair)*, Mr Bidgood, Mr Champion, Mr Cheeseman, Dr Jensen, Mr Johnson, Mr Ramsey, Ms Rishworth and Mr Symon

Members in attendance: Mr Champion, Dr Jensen, Mr Ramsey, Ms Rishworth, Mr Symon and Ms Vamvakinou

Terms of reference for the inquiry:

To inquire into and report on:

Long-term meteorological forecasting with particular reference to:

- The efficacy of current climate modelling methods and techniques and long-term meteorological prediction systems;
- Innovation in long-term meteorological forecasting methods and technology;
- The impact of accurate measurement of inter-seasonal climate variability on decision-making processes for agricultural production and other sectors such as tourism;
- Potential benefits and applications for emergency response to natural disasters, such as bushfire, flood, cyclone, hail, and tsunami, in Australia and in neighbouring countries; and
- Strategies, systems and research overseas that could contribute to Australia's innovation in this area.

WITNESSES

Committee met at 8.31 am

GIFFORD, Mr James, State Engineering Coordinator, SA Water

McLOUGHLIN, Mr Antony Stephen (Tony), Principal Project Manager, SA Water

CHAIR (Ms Vamvakinou)—Good morning, everyone. I declare open this public hearing for the inquiry into long-term meteorological forecasting in Australia being conducted by the House of Representatives Standing Committee on Industry, Science and Innovation. The inquiry arises from a request to this committee by Senator the Hon. Kim Carr, the federal Minister for Innovation, Industry, Science and Research. Written submissions were called for and 34 have been received to date. The committee is now conducting a program of public hearings and inspections. This hearing is the eighth for the inquiry. I call the first witnesses. Would you state the capacity in which you appear.

Mr Gifford—I am the State Engineering Coordinator for SA Water, relating to state emergency management and utilities management within emergencies.

Mr McLoughlin—I am the Principal Project Manager, SA Water. As Jim said, our division works specifically for state emergency management.

CHAIR—Although the committee does not require you to give evidence under oath, I should advise you that these hearings are formal proceedings of the parliament. Consequently they warrant the same respect as proceedings of the House itself. It is customary to remind witnesses that giving false or misleading evidence is a serious matter and may be regarded as a contempt of parliament. We thank you for your submission and now invite you to make a brief opening statement before we proceed to questions.

Mr Gifford—Thank you. We thought it was important for us, from our observations in working in an emergency management space supporting the emergency services, to look at the impacts on our communities and on our infrastructure, particularly looking at what CRCs are doing and also where climate change is going. We believe that some of the baseline science that we have been using for years has moved, and I think that has been underscored by the various climate change reports and the coming together of all of the climate change models over the last 10 or 12 years. We have engineering utility in our patch. Recently there has been a review of the building codes and we tend to take a minimalist approach rather than an approach like those seen overseas, which are to ensure protection—for instance, cyclones and the cyclone codes used in America.

With that in mind, and remembering the events in February this year in Victoria—we were faced with a similar situation here; we were just lucky we did not get the fire starts on the day—we think there is probably scope for some research and perhaps realignment of some of the warnings and some of the danger levels that we are putting out in a risk management context. That was the reason for us going forward.

The second issue we raised in our submission was in relation to heatwaves. Despite us having probably our worst heatwave, it did not register in the bureau's heatwave scale purely because one day we dipped under by half a degree or something like that. We are wondering whether

there should be a reassessment of those guidelines, particularly as they relate to early changes in the system, where people have not become acclimatised to the higher temperatures and there are sustained overnight temperatures which are causing infrastructure failures in our power systems because there is no cooling down. We wonder whether, as part of moving forward it, dealing with climate change and early warnings, you could separate those. They exist in a mass and work together. We wonder whether there should be a little bit more work done on those relationships for the betterment of the community in the longer term.

CHAIR—Mr McLoughlin, do you have anything to add?

Mr McLoughlin—No, not at this point. Thank you.

CHAIR—Could you describe the organisation's relationship with the Bureau of Meteorology—how you work together and where there may be areas that may have some shortcomings or failings that need to be addressed.

Mr Gifford—From day to day we receive all the warnings which come out from them via email to emergency services. We are hooked into the same warnings. In the state emergency sense, we are present in all the country fire state coordination centres. We deal with the bureau one on one, the same as they do. We are all part of the same team. We also meet them at various emergency management seminars around the country. There are certainly other parts. For instance, we are sitting in the state recovery office at the moment. The director of that office is part of the emergency warnings review that is going on federally.

CHAIR—Do you only deal with the bureau in relation to information or do you seek that information from other sources as well? We have heard evidence from other departments that find that they need to go to other sources.

Mr Gifford—I subscribe to Weatherzone as well. Lightning strikes is probably the biggest area for which we get additional information.

CHAIR—Is that because the information is not available from the bureau?

Mr Gifford—It is not one of their normal products which is put out, unlike severe weather reports, severe thunderstorms or flood watch. Emergency services get a separate briefing on the lightning activity level that can be expected and whether it is wet or dry. We get that—it is not public but it is an emergency services publication.

CHAIR—Overall, do you think the bureau provides you with sufficient information for you to be able to conduct your—

Mr Gifford—I think they do. They provide a very good suite of services. I think it is important that that is noted. Where we are coming from is the incremental changes in some of the systems which are used. The fire danger system is a zero to 100 system, yet in summers we are commonly seeing 10 or 12 days approaching 200. So we are wondering whether the scaling of those systems should be revisited and whether, as per our submission, there should be some additional levels put at the top when we know that a normal structure is not going to survive a fire. I think enough evidence has been built around the country over the last decade or two that

says that there might be a limit where the stay-and-defend policy is actually practical. I do not know the answer to that, but I think the bushfire CRC and some of the other work that is going on should be able to put some reasonable parameters around it.

Mr SYMON—I would like to ask about a few things, the first one being fire danger levels, as you mentioned earlier, and an additional band for those. From my perspective, that seems to be quite a sensible attitude, because at the moment once it gets to 'extreme' fire danger in Victoria, for instance, that is it; that is the end of the scale—but 'extreme' is reached quite often.

Mr Gifford—Yes.

Mr SYMON—It is not an unusual day in summer in Victoria, for instance, to have the fire danger level at extreme. And of course, as you were just saying, by measuring in a different sense you can get many indicators of a level beyond that, but the alert that goes out to the public is still the same. Your submission has got the levels listed in a table and then a different table with extended levels. Is there anything you can add to that that could be of use to not only South Australia but also other states?

Mr Gifford—I guess, as we put in there, an indication whether power companies are using the information for disconnection of known fault lines when conditions get really bad. There are linkages then to safe havens—as has been said in Victoria, if you are in a besser brick building, if you look at some of the telecommunications infrastructure. In besser brick buildings with a concrete floor and a concrete roof and a fireproof door, the highest temperatures they recorded inside with the equipment was about 35 degrees, yet everything outside melted. So there are some things there about building codes and balancing the risks. I think we have got to inform our community. Whatever the outcomes and whatever we do, we must work with community warnings, and the community needs to understand the risks, because I am not so sure that we are completely giving the upper end of the risk scale to the community at the moment, which aligns with what you were saying.

Mr SYMON—That seems true to me. I know that in Victoria, on the day before Black Saturday, the state Premier came out and said, 'This is going to be the worst risk you will ever see in terms of fire,' but there needs to be a far more systemic arrangement for messaging than that, as you were just saying.

Moving on, you were talking about electricity. In terms of the electricity grid, if you had a reliable long-term forecast, would that allow for the disconnection of higher risk lines over a longer period? For instance, if you knew you were going to have a week of temperatures of over 40 degrees and high north winds and there were particular lines at risk that you would normally try and isolate on a particular day, would having a long-term forecast assist you—so you would know to have people and resources in place to be able to do that ahead of time?

Mr Gifford—Working with the utilities, as I do here, I know that if people have got a heads-up warning they are normally pretty responsive and they will try and do their best to get the systems in the best shape they can be for the day. So certainly that could be an advantage for utility operators.

Mr SYMON—You were talking before about heat waves, especially when they are prolonged and when temperatures stay high overnight, leading to more breakdowns, especially in electricity grids. It is the same question again: if you had advance warning, is there something you could do to prevent that from happening, or is it just that if you know it is going to happen you can try to work around it as best you can?

Mr Gifford—I think it is a bit of both. If the design parameters are changing, and with climate change we are seeing a shift in some of the base temperature models, and we can get those nailed down then any investment required by the power companies can be put into the regulated plans—because most of our power companies around the country are on a five- or eight-year capital works plan, and that is to address a set of standards, and it is only if those standards change that they can vary their investment pattern.

Mr SYMON—Okay. Thank you.

CHAIR—Mr Ramsey?

Mr RAMSEY—Thanks, Chair. I have to say I was quite pleased SA Water were coming but I was a little bit surprised about where the submission goes, with emergency services in particular. I would have thought—and I hope either of you will be able to answer my questions—there were a number of issues resulting from the ability to forecast seasonal conditions, which is what this inquiry is primarily about, that affect SA Water directly, such as the ability to predict the amount of pumping from the Murray back to the Adelaide reservoirs, which is of course an enormous cost to you, and the ability to manage in particular the Eyre peninsula water sources, which are all from underground aquifers. I am a South Australian, so I come with some working knowledge of the background to these issues. The rest of the committee members probably do not, so I was wondering if you could give us some idea of what weight SA Water give to the seasonal forecasts when you design your program for the next three or four months. At the moment we have got big inflows into the catchments; that is pretty obvious. But you must be very interested in what will happen with the spring rainfalls.

Mr Gifford—Firstly, I must say that is not my area of responsibility or expertise. However, I would point you to the government's new plan, Water for Good, which has got 90 actions around ensuring a water supply for the city. From my general overview of the corporation I do know there is a lot of emphasis placed on ensuring they get the balance right. The last thing they want to do is pump it from the Murray for it to then go with storm water down the river. You are quite correct about that last three months and the spring rains. It is a fine balancing act that is done. But it is not my area of expertise. There are people who spend their whole careers working in that area. I do not think I could advise the committee appropriately.

Mr RAMSEY—I am guessing it is not yours either, Tony.

Mr O'Loughlin—It is not. It is a bit of an anomaly. Although we work for SA Water, we are very much separate from the SA Water corporation in that I guess we are the only utility that is government owned. Because of a certain amount of history going back to E&WS days, we have an overall responsibility for infrastructure and utilities generally including gas, power and even fuel supplies. Water is part of that mix but we are not actually looking at securing water flows. We are looking at restoring infrastructure and utilities in the case of emergencies.

Mr RAMSEY—To come back to emergency infrastructure, I wonder about this. I think you have been largely talking about short-term forecasting as to what the weather risk is going to be over the next week. Is there any real input to you over the longer term as to the seasons with the three-month or four-month type of forecasting? Do you make decisions based on that?

Mr Gifford—I guess if you are talking about a water supply scenario, yes, we would be making decisions as to that. Given an emergency management scenario, yes, we do in terms of bushfire planning and how much resource we should be looking at. For instance, this year we undertook a review of dry firefighting by heavy plant and machinery for the CFS here. We did an independent review of what is available and what arrangements should be in place. Unlike those in the Eastern States, we do not have formal contracts and we do not have bulldozers floated around like the DSC and CFA in Victoria do.

Mr RAMSEY—I asked a question yesterday about firefighting services in Western Australia. I know that in South Australia from time to time we import or lease water bombing aircraft. Are those decisions influenced by seasonal forecasts or is it pretty much a case of: 'It's December so we'd better get the water bombers over here'?

Mr Gifford—I think there are two levels there. Obviously, the CFS should be answering this question, but my observation would be that there are two levels. There is the normal base level of support that would be available. Then if it is a particularly bad year that is then ramped up. That would be based on forecasts.

CHAIR—Dennis, do you have any questions?

Dr JENSEN—Yes, two very quick ones. I was going to ask something about prescribed burning but that is obviously not your field, Mr Gifford.

Mr Gifford—That is correct.

Dr JENSEN—I would say that your identification of rapid changes in temperature is something that should be looked at. Something similar was found with military aircraft about 20 years ago. They found that pilots were dying and they could not understand why because the aircraft were not pulling more G than they expected. What it was was this. They were getting to maximum G very quickly. It was the onset rate that actually caused the problem. I think that is something similar to what you are saying as to temperatures. I do agree with you that that is worth examining.

Mr Gifford—There is a difference between the north of the state and the south of the state. When we had extreme weather in January and February, people in the north of the state, in Coober Pedy and Port Augusta, were saying: 'What heatwave? This is what we're used to. Why is the government doing these things?' Yet, if you look at our hospitals and everything around those systems, they were completely full.

Dr JENSEN—You said something about the coming together of all climate models. Having taken a very active interest in that area, I would differ with you. There are significant differences with them. In fact, in the last 10 years, particularly on a global scale, they have not been very good at all in their predictive capacity. Some of the lead authors with the Intergovernmental

Panel on Climate Change have actually stated that it is even more problematic on the regional scale. To what extent are you taking those models as a given of future climate behaviour?

Mr Gifford—I guess I was going in a presentation which I attended in Sydney by the Department of Climate Change and the ANU. They put up for us probably eight different models from around the world and the general trends were all heading in the same way. The message for me was that the changes started since the industrial revolution. You could see that in the models that they presented. They were all aligned; they were all kicking up.

Dr JENSEN—Without getting into too much detail with this, the way that they validate those models is by literally having hundreds of models. The models that they accept are the models that basically backtrack the data. As I said, they have been pretty lousy this century with predicting global climate.

Mr Gifford—I am not an expert; I was only going on what was presented by the professors from the ANU.

Dr JENSEN—Forgetting about that detail, how much are you actually relying on climate change model outputs?

Mr Gifford—One of the things we have been directed to do by the Premier is make sure that the emergency management arrangements take account of climate change. We have been trying to inform ourselves of where the thinking is going in the country and then trying to apply that back to what it means in our space. The ones which are coming up in our eyes are the ones which we have been talking about this morning. It is about the impact on the electrical systems, the impact on the community of rapid changes and extended temperatures, and the fire danger models.

Dr JENSEN—What is the cost associated with that—I guess you could almost call it remedial action that you would be taking to mitigate?

Mr Gifford—It depends on whether we realise the risk. I am not an economist, so I do not think I should comment on that, but our experience has been that, if we are well prepared, we will mitigate the costs of impact. If we are not well prepared then the costs of impact are generally higher.

CHAIR—That is in the event of a catastrophe. Dennis's question might be about what the costs are now in terms of preparing infrastructure for the event of a disaster.

Dr JENSEN—Yes.

CHAIR—Do you have to increase the level of infrastructure you have?

Mr Gifford—Individual companies would be looking at the number of spares they are holding. Instead of just blowing fuses, transformers are having to be replaced in power systems, for instance.

CHAIR—As there are no further questions, thank you very much for that this morning. We look forward to getting through our inquiry. Your submission has been very useful.

Mr Gifford—We look forward to reading the outcome.

CHAIR—I am sure you will be. Thank you.

[8.55 am]

STARICK, Ms Sharon, Chair, Natural Resources Committee, South Australian Farmers Federation

CHAIR—Welcome. Although the committee does not require you to give evidence under oath, I should advise you that these hearings are formal proceedings of the parliament. Consequently they warrant the same respect as proceedings of the House itself. It is customary to remind witnesses that giving false or misleading evidence is a serious matter and may be regarded as a contempt of parliament. We thank you for your submission and now welcome you to make a brief opening statement before would proceed to questions.

Ms Starick—Good morning, everyone. The South Australian Farmers Federation believes that adaptation to climate change is one of the biggest issues that will affect its membership, South Australia and Australian farming industries in the future. With climate change potentially causing an increase in the incidence of storms, flood, dust storms and heat waves, which may result in an increased risk of bushfires, it is vital that farmers have access to the best weather forecasting data possible. Having access to accurate, reliable and regular weather information, farmers are able to plan their farming activities on a weekly, monthly, seasonal and yearly basis. With this information, they are able to adjust the types of crops that they sow or plant and when they harvest, and plan for the amount of water resources available to them if the drought is seen to continue.

CHAIR—We heard evidence from the Western Australian Farmers Federation yesterday in Perth. It became apparent that farmers were having some difficulty interpreting forecast advice that has been provided. Is that the case with South Australian farmers?

Ms Starick—I would absolutely agree with that. It happens, I guess, at two levels—firstly, the adequacy of long-range forecasting and how it applies in South Australia. In the eastern states, El Nino significantly affects the weather and the climate in those states. In South Australia it is different, so El Nino is not as relevant in South Australia as in the eastern states. When it comes to farmers interpreting the information, that is of great concern to the federation, its membership and farmers in general in South Australia. The media relays the information in the newspaper or via media outlets through headlines such as 'We are in for a below average spring'. What exactly does that mean? What specifics are around that information? That is not well understood by farmers or well conveyed to farmers or the wider community. It makes it very difficult to interpret information.

I was talking to a farmer late last week—a very good, well-educated farmer in South Australia. Last year, when he saw the long-range forecast for spring, he actually physically felt sick. That is not a good place to be for our farmers. They have to be continually making decisions. His comment to me was, 'I now ignore long-range forecasting. It is of no benefit to me health-wise or of any benefit to my business.' This is from a well-educated farmer with good practices in place. It is of great concern that he does not view it as a useful tool anymore.

CHAIR—Has he made the decision to ignore it because he believes its accuracy is just not worth considering? Is that why it is being ignored?

Ms Starick—Partly that and partly the way the information is interpreted and portrayed in the media. The background behind it is not well understood. For instance, there is the accuracy of long range forecasting. The three-monthly forecast comes out in April. That has a significantly lower accuracy associated with it compared to later on in the season. The difficultly is that farmers are making decisions at the start of the year and right through April and May. Those are the critical times when they are making decisions about the area of crop to be sown, the number of livestock that they are going to maintain on their properties and the types of crops that they are going to grow. For them, those are the critical times of the year. And that is the time when we have the lowest accuracy in long range or three-monthly forecasting.

CHAIR—You made reference to the media. Do you make that reference in relation to the media simply reporting the forecast or does the manner in which it reports interfere with the quality? Is that is why the media is an issue?

Ms Starick—It is more about the fact that the media do not tell the whole story. The whole story is around how accurate the information being given is and what it actually tells us. It is telling us that we have a higher probability of below median rainfall for spring. It is not telling us that we will have that; it is also not telling us how much it will be below median by. It is not necessarily the amount of rainfall that is critical in farming systems; it is the timing of that rainfall that is absolutely critical. Associated with that are the soil moisture levels. It is also to do with other events like frosts, storms and heat waves. Those are some of the critical things to farming systems in South Australia.

CHAIR—I want to explore this issue of the media and the information that is conveyed a little bit more. From what you have said, my understanding is that the media do not give all the detail. Presumably, they have the media has the detail.

Ms Starick—I am unsure.

CHAIR—Okay. That is what I want to go to. If the media do not have the detail then perhaps the forecast is not coming with the detail. That becomes an issue for those who are issuing the forecast. The fault may lie there. Is that correct?

Ms Starick—I really do not know whether the media has the complete detail and understands what the long range forecasts tell us. Like I said earlier, I do not know whether they have the full picture to understand the accuracy behind that information or whether the issue is in the information that is being conveyed by the Bureau of Meteorology or other long-range forecasters.

CHAIR—But is the media the gatekeeper for the dissemination of information, or do farmers have access? They seem to know a lot more about forecasts than media outlets do.

Ms Starick—Yes.

CHAIR—Clearly, you have indicated that by your analysis of what other variants are not conveyed in the media message. Do farmers rely solely on the media for these forecasts or do they have their own access points so that they do not have to worry about whether the media has gotten it right or not? I am just getting a picture that they open the paper up and their decision are made entirely on the basis of what the paper is saying rather than being a decision informed from other points. Can you elaborate on that?

Ms Starick—They do access information from other points, particularly the internet. As farmers have become more up to date and have come to feel that they can manoeuvre around the internet more easily, that has become a critical access point to information. The issue also comes down to how they access that information. Yes, it is definitely on the internet. Sometimes you have to search for it. It is about what level that information is pitched at. Is it being pitched at the right level so that a farmer can understand the assumptions, the models and what that information is saying. There are some information with how the information is being presented.

CHAIR—Is that a problem for the bureau, which is issuing the information?

Ms Starick—It could be.

CHAIR—Do you have any thoughts on whether it is a problem and why it might be a problem?

Ms Starick—Having visited the bureau site a number of times, from my perspective I actually find the site to be quite difficult to manoeuvre around. The long-range forecasts are also very much on an Australia-wide basis. You can drill down potentially to a state-wide basis, but it is still at too high a level to be making really good decisions. Farmers need information either at a regional or local level. At the moment that information is not being presented in that way, so it makes it extremely difficult to use that as a good tool.

CHAIR—As a final question, how does that information get conveyed to farmers at the very local level? Is it a matter of having more resources made available or experts on the ground who actually interpret forecasts for the particular areas that farmers are interested in? How do you convey it; how do you make it that personal?

Ms Starick—I think there are a couple of issues behind the background to some of this. One of them is around the number of rainfall gauging stations that we currently have that are the responsibility of or managed by the Bureau of Meteorology. So, for a start, we are not actually getting really good accurate information on a daily basis. There are some real issues around that. Yes, the information can be modelled, but when you actually go to the model of where rainfall events should be occurring on a particular day or have been occurring over the last 24 hours they are not accurate by any stretch of the imagination. So I think there is a significant gap there in currently measuring what is happening on a daily basis. It would actually help to some degree to actually look at how the models work on a regional or local scale because there are regional and local differences where you have things like rain shadows and all those other sorts of things.

Ms RISHWORTH—If you are looking at the usefulness of information for farmers, how accurate do you need the long-term forecasts to be. Obviously, if you have got some saying,

'They are just not accurate enough for me so I am just going to throw them out the window.' Just how accurate do you need your forecasting to be?

Ms Starick—We would love it to be 100 per cent accurate but realistically that is the absolute holy grail. That is where some farmers are starting to come from. They are now saying, 'Is long-range forecasting the holy grail and we will never actually get there?' The challenge is to improve the accuracy. As I said earlier, the critical time for farmers in South Australia is really the first parts of the growing season, so we are talking about farmers making decisions from January right through to May and June as to the types of crops, the size of cropping they are doing, the number of livestock they are maintaining on properties and whether they are renovating pastures. That really is critical timing. Spring is another critical time because that will impact on the number of inputs that they will feed out to their crops, as in fertilizer, whether they will spend it on chemicals to maximise crop production, and some of those sorts of things. So those two time periods are probably the most critical and if we can improve the accuracy around those two particular times that would be a great advantage to farmers.

Ms RISHWORTH—What about some of the medium-term forecasting. I have got a lot of grapes in my area and people talk about one degree difference as having a huge impact, and obviously the heat wave had a huge impact on grapes. How useful is medium-term forecasting—I know we are looking at long term—two, three or four weeks out?

Ms Starick—That can be advantageous as well, particularly around whether it is forecasting of heat waves. You mentioned grapes but heat waves are also pretty critical when it comes to pastures and crops at the seed or flowering stage and the grain field stage. So farmers could be making decisions then around allowing the crop to continue, to produce grain, or making decisions around whether they should be cutting it down for hay. They can also impact on farmers' decision making. Two weeks out would be fantastic to have really good information about what is coming up. Farmers also look at that two-week information at the moment and make decisions about whether to put nitrogen fertilisers on crops, because nitrogen fertilisers need follow-up rainfall to take advantage of it. There would be some real opportunities to maximise our farming or better manage our farming systems in South Australia.

Mr RAMSEY—Sharon, thank you for coming in this morning. It is good that you have come in. You have given a strong opinion on the value of seasonal forecasting and the current arrangements for farmers. It is something we saw yesterday in Western Australia. Western Australian farmers also have great doubts about its value, particularly in the autumn period. Do you know people who are making decisions on crop area based on seasonal forecasting at the moment?

Ms Starick—No. If anything, that has decreased over the last few years because of people's confidence levels, partly because of drought and partly because of how they view the accuracy coming through on seasonal forecasting. Rather than saying, 'Yes, I'm going to be basing decisions around size of crop area' they are saying, 'I'm going to take every season as it comes and I'm then going to make decisions partly around when the opening to the season is.' Some of them may also be looking at the long-range forecast and using it as a tool but not basing their decisions on that specific tool.

Mr RAMSEY—As we heard from the Western Australian farmers yesterday—you and I know this—many of the South Australia region farmers are looking at dry sowing before the season opening range. They are taking a total punt on the season, aren't they?

Ms Starick—Dry sowing of crops in South Australia mainly occurs in the northern parts of Eyre Peninsula and the northern Mallee. Those two parts of South Australia are where dry seeding really comes into its own. Other parts of the state generally still wait for the seasons. As seasons have progressed, people's views on whether dry seeding is advantageous or not are changing. Last year, even though they dry sowed their crop, at the end of the season people still did not reap anything or much. Their yields were still quite depressed. I think there will be a critical look by farmers over the coming years about whether to continue with dry seeding because of the input cost to actually put a crop in the ground. Once it is in the ground, that is it—you have spent your money and you cannot go back—whereas, if you are still holding onto the seed fertiliser chemical, until you at least get an opening season and actually see what the season is going to shape up like and when it occurs, you can make some decisions along the way.

Mr RAMSEY—I concur with that. Certainly in the north-west, around the Ceduna area, that has been the case for a number of years—you wait until you see what the season is doing. It is opportunity cropping, really.

Ms Starick—Yes.

Mr RAMSEY—Would the environment committee have a view on how much of the South Australian cropping sector is under threat from, say, a 15 per cent drop in rainfall and whether this could be managed with more accurate seasonal forecasting?

Ms Starick—That is a very big question. It is so dependent on so many things. If we are looking at that taking place over the next, say, 10 years, we have a big opportunity in the industry to look at improving technology, improving long-range forecasting, improving current plant varieties and maybe looking at alternative farming systems for some of our lowest rainfall areas where cropping currently exists. There are some big opportunities but there are also some really big risks as well. The big risks are around input costs and the price that people are being paid for their cropping—for wheat or barley—at the end of the day.

So, whilst there are some big opportunities there to continue farming in those areas, there are also significant risks. So I do not know whether I can actually answer your question very well at all, given that there are so many variables in that question. But, if long-range forecasting was more accurate, that would give us as farmers greater confidence and also assist us in being able to make good decisions.

Mr RAMSEY—Okay. I will leave that for a little bit, Chair; I might come back to it.

CHAIR—Yes, we will see how we go. Mr Symon?

Mr SYMON—Thank you, Chair. Good morning, Ms Starick. I would like to go back a step to the long-range forecasting and the probability that we see with it. I was just going back through my notes to have a look at what we heard at the Sydney hearing, where The Weather Channel presented us with a couple of printed examples of forecasting. From memory, one of them said,

'The long-range forecast is there is a 50 per cent chance of above-average rainfall over the next three months.' That was presented as an example of a piece of useless information, which of course it was. You might as well have flipped a coin, in my opinion. At the same time, they presented another piece of information which, I think, dated from 2003 and actually forecast eastern seaboard rainfall to be above average. Farmers at the time followed it, and there was a large crop as a result. That would seem to me as a non-farmer to be a more useful piece of information than the first example I quoted, the fifty-fifty chance. If more long-range weather forecasts were of a structure that you could actually gain some information from them, compared to having none, would more farmers be inclined to follow them?

Ms Starick—I think so, but it also hinges on the accuracy of that information. There were farmers that really looked at the long-range forecast in recent years—I cannot be sure whether that was 2006-07—and the early forecast in South Australia suggested that the season was going to be quite a good one. People did base decisions on that and, at the end of the day, regretted those decisions pretty badly. So I think that is why, for the last few years now, people have started to actually walk away from long-range forecasting. They are saying either 'I'll ignore it' or 'I'll consider it a tool but I'll put a very small weighting on that as a tool to use'. So, whilst I agree with you that if we have good information farmers will use it, it also has to have a level of accuracy behind it. It is all well and good to say, 'Yes, the season's going to be a good one,' but, if it is not accurate or it does not have a higher degree of accuracy, people will walk away from it and say, 'I can't use this information.'

Mr SYMON—Okay. That leads straight into the next question. As I understand it, the long-range forecast is mainly based on statistical models—

Ms Starick—Yes.

Mr SYMON—changing over to a dynamic model. But with the changing climate it would seem to me that a statistical model based on previous years, maybe before that climate changed or when it was just starting to change, and re-presented now would not be based on the current situation.

Ms Starick—Yes, there is that possibility.

Mr SYMON—Would you be able to link that? Were more farmers prepared to back a long-range forecast a decade ago than they are now? From what you have said this morning, that is how it sounds to me, but I would like to hear it direct, I suppose.

Ms Starick—Yes, I actually think that is the case, because people's views on long-range forecasting are that it has not been accurate over the last few years. Yes, it has been accurate, but by the time you get to July-August it is too late. People have got their crop in the ground. People have made decisions about matings of cattle or joining rams with ewes and those sorts of things. They have already got their stocking levels on their property. So it is too late at that time of year.

I guess the other thing that has a big impact at that time of year is the moisture levels within the soil. Something that farmers are getting quite excited about is the tools that they can use to understand not only the water-holding capacity of their soils but the current level of moisture within their soils, because that can provide a bit of a buffer if we get dry periods in the season.

Farmers are starting to look at tools or ways to measure the moisture levels and at using those more as a tool in their management.

Mr SYMON—Do you see any need for training to be provided, by the bureau or a similar organisation, for farmers in understanding what is contained within long-range forecasts and how it may or may not affect them?

Ms Starick—A significant amount of training has already been offered to South Australian farmers through SARDI, which is our research organisation in South Australia. I guess it still depends on how people interpret the information. When the long-range forecasts come out they are not necessarily presented in a way that is useful and in terminology that people can understand.

CHAIR—Can you give me an example of how people interpret that information? It seems that how someone interprets a forecast could lead to a whole series of decisions that could be financially catastrophic. I am curious. I want to know how a farmer interprets a forecast to get it right or wrong. It is going to be about either the quality of the forecast or the skills of the farmer in interpreting it. Somewhere in-between there needs to be some meeting.

Ms Starick—I think it is a bit of both. One part is providing the forecasts in the first place and the other is presenting the forecasts in such a way that people can interpret them. In the way that long-range forecasts are currently presented, it is around median rainfall and probabilities. A lot of people do not understand, firstly, exactly what that means. They also do not understand the accuracy that lies behind that, because the accuracy does change depending on where you are—

CHAIR—You mean the level of accuracy, rather than the accuracy.

Ms Starick—Yes, sorry—the level of accuracy in the models in putting out a three-month forecast. In April they are less accurate than they are in July-August. The models are more accurate in July-August than they are in April.

CHAIR—You know that; do the farmers know that? If they don't, why don't they?

Ms Starick—I would suggest that a lot of farmers would not know that. It is partly to do with the Bureau of Meteorology website and even other websites not being up-front about when the models are more accurate. It is not obvious to people, and the language that is used cannot be easily understood by farmers, by policymakers or by the wider community.

Dr JENSEN—Do you know what strikes me here? The word is communication. Have you told the Bureau of Meteorology what method of presentation of that data would be more useful to you or have you just effectively waited for the bureau to come up with a web page that is more useful to you?

Ms Starick—I guess we have not been proactive in going to the Bureau of Meteorology and talking to them about it. Our issue, as well, is that, until the accuracy is there, people will not view it as a useful tool. So there are two problems there. One is around communication, around the tool itself, and the other is around the accuracy of that.

Dr JENSEN—You were saying that in many cases the data put out by the bureau bears no resemblance to what has actually occurred. I guess this comes back to what in computer terms is called 'garbage in, garbage out'—or, in climate change models, 'garbage in, gospel out'. Were you saying that there need to be more data collection stations or is the issue that the data that is collected in the existing stations is not good?

Ms Starick—It is around more data collection stations. The Bureau of Meteorology are well aware of that, because that is something that farming organisations across Australia have been calling for over a number of years. Other organisations—like, for instance, our natural resource management boards in South Australia—have also been calling for more weather-recording stations, to better provide information to farmers and to community people in rural and regional areas across South Australia. The difficulty for the Bureau of Meteorology, as I understand it, is around resourcing. I do understand that, but that does not stop us from highlighting the need that is out there.

Dr JENSEN—My final question gets back to something that Mike was talking about a little earlier, and that was seasonal or long-range forecasts being used more 10 years ago than they are now. Is that an issue of the changing climate or is it that farmers have come to realise the limitations of those forecasts, after initially, when they were offered as a new product, assuming they could do more than they could?

Ms Starick—That is a really difficult one because in South Australia, all along, even for the last 10 years, I would say, the level of use has not been as high as in the eastern states—just because the forecasts have not been so applicable to South Australia. The models that have been used have been based around El Nino, and that does not impact on our climate here as much as—

Dr JENSEN—It is more Indian Ocean Dipole, isn't it?

Ms Starick—Absolutely. That information, as I understand it, has been being built into the models over the last few years. I do not know that in South Australia we have had as much uptake by farmers of long-range forecasting as we have had maybe in some of the eastern states—particularly, I understand, Queensland. They use their long-range forecasting quite well, although I am even hearing some disgruntled comments from farmers in Queensland about the accuracy of long-range forecasting there.

CHAIR—Going back to that whole discussion about the dissemination and the accuracy of the information, do you think that the bureau in issuing those forecasts should have a qualifier that goes to the level of confidence that people should have in what they are putting out? You said at one stage that farmers may not know that this is not necessarily that accurate and you said that it is all sort of hidden and open to interpretation. Do you think the bureau should be more specific about the confidence that people should have in its product?

Ms Starick—I think that would help in the interpretation. It would also help with the way that the media convey that information to the wider community. Long-range forecasting is potentially a tool that could be used by not only farmers but also policymakers in South Australia, whether they be based in natural resource management boards or in government. We are also talking about the wider community and how they view things. In South Australia the wider community

is much more aware of water issues now than they were five or 10 years ago. They are actually taking more of an interest in long-range forecasting now than they did, say, 10 years ago.

CHAIR—Yes, because there is a water shortage.

Ms Starick—Absolutely. So there is a real need for some sort of qualifier about the accuracy of the information or for better conveying the information.

CHAIR—I am just getting the impression that farmers seem to be—

Mr RAMSEY—Sceptical buggers.

CHAIR—Well, yes. Do farmers not have an inherent, acquired, practical experience of weather forecasting? One would think that they are on the land and they have their own tools just by virtue of experience to actually understand some of the things that are happening to make decisions. Do they not have that anymore or is it that the climate has changed in such a way that there are new variants that do not come with that acquired experience of the land? We hear about people who can put their finger up and test the weather and see this and see that. Is that gone? Is that sort of acquired memory no longer useful?

Ms Starick—The major concern at the moment is that farmers' confidence levels have been really battered over the last few years, particularly because we have had three years now of drought in South Australia. The season at this stage is looking okay for the majority of the state. I will say 'the majority of the state' because there are still patches where it is not good at all and where the season does not look like it is going to be a great one at all. It is peoples' confidence levels. It really is about having confidence—confidence to actually make good, sound decisions. Farmers are also becoming more concerned around climate change and asking questions. Is it here? If it isn't quite here yet, what is it going to look like? Are the last three years now going to be the norm rather than what we consider to be drought? Farmers are starting to ask all those questions. At the moment there are no answers. That has something to do with being able to trust their judgment. Farmers from my area would say that we could definitely count on one year in 10 being a drought year. Well, we have had three in a row. That is not something that is very common, although you can go back to the records and there are things like the Federation drought and there was a drought in the forties. It is not as though it has not occurred in the past, but it has not occurred in my living memory and in the living memory of a lot of other farmers.

Mr RAMSEY—And it costs you half a million a throw now.

Ms Starick—Absolutely.

Mr SYMON—I have a question which goes to the seasonal forecast. At the moment, is the seasonal forecast that is issued in South Australia for the whole state or is it broken down into regions?

Ms Starick—It is issued for the whole state, from what I can understand.

Mr SYMON—Obviously South Australia is quite a large state and there are differences from east to west and north to south. If that long-range forecast was issued in regional parts of South Australia would it provide a greater level of confidence to farmers in those particular regions?

Ms Starick—It would have the potential to provide a greater level of confidence—people would feel that is was more tailored to what they need. It would also have the potential to provide information to natural resource management boards and other organisations that might be managing water, land or vegetation. It could also give those organisations a level of confidence to make better decisions.

Mr SYMON—If that were the case, that would then tie back into the amount of data collected and measured by various weather stations. As you said before, there are significant gaps in those in the state.

Ms Starick—Yes.

Mr SYMON—If you were to have the right number of automatic or manned weather stations in place, would it then take greater account of geographic differences and therefore provide not only more accurate measurement in the short term but, hopefully, be fed into the model for long-term forecasting so that seasonal forecasting may then reflect a local area with topographical differences?

Ms Starick—It would definitely have the potential to do that. At the moment the models that they use when they model where rainfall patterns have occurred do not necessarily take into account things like rain shadows—I guess those topographical differences and differences across a regional area. It is just a blanket line that cuts across without taking into consideration where some of those differences could actually be.

Mr SYMON—Just from a Melbourne example, I live on the rainy side of the hill and we get double the Melbourne rainfall. That is common. I am sure it happens everywhere else in the world as well—areas have their own climate when it comes to that.

Ms Starick—That is right.

Mr CHAMPION—Do you think, though, we could ever have enough weather stations to properly account for that? In my electorate you do not have to drive very far for it to vary pretty greatly. It is unlikely we are going to get down to the differences between Freeling and Sheoak Log, or Freeling and Balaclava. How many regions do you think we would need to give a local farmer some degree of confidence?

Ms Starick—I cannot answer how many additional weather stations we might need in South Australia.

Mr CHAMPION—How many regions are there in your opinion?

Ms Starick—Based on natural resource management boards we actually have eight regions in South Australia at the moment. Those regions are pretty big. People are making decisions more on a regional basis anyway. Eight regions would definitely be a good start.

Mr CHAMPION—So mapping the regional development boards?

Ms Starick—These regions up probably a little bit bigger than regional development boards.

Mr CHAMPION—Would you have them along those existing boundaries or would you draw up a new set of boundaries? I guess that is what I am trying to ascertain. This is a problem in regional Australia anyway, where there are a different set of boundaries for every set of decision making. They are trying to align boundaries now.

Ms Starick—Yes.

Mr CHAMPION—Would you do the same thing with the weather stations and that sort of thing, if you were going to put more in?

Ms Starick—You could. I guess the challenge would be the interface between adjoining regions. The challenge would be there. In South Australia our regions are being aligned. Our health, education, natural resource management boundaries are actually being aligned so that we do have more of a focus on regional communities with the same boundaries rather than having multiple boundaries, which just makes decision making even harder.

I do not know whether I have answered your question, and I am not quite sure what the answer might be. I guess to me it would really take some knowledge and skills within the Bureau of Meteorology to understand where the gaps in information are at the moment and where we actually need additional information. To me that would help focus attention on where we might need additional data points and even potentially asking organisations like the Farmers Federation, natural resource management boards and some of those other regional based groups that may be able to identify where some of the gaps currently are.

Mr CHAMPION—What about concentrating on high-value regions, because there are parts of the state which produce more than other parts? Are we better off, if we have a limited amount of resources, concentrating in areas like McLaren Vale or the Barossa Valley, or some of our high yield grain areas? Are we better off having more weather stations in those productive areas and less in the least productive areas of the state? Would that be another way of doing it—to get really accurate regional knowledge where the state produces more and less where it does not?

Ms Starick—I guess that is going to be very difficult—

Mr CHAMPION—It is problematic.

Ms Starick—Yes, absolutely, because, if anything, we actually do need better information in some of our more marginal areas of the state to better understand what is actually happening there for farmers to be making some really good decisions in those areas so that they are not going to go broke or out of business. We do need them to be there. They are not only producing food; they are also managing the natural resources that are in those areas at the same time. I am not sure I am unable to answer that question. It is something that would have to be balanced up.

My concern is that you do not want to end up with too many data points, because that could confuse the story. There has to be a balance in there, trying to fill in some of the gaps in the

knowledge that is not there at the moment but not overdoing it so we end up with too much information and too much data that we then do not know what to do with and that does not add value. That is the other thing: is it going to add value at the end of the day?

Mr RAMSEY—Something I said yesterday was that the bureau and CSIRO are relatively convinced that they have gone as far as they can with the statistical models and that the future of weather forecasting will be in the dynamic computer driven models. I tend to think that is right: having more data collection points probably is not going to tell us anything we do not already know, to be quite honest—as much as we know anything. The couple of things I have to say are probably more reflections than questions. You were talking about the faith in the models and why the bureau do not give us an indication of how correct they think the seasonal forecast might be. I would say that, in effect, they do. The current season forecast, as you are probably aware, is, I think, for a 55 per cent chance of drier than median rainfall. In effect, they are saying they are 55 per cent confident of being correct. I do not think there is any other reading you could put to it. A 55 per cent chance of being right is just about useless as far as making a decision on the ground is concerned, so, as far as their knowledge goes, the indications on the season are not strong enough to be of any value to farmers to make any kind of decision at all. Perhaps a stronger seasonal forecast—someone was talking about 2003, where they were 70 per cent confident of the outcome—is the kind of thing we should be making decisions on. But it would seem that that message is not well understood by farmers: the bureau are only 55 per cent confident of being right. It is just about a throw of the coin.

The other thing I wanted to reflect on was your comments about the mental stress on farmers upon receiving these bad seasonal reports. To back that up, this last prediction of a 55 per cent chance of less than median rainfall was accompanied by a heap of images on the television of farmers sifting dry-as-rock soil through their hands in front of drought stricken paddocks. That is the kind of thing where you say, 'Hell, we've got that to look forward to'—while it is pouring outside. You do wonder at the value of it. I do not know how we control the way that people tell a story, but I thought when that story came up, 'That is not adding any value to anything.' It does not inspire confidence; in fact, it properly leads to you making more conservative decisions than you would because that has just emerged as a downer on you. I know a farmer who probably lost his farm on the strength of seasonal forecasting when it was in its infancy, where he put great faith in it and did not sow a crop in an excellent season. He sowed virtually nothing and it was as good a year as we have never had, and he never really recovered from it. Therein are the warnings. As our confidence has fallen—that is what you are saying is happening and I concur with that—through the years we have had different forecasters come forward, focusing on different parts of the raw data and saying that they have the answer. For two, three or four seasons people get very enthusiastic about this new product, and then they have the one that is completely wrong and so completely lose faith in the system. Once burned, forever spurned. I know they were not questions, but, unless you really disagree, they are my collective thoughts.

Ms Starick—I would very much support those comments. The other comment that I would make is about the current forecast. Because it is still raining out there, adding to the soil moisture profile, people's confidence levels are starting to turn around. People actually have a bit more confidence in the season—and I hope it continues. But the season is not dependent solely on the amount of rain. It is when it falls and whether there is stored moisture in the soil. That has a really big impact.

CHAIR—Thank you very much for your evidence today. It was very informative. I also thank you for driving here. I understand it was bit of a hike. I hope it has been useful for you; it certainly has been for us.

Ms Starick—I appreciate the opportunity.

Proceedings suspended from 9.45 am to 10.07 am

POTTS, Mr Keith Alan, Private capacity

CHAIR—Welcome. Although the committee does not require you to give evidence under oath I should advise you that these hearings are formal proceedings of the parliament. Consequently, they warrant the same respect as proceedings of the House itself. It is customary to remind witnesses that giving false or misleading evidence is a serious matter and may be regarded as a contempt of parliament. Would you like to make a brief opening statement.

Mr Potts—I am a geophysicist with 20 years experience in technical and management positions in the international geophysical contracting industry. After retiring from full-time work I became interested in the cause of droughts in Australia in 2006 when the weather was obviously significantly different to that which I experienced in 1974 when I was marooned by rain and flooding in the Simpson Desert in Central Australia will an oil exploration crew. The cold fronts that provided a significant around to rain to southern Australia appeared to have moved 10 degrees of latitude south in 2006 compared to 1974. My experience in geophysics is that changes in this magnitude must have a cause. After a few months of investigation it became apparent that particulate plumes over Indonesia seemed to correlate with drought in southern Australia and, on 16 October, 2006, the *Australian* newspaper published my letter with this suggestion in it.

Through the good offices of Alexander Downer I met the Bureau of Meteorology in late 2006. They suggested that I should publish my work in a refereed journal and that I should talk to the CSIRO laboratory, which worked on particular research. I met CSIRO in December 2006 and an experiment was conducted on the CSIRO low-resolution climate model over the Christmas/New Year period. Later, I will return to the results of the experiment, which I provided to the committee in a supplementary submission. After extensive discussions with CSIRO management over several months in 2007, I was unable to persuade them to undertake any work on particulates and drought due to a stated lack of resources in finance, computing and personnel. I then continued to work alone at my own expense and I can now prove, using normal scientific methods, that droughts in south-eastern Australia are caused by anthropogenic and/or natural particulate plumes over south-eastern Asia. My research paper, which this committee accepted as an exhibit and which I am revising for submission for publication, contains this proof.

During this research I presented two papers on the subject at technical conferences in San Francisco and in Melbourne this year. A similar paper was also accepted at the Copenhagen scientific conference in March 2009 arranged as a scientific update before the Copenhagen meeting later this year.

In recent developments the US Climate Change Science Program, in reports 2.3 and 3.2, which I suggested this committee consult, stated that the IPCC focused on long-lived greenhouse

gases whereas their reports also include particulates and short-lived gases. I stress the following statements in their reports, which are included in my submission:

… by the year 2100 short-lived gases and particles may account for as much as 40 percent of the warming over the summertime continental United States.

… … …

It is noteworthy that the simulated climate response to these pollutants is not confined to the geographical area where they are released.

… … …

Changes in pollutant levels, primarily over Asia, may significantly increase surface temperature and reduce rainfall over the summertime continental United States.

I note that Australia is much closer to Asia than the USA and it is inconceivable that if Asian particulates are affecting the USA nearly half a world away they are not also affecting Australia.

My research paper demonstrates that continental-scale particulate plumes over South-East Asia cause drought in south-eastern Australia, El Nino and Indian Ocean dipole events simultaneously. I refer you to the output from the CSIRO experiment in the supplementary submission that I provided. Page 3, figure 1 shows the particulate plume introduced by the experiment. Page 4, figure 2 shows the changing winds, with a reduction just south of south-eastern Australia and an increase at latitude 50 to 55 degrees south—the Roaring Forties have in effect become the 'Roaring Fifties'; a 10 degree shift south, which is what I notice is the difference between 1974 and 2006—a reduction over the central Pacific Ocean, which will cause an increase in the sea surface temperature due to the reduction in wind speed, which is in fact an El Nino. Page 6, figure 4 shows rainfall and shows a decrease to the south of Australia where the wind speed is reduced.

My research also demonstrates that other continental-scale particulate plumes in Africa, the Middle East and eastern Asia have significant effect on the climate of the tropics and the higher latitudes, which can all be explained using the regional dimming model outlined in my research paper. The impact of the plumes is immediate; it does not occur in decades or centuries. A particulate plume over south-eastern Asia will cause a drought in south-eastern Australia in a few days—my estimate is two to three. It does this by altering the atmospheric circulation system, which is at the top of exhibit 2.

I note that the CSIRO and Bureau of Meteorology stated in their evidence on 18 May to this committee that:

… we are moving to these physically based models. They are extremely dependent upon the specification of the initial state for the outcome …

It is therefore even more important that the physics is correct, and that means including aerosols, which, to my understanding, are not currently included.

Secondly, they also stated:

Essentially what it is setting in place is a contraction of the westerly rainfall belt towards the poles. That is evident in both hemispheres.

That is exactly what I am saying is being driven by the aerosol plumes in the tropics and can be seen in the results of the CSIRO experiment.

Third, they stated:

We are still not really able to simulate El Nino properly. This is a common deficiency in most models. They do have an Election Nino, but its properties are not quite right. The warming in the ocean is not in the right place. That is still the No. 1 problem. Because El Nino and the Indian Ocean are the main drivers of climate, if you do not get that right the rest is difficult to get right.

That was a major discussion point at San Francisco and in Melbourne.

Fourth, they stated:

… we have such a variable climate …

It is an interesting question: why does Australia actually have a variable climate? Many other parts of the world do not; something has to be causing it. Until particulates are included, there is no explanation, and once they are included it all becomes obvious.

In conclusion I submit that the US Climate Change Science Program and the IPCC fourth assessment report both point to the importance of particulates on regional and global climates and on the hydrologic cycle, which is at the bottom of the front page of my document. Second, my research and the CSIRO experiment both point to the importance of particulate plumes over South-East Asia and drought in Australia. Finally, this committee should recommend that funding be available immediately to investigate the effects of particulate plumes over south-eastern Asia on the climate of Australia as the US Climate Change Science Program has done for the USA.

CHAIR—Can you give us a frank assessment of how accurate or inaccurate the models are that are currently being used for weather forecasting.

Mr Potts—The US Climate Change Science Program says that they may be inaccurate or even misleading if they do not include aerosols at the correct resolution.

CHAIR—Which they do not at the moment?

Mr Potts—They do not at the moment. My background is in the oil industry—and I have said this many times—and if the oil industry used models that are as bad as the climate models you would all be walking to Canberra because there would be no petrol and no aviation fuel.

CHAIR—The oil industry is obviously using other models that are—

Mr Potts—The oil industry does not use a climate model. We are talking now about models looking deep into the earth to find oil and gas. In the early days of these models, there were things missing from the models and they caused a significant number of dry holes to be drilled. Those were corrected quickly. I believe the climate models are currently in the same state as those models were.

CHAIR—Correct me if I am wrong but I sense an imputation that maybe our current authorities are not willing to make those corrections or, indeed, recognise them.

Mr Potts—There seems to be a reluctance in Australia. I have to say that there is a great deal of interest in the US—in NASA and in NOAA. NOAA is the US's bureau of meteorology, as you probably know. There is a great deal of interest in particulates, which I find strange given that Australia is actually just south of the largest emitter of natural aerosols or particulates in the world, being the volcanoes across Indonesia. Twenty per cent of the volcanic eruptions in the world occur in that region on about three per cent of the land surface area. Once you understand particulates and how they operate, it is immediately obvious why Australia has such a variable climate; it is to do with the volcanoes.

CHAIR—Why do you think there is a lack of interest?

Mr Potts—One of the issues has been that research in this region in this area—this industry if you like, which it now is—is basically done with computer models. The computer models do not have particulates or aerosols in them and therefore they cannot be researched because they cannot be modelled. It is as simple as that. There is not doubt that the models are getting better as computers get faster. Modelling particulates is much more difficult than modelling long-term greenhouse gases, which are well mixed across the whole atmosphere. As you can see in the papers that I gave you, the particulates are not, and they change constantly. Modelling them is much more difficult and therefore they have not been included. Where they are, their effects vary significantly between models.

The US Climate Change Science Program in one of its reports suggests that there is a variation in the sulphur aerosols of a factor of six between models. The variation in the effects of carbon dioxide are significant, and are basically taken by variations in the aerosol effects. The models have to replicate the 20th century, and they all do it differently. The sensitivity of the models to changes in CO2 is different. Therefore, there has to be a difference between the models in the aerosol effects to compensate for the difference in CO2. The US Climate Change Science Program says this explicitly in their reports. You only have to read the executive summaries at the beginning, which are easily readable.

CHAIR—We will come back to that.

Mr SYMON—I have a couple of questions. Have you put the papers that you presented to the conference up for peer review as well?

Mr Potts—I have put it to *Science*. They suggested that it should go to a more specific journal. I have nearly finished writing it for the *Journal of Geophysical Research*. I am hoping to send it off in the next two weeks.

Mr SYMON—Have they indicated that it will be published?

Mr Potts—No. You do not get any advance warning, and certainly none as a private person. If you were working in NOAA or NASA that might be possible, but not for somebody like me. But all I can do is keep trying. If it is not me, it will be somebody else, because the science, without question, is shifting. There is a huge interest and a huge amount of effort going into aerosols or particulates. NASA currently has the Terra satellite, the Aqua satellite, the army satellite and possibly the A-Train system flying around and part of what they do is look at aerosols. It is realised that they are significantly important in what is going on. If you look at the IPCC report and at its table that includes all the different elements of climate change, the two big ones are carbon dioxide and long lived greenhouse gases and aerosols. The level of scientific understanding is clearly low to medium for aerosols. The understanding of carbon dioxide is high. There is a huge amount of interest in the scientific community of North America in aerosols, because they realise that it is significant issue. Just as an example, recently there was a published paper that suggested that the major source of pollution in Montana in the US is China.

Mr SYMON—I have a follow-up question in relation to that. Are there areas in the Northern Hemisphere where aerosols in the atmosphere are having a similar effect on their weather?

Mr Potts—Yes. There are some quite good examples. The aerosol plume that came out of Nigeria in 2007 was gigantic. As part of my background, I worked in Nigeria in the oil industry. I sent an email out to the group that I used to work with asking if anyone was there who knew what happened. They said, 'Yes: MEND, which is the guerrilla organisation fighting for a bigger share of the oil revenues from the Niger Delta, is attacking the oil organisations.' I had a look at a newsletter yesterday. Thirty per cent of the headlines were about violence against the oil industry in Nigeria from January to July. This gigantic plume came out and it just happened to coincide with the warmest January on record in Europe. What caused the warmest January was a high pressure system over the Mediterranean that was far further north than it should have been at that time of year. As you can see on the top diagram, these systems move north and south as the sun moves north and south. In January, these systems should be well south and the high pressure system should be on the southern side of the Sahara Desert, not over the Mediterranean. Yet there was this high pressure. It was caused by the aerosol plume changing the atmospheric circulation system, as the IPCC says aerosols do and as the US Climate Change Science Program says that they do. Once you put that high pressure system in, with the winds going around clockwise in the Northern Hemisphere, it drags tropical air up into Europe and it makes it warmer. It pushes the cold Arctic air away. The paper, in fact, has some high level correlations—statistically significant—between the aerosol plume over West Africa and winter temperatures in Europe. There is a direct connection. And there are others.

Ms RISHWORTH—I have a couple of questions. You have alluded to some of the ways that it is difficult to get measures on these plumes because they disperse quite quickly. Obviously, they also occur around the world at different times. Do you have any suggestion on how one might be able to measure them? You have mentioned satellites, but there are not enough to constantly measure these things. Do you have any ideas about that? If you are correct, feeding this information into the modelling is essential if we are going to get accurate long-term forecasting.

Mr Potts—The Terra and Aqua satellites, the NASA satellites, provide daily data. It is a matter of setting up a system to acquire that data in a timely fashion so that you can see what is changing. My gut feeling would be that to get a really good luck at this and the effects of these aerosol plumes you need at least a monthly time resolution and you need a geographic resolution of probably five degrees maximum, preferably two. Most good climate models now are down at the two level, but they cannot model the particulates because of the computing power needed for this thing that is changing constantly. Although the individual particulates of the aerosol plumes are only there for a week or two, the particulate plumes tend to be there for a month or two or three. For example, you can see quite clearly that the West African plume starts in November each year, reaches its peak in February-March and then is killed by the wet season start in April. As soon as it rains, the particulates are washed out of the atmosphere and disappear. Each year, the particulate plumes exist for about the same time. It is question of how big they are each individual year. If anything happens, like MEND guerrilla activity, then in one month you can have a huge plume, especially in the dry season. In the wet season, it is not so bad.

Mr RAMSEY—As I said earlier, I have seen your presentation before in probably more detail. You met with the CSIRO and they have some information that they are not prepared for you to use publicly. Why do you think that the CSIRO are so resistant to this? You touched on the fact that they are.

Mr Potts—It was a quick and dirty experiment to see if there were any facts and if it was worth following up. My interpretation is that there is no question that it is worth following up. The CSIRO's view was that it would take so much effort to get this to a state where they believed that they could take it through their publication system that they were not willing to do it.

Mr RAMSEY—So really it is a matter of resources. They are saying that they have put all their eggs in one basket because they think it is the most likely and the others are too difficult.

Mr Potts—It was really: 'This is our plan and this is over here. It's not part of our plan—it's not funded—and therefore we can't do it.' That surprised me, I have to say. I would have thought that somebody who was intellectually curious would have seen that this is something that needs to be investigated, especially when NASA and NOAA are so interested in this in North America. It was a surprise. As I said in my opening remarks, this committee should demand nearly that the effects of particulates in Asia upon Australia are investigated and investigated rapidly. The work that I have done basically just looks at this South-East Asian plume. However, as you can see on the front page of this report, in October 2006 the South-East Asian plume coalesced with the East Asian plume. The effects of that could be significantly more disastrous for Australia. I cannot do it with just simple correlations. It needs a climate model to do this at the correct resolutions.

Dr JENSEN—I have a few questions. The thing that concerns me in regards to what you are saying about the CSIRO is that it reminds me of a quote by Upton Sinclair in a book he wrote in 1934 called *I, Candidate For Governor: And How I Got Licked*. He said: 'It is very hard to get a man to understand something when his salary depends on his not understanding it.' The point here is that the funding for so much of the work done in atmospheric physics in particular is related to carbon dioxide that they are loathe to look at any other factors. I would like your comment on that.

Mr Potts—There is no doubt that it is an issue, I believe. Professor Stephen Schneider, from Stanford University in the US, who was an Adelaide Thinker in Residence, said that when he started in the 1970s there were probably 10 to 100 scientists worldwide researching climate change; I think he said there are now 100,000. Something like US$11 billion a year goes into climate change research. If you are a scientific manager, there is obviously a need to keep that river of gold flowing. Therefore, having created this sense that carbon dioxide is the prime culprit, you have to tailor the programs you are going to establish and put up to the people who provide the money—the parliament and the government—that they are actually researching the area that is of greatest concern to your constituents, which currently is carbon dioxide. It is an issue. There are people and there is money going into particulates; I would not want you to get the wrong impression—but the significant amount of money is being spent in the US, not in Australia, and I think that should be redressed.

Dr JENSEN—How much resistance do you find at particularly the management level in terms of making data available and investigating different things? I am thinking about Phil Jones at the Hadley Centre, who is head of their repository of climate data, who in a letter to Hans von Storch said: 'We have 25 years invested in the work; why should I make the data available to you when your aim is to try to find something wrong with it?' Do you think that there is a similar sort of philosophy with CSIRO?

Mr Potts—CSIRO does not actually own the data that I would look up, the raw data. That is the Bureau of Meteorology.

Dr JENSEN—So it is the model—

Mr Potts—In terms of the data and data access, the bureau is the only place where I have had to pay for the data, for the climate data for Australia. The best example that I have of ease of access is actually NASA. When I started this three years ago, the way to access this data—which I could not possibly do—was to download files which were about 250 megabytes for each day and then break open those files and process them using some software that may have come from NASA or from somewhere else. What NASA then set up was a system called Giovanni to distribute the geophysical information that they are derived from the satellite data. These images and the data that I have used for all of the aerosols and particulates come from Giovanni.

Giovanni is a system that you can go to and select which parameters you want—so I would look at aerosols. You can select the area of the earth you want to look at or the whole earth. You can look at it as an image, you can look at it as Mollier diagrams in all sorts of ways or you can look at in a time series. Once you have selected all this, you ask NASA to process it, and in about a minute you are looking at the results—and it is free. That would be the gold standard of access to data. Hiding the data is seriously bad science, I believe, and publicly funded institutions should in fact be making data more easily available. If that is in fact what the Hadley Centre say, I find that outrageous.

Dr JENSEN—It is a significant concern, because another example is Dr Michael Mann, an IPCC lead author, who came up with the hockey stick—you know, that chart straight line and then rapid upturn?

Mr Potts—Yes.

Dr JENSEN—In fact, there were significant problems found with that, but it took the US congress to get him to actually release his code that he used to generate that graph. This seems to be a problem in not only Australia but other nations as well. I am just highlighting that as a significant concern and I think it is something, certainly in the Australian context, that we need to address.

Mr Potts—It is certainly a human issue, in that if you have spent your life researching this it is actually quite difficult when someone comes from outside your industry and says, 'Well, there's actually something else that's equally, maybe more, important that you should be looking at.'

Dr JENSEN—Yes, they have invested significant proportions of their lives; it is not just about money.

Mr Potts—And there is a significant personal issue for some of the senior managers in the research industry around this topic.

Dr JENSEN—Another question I have—and this is getting off the CSIRO issue. You were talking about huge plumes in Nigeria, obviously spreading westward, causing major problems with European climate. Have you looked at the effects of the plume that resulted from Desert Storm ?

Mr Potts—If you look at the nimbus 7 data for June 1991—I am not sure whether I have put it in any of these papers—you see that June 1991 is interesting because two things were happening. One was that the oil fields in Kuwait were on fire and if you look at the aerosol plume in terms of just visible images you can see it quite clearly coming down the Persian Gulf on the western side. Looking at the aerosols, it comes down and then does a sharp right hand and heads out to cross the Sahara. At the same time in June, Pinatubo erupted—the second biggest eruption of the 20th century. Of the two, the Kuwaiti oil fields stand out in black and red and Pinatubo fades. It is a good example and I use it in my presentations to demonstrate the problems of averaging aerosols. If you average over a month a big eruption like Pinatubo it basically averages away and you do not see the effect that you would get in those few days around the eruption, whereas the Kuwaiti oil fields on fire are gigantic and stand out because they are there the whole time. It was that image that told me to look at Darfur and see if the drought in Darfur had anything to do with the aerosols coming out of the oil industry in the Middle East, and I suspect they did. I used to fly backwards and forwards to England a lot in the 1970s and the Middle East was alight at night with gas flares from oil production. The aerosols from that go straight across the Sahara. The paper has a section on Darfur and demonstrates that with the rainfall in Darfur in July and August, the high rainfall months, as the systems move north they suck in moist air from the Indian Ocean. The systems are affected by the aerosols so the systems cannot move so far north, so it does not rain. It is quite simple, once you get to the aerosols.

Dr JENSEN—From my perspective—I was previously a research scientist—I find what you say in your research very interesting and certainly in my view it should be pursued further. I would certainly be looking at having resources made available to further this research.

Mr Potts—Thank you.

Mr CHAMPION—Given that south-eastern Australia has been in drought for probably 10 years, some would argue, certainly for South Australia it has been the best part of seven years, do you have an explanation on the particulates coming out of South East Asia which would explain the drought?

Mr Potts—Yes, I do have a very good explanation, if you look on page 2 of the sheets I gave you and if you look on page 28 with the graph at the top of the first exhibit. On the basis of what I have been saying, if it is particulates that are causing our problems in terms of drought, you would expect a serious increase in particulates over the last 10 years. As I said in my submission, one of the interesting things I am involved in currently is angel investing and I am chairman of one of the companies that the group I belong to has invested in—pristine forest technologies. We produce new plant varieties for broadacre agricultural—lucerne, medic and balsana.

The medics and balansa are annuals. They flower in spring and are harvested typically in November and December. If there is a drought in spring, they are decimated. Last year, for example, we contracted Keith Seeds to do the seed multiplication and then sell the seed. In the last few years there has been a serious spring drought in south-eastern Australia. We expected to harvest 200 tonnes of one particular variety of balansa and we got 20 last year. It was similar for the medics and the other balansas. The spring rainfall is directly affecting my personal investments.

If you look at the graph, you can see that quite clearly in October 2002, 2004 and 2006 there are gigantic aerosol plumes coming out of rainforest destruction in South-East Asia, specifically Indonesia. Millions of hectares in these three episodes were destroyed. One of the interesting issues to pursue broadly is you cannot burn down a million hectares of rainforest without some planning and some organisation. An individual just could not do one hectare probably, so there has been a significant plan to do this. This has a detrimental effect on our spring rainfall very specifically, because they occur from August to November. They finish in November when the Indonesian wet season starts and they kill our spring rain. I can explain how they do it. That is the spring rainfall.

The volcanic eruptions are even more interesting. The two graphs on the second page are basically the same. They just show the data slightly differently because some eruptions do not have a start date—they have a start year but no start month or day. The vast majority of them do. The top graph ignores all the eruptions that have no start month and in the bottom graph those have been randomised and some do appear. It is basically the same data. If we look at the top, the blue bars are the number of eruptions and the green low bars at the same level are the average eruption per decade over the 20th century. You can see the green is at about 40 eruptions. The blue bar in the decade of the 2000s is actually at 75. That is only dated to the end of 2008, so there is 2009 to add to that. Basically, there have been twice as many eruptions of volcanoes in South-East Asia in the last decade, which indicates there is a lot more tectonic activity going on to the north. The earthquake that caused the Boxing Day tsunami is another example of this seriously big increase in tectonic activity to the north of us.

Let us look at the volume of tephra. Tephra is the particulates that come out. Everything you see in that image going up is tephra. It can be boulders the size of houses down to submicron sized particles. The volume of tephra has actually trebled because there are bigger eruptions happening. You would expect—and this information comes from the Smithsonian database—a

higher level of tephra coming out from the high level of eruptions. I sent an email to Lee Siebert, who is the Director of the Global Volcanism Program run out of the Smithsonian, and said: 'This is the case. How long would you expect it to last? There has been a significant increase compared to the previous century.' The answer is that we do not know. That is one of the problems with volcanic aerosols and with forecasting in Australia. You would have to instrument every volcano to know if it is going to erupt. It could be done for sure in the same way that we have automatic weather stations. You could probably do the same thing with volcanoes. It would require a significant amount of effort but to be able to forecast the volcanic activity reasonably well in an area that affects us extremely badly—just with wheat and barley we are talking about billions of dollars being lost in the drought—may be worth contemplating.

Mr RAMSEY—So you are saying that in the last decade there has been a big increase in these volcanic particulates and then in the years 2002, 2004 and 2006 it has been amplified again by large forest burn off?

Mr Potts—Yes. The other issue that is significant across all the tropics—in South America, Africa and Asia—is the big increase in populations. UN statistics show that, since 1950 to 2007, the population of South America trebled, the population of Asia has trebled and the population of Africa has quadrupled. The way agriculture works in the tropics is slash-and-burn agriculture. Some of the plants that grow naturally are legume type plants that absorb nitrogen from the atmosphere and put nitrogen into the ground. If you chop the natural vegetation down and plant a food crop, that food crop takes the nitrogen from the biological decay of those plants, but once you have done that for a year or two—as you would understand with a farming background—the nitrogen is gone. You cannot actually afford to put nitrogen on from the bang, so therefore you move to the next area, you chop that down and burn it. There is a significant level of burning across the tropics every year. In fact, NASA flies satellites to look out for fire in the tropics. That is available on the intranet as well. That is the other issue that has happened over the decades. Over the long term, the significant increase in the populations results in the significant increase in the level of smoke from biomass burning; also from natural activity, using bio fuels as the fuel source in domestic activity. There are several reasons that this decade is worse—one is long term, but these volcanic eruptions and the burning down of the rainforest are—

Mr RAMSEY—Just to go one year further in your graph—the spring rains were a pretty spectacular failure last year through south-eastern Australia. Do you have any information on that at this stage?

Mr Potts—I am afraid not. I am one person and I do lots of things as well as this. It would be nice to have a group actually looking at all of this stuff in terms of particulates. I looked at the so-called South-East Asian plume area, from 90 east to 160 east; 10 south to 10 north. It is easy to demonstrate. That is the area just over Indonesia and Papua New Guinea. I put the diagram in the submission. It beggars belief that the area that actually affects Australia is exactly that, but that is the area where the volcanoes are. There needs to be a lot more work. The Bureau of Meteorology says on its website that the sea surface temperature just to the north and north-west of Australia has a significant effect on rain in south-eastern Australia, because that is one of the major sources. A lot more work needs to be done on this and—I hate to say this—it needs to be done in a climate model properly set up with particulates and our results.

Mr RAMSEY—This is probably taking you a step further than you have been, but my understanding is that for the last, I think, 11 years we have had a region of cold water against the North West Shelf of Australia. Would you put the proposition that that has actually been caused by the air currents being caused by the plume, or not?

Mr Potts—If you look at the plume, it is not a very big image. You can see that the plume actually comes down over that area. If you look at the bottom image you will see that, when we are talking about to rain, it starts with the sun hitting the ocean, heating the ocean and the water evaporating. If you put an aerosol plume over the top of that, you reduce the amount of solar radiation and you automatically have to reduce the amount of evaporation that happens. That is done without changing the wind systems, because you have altered the atmospheric circulation system.

On the issue of wind systems: think about two consecutive days in summer in Adelaide. On day one it is over 40 degrees; on day two it is under 30 degrees. The sun is basically in the same position in the heavens; that has not changed. The only thing that has changed is the wind. When it is hot the wind comes from the north; when it is cool it comes from the south. If you can change the atmospheric circulation system, which implies you have changed the wind systems, you can change the climate in a day, as our example demonstrates. That is what this plume does. It shifts the circulation system and therefore you get a change in the wind. If you change the surface wind you change the climate immediately. You can see that quite clearly on some of the Noah data in the middle of Pacific where they have had moored buoys for a long time now. As the wind speed changes so the sea surface temperature changes, and it happens immediately. High wind speed means low sea surface temperature; low wind speed means the reverse.

Ms RISHWORTH—We are looking at developed countries where the biggest plumes are because of the way they are doing business. In advanced economies plumes that are identifiable maybe on a smaller scale but could also be having some effect?

Mr Potts—For the plumes to have the effects that I am talking about, they have to be continental in scale—and by continental I mean the size of Australia. Now and again you do see large plumes coming over the eastern US in July. I am not quite sure what the cause of them is. It is not like that every year, I believe. It also is not in the tropics. Because the circulation system moves north and south and is driven by the sun, which only moves between the tropics, the plume fundamentally has to be in the tropics to get a major effect. If it is outside the tropics you may well get an effect if the sun is close to that side of the tropics like, for example, as I mentioned in the paper, the plume coming out of East Asia and China actually has an effect on the Arctic ice. That is in the summer when the sun is far north at 20 to 23 degrees north and the plume is between 30 and 40 degrees north. That is possible to generate, again, a change in the atmospheric circulation.

CHAIR—Thank you for your submission. It has been very interesting. We certainly look forward to you pursuing this and we may raise some questions too with CSIRO on your behalf. You are putting forward a case that I believe needs to be explored, so you can be certain that we will be doing that. Can I have a member of the committee move to accept this document as an exhibit?

Mr RAMSEY—Yes; I so move.

Dr JENSEN—I second that.

CHAIR—Thank you.

[10.53 am]

CARPENTER, Mr Geoffrey Walter, Private capacity

CHAIR—Welcome. Although the committee does not require you to give evidence under oath, I should advise you that these hearings are formal proceedings of the parliament. Consequently they warrant the same respect as proceedings of the House itself. It is customary to remind witnesses that giving false or misleading evidence is a serious matter and may be regarded as a contempt of parliament. We thank you for your submission and now invite you to make a brief opening statement before we proceed to questions.

Mr Carpenter—Thank you for giving me the opportunity to share my fire weather experienced with you today. I would like to cover the topics of marine and automatic weather station, or AWS, observations, trend type forecast and the provision of improved weather charts. In the mid-1970s I was employed by the Bureau of Meteorology as a full-time trainee observer, where I received significant training in meteorology. Following the 12 months of training, I worked at seven different offices, including the Tamworth met office, where I finetuned many of the skills I use today. In 1983 I transferred to another Commonwealth department as a safety officer but maintained a strong interest in the weather and forecasting.

In February 2001, when going fishing in the Lincoln National Park, a friend and I drove past a fire adjacent to Tulka. It was not very wide; however, it extended parallel to the township of Tulka. At the entrance to the park, I became aware that when the wind changed to the south-west we would be trapped in the park and decided it was too risky to continue. Passing Tulka on the way home, I said to my friend, 'Have a good look at Tulka because it won't be there tomorrow.' As predicted, the wind changed. Unfortunately, another friend was on the eastern flank of the fire, in the Tumby Bay CFS fire truck. His truck plus other vehicles became engulfed in fire when the wind direction changed, putting them directly in the path of the fire. They all escaped unharmed.

With local knowledge, combined with experience gained in the bureau, I knew that wind changes could be more accurately predicted using Port Lincoln's fishing resources. As a consequence I approached the CFS and was welcomed into the region 6 communications group. I have been a volunteer with the CFS in the operations centre since mid-2001. Marine observations were desperately needed to improve the accuracy of the synoptic charts, as there were very few observations, if any, from boats out in the Great Australian Bight. As ocean areas of synoptic charts are produced from satellite information, often without the benefit of marine observations to improve their accuracy, it was decided I would establish a register of vessels capable of providing wind speed and direction observations during fire weather events. In the bight during the fire season, there are often local tuna boats either towing cages or fishing. With the assistance of the Tuna Boat Owners Association, we obtained the satellite phone numbers of the entire fleet. The tuna fleet have been very supportive, with Blaslov's even offering the use of their aircraft in times of emergency.

Over the years, the rock lobster, shark, leatherjacket and trawling fleets have also agreed to assist the CFS in wildfire emergencies by adding their phone numbers to our register, now

totalling some 100 fishing vessels. To save valuable time and streamline the process, it was agreed I would initially contact the shore managers, who would advise me of the locations of their fleets—and they often knew where other boats were in the bight. The skippers of the boats in the bight are very experienced in weather patterns and conditions, as their lives depend on that knowledge. The information I required from the vessels was the time and position of recent wind changes or their current conditions and positions, plus for them to contact me when the wind direction changed. This information would be immediately relayed to forecasters in Adelaide and, recently, to Melbourne.

During the process of setting up the register, I was advised that during the Tulka fire the skipper of the *Dageraad* had attempted to warn the CFS of a significant wind change that he had just experienced off Elliston. The first time any shore manager was contacted was on Black Tuesday 2005, immediately after the fire jumped containment lines. The most important observation that day came from Richard Leech, who was the skipper of a rock lobster boat at Flinders Island, some 40 kilometres west of Elliston. One of the tuna boat skippers out in the bight gave me Richard's phone number. Richard phoned me when the wind changed and that observation was passed on to the bureau. I requested an update of the forecast at that time, but the forecaster needed time to check his charts. Unfortunately, before an amended forecast was issued, two firefighters, Neil Richardson and Trent Murnane, were engulfed in fire when the wind changed and perished.

In hindsight, if I had insisted and waited for an updated forecast on Black Tuesday, or there had been an automatic weather station on Flinders Island, there may have been a different outcome. We now know that, with some weather patterns, there is a window of opportunity of about 20 minutes before the wind change reaches the mainland from Flinders Island. Using a wind change observation from Flinders Island some months after Black Tuesday for the Lake Malata fire, an amended verbal forecast predicted the wind change at the fire front to within one minute. The lack of real-time information from our western observation site at Coles Point or the ability to phone that automatic weather station, as with airport AWSs, for real-time observations continues to put firefighters' lives at stake. The bureau's aviation site transmits AWS data in code without any delay. However, firefighters are forced to wait between eight minutes and one hour seven minutes for the same data that the bureau transmits on its aviation site.

We all know that our volunteer fire-fighters work in dangerous situations. Restricting their access to the best available weather information for bureaucratic purposes is something that this committee should look into. Updating AWS without delay whenever the wind direction changes by more than 20 degrees or when the speed changes by more than 15 kilometres per hour should in most situations give fire controllers time to warn or relocated fire-fighters.

Flinders Island is now the most critical observation location for fires in the lower Eyre peninsula. Unfortunately, it is not manned 24-seven. Despite many requests for an automatic weather station on the island, nothing has eventuated. Since the Tulka fire, there has only been one additional AWS set up in the lower Eyre peninsula, and that was paid for by the Cummins Community Bank and Rotary International. The Cummins AWS has been of great benefit to forecasters, but is of little use for wind change warnings. It is not the role of communities or charities to provide this infrastructure, especially at time when the bureau's Docklands office fit out exceeded estimates by tens of millions of dollars.

AWS locations throughout Australia need to be reviewed to ensure that they are suitably located for fire weather purposes. Coles Point is the only AWS on the lower Eyre peninsula capable of providing early warning of wind changes but it needs to be relocated to a more suitable site. I believe that there should be an AWS installed on Flinders Island and that the Coles Point AWS should be relocated to the south-west of Point Sir Isaac to address the needs of the lower Eyre peninsula. Deploying and setting up portable AWSs is not a viable option, as they take too long to set up.

The Adelaide Bureau of Meteorology puts out excellent fire danger forecasts prior to the issue of total fire bans and provided comprehensive briefings for the emergency services on a regular basis. George Mueller's weather central 1,500 metre prognostic chart, a sample of which is on page 14 of the book that I have provided, has been found to be very accurate at predicting very hot and dry days up to six days in advance. I find it very useful for my planning purposes.

Bearing in mind that on most occasions wild fires often occur without warning, it takes time to organise forecasts—time that we do not have to spare, especially if there is an imminent wind change. One of the most useful charts available, located on the Australian Weather News web site, is the hourly updated streamline chart. Laurier Williams is an amateur weather watcher who uses Bureau of Meteorology data to produce the Australian Weather News charts—not just pressure charts, but hourly temperature, wind, streamline and other local charts, such as those for Adelaide and Melbourne, as per the samples that I have provided to you.

If a wild fire commences at 11 am, the latest bureau synoptic chart is the three am chart, similar to the one on the cover page of the sample book of charts. Pages two to 10 are samples of Laurier Williams consecutive hourly wind streamline charts and pages 10 to 13 are samples of mean sea level pressure charts, with isobars every one hectapascal. But they do not have fronts or trough lines indicated. If the bureau's web site contained similar charts to those produced by Laurier Williams and there is no reason why they could not be produced half hourly, it would make the CFS's role easier—plus, the general public would be kept more informed.

I also believe that there should be the provision for computer input of additional observations, such as those from the various fishing boats, in times of emergencies and that the bureau should manage an Australian contact register similar to that established for the Port Lincoln fleet. Because of the time delays for paperwork to go through the system—and there are valid reasons for these delays—it can take up to one hour or more to receive a fire forecast. This process must be streamlined to reduce delays.

When paged by the CFS during a fire, I initially decode the nearest terminal aviation forecast, as they are regularly updated and comply with various criteria. This option is not available to other CFS regions as they do not have the ability to decode these forecasts. From my observations, forecasters and fire-fighters do not have an appreciation for each other's requirements or safety needs. I believe that urgent training is needed to rectify this problem. I must point out at this time that I have been in the operations sections of both the bureau and the CFS during wild fire incidents and every single officer involved in both of those agencies can only be described as completely dedicated to their role. They just lack a few tools.

Initially forecasts for going wild fires are good. However, I have noted that the forecasts appear to be updated on a time basis and not on a weather criteria basis. Our fire-fighters' lives

are in their hands, particularly when it comes to wind changes, and that includes local effects such as sea breezes. This is a major problem that I believe should be urgently addressed to ensure that updates are issued on weather criteria whenever the conditions change. Farm based fire-fighting units do not have the benefit of any fire specific forecasts and the general public affected by wild fires do not have access to fire specific forecasts.

We rely more and more on technology. However, when the fire causes power failures or computer systems to crash, there must be back up provisions. Battery radio is our only option. In the case of the Black Tuesday fire, our local ABC radio station was not manned; nor was back up power available to keep the transmitters working after the power supply failed.

The concept of trend type forecast is not used, as the bureau has been issuing these accurate short-term forecasts at major airports for over 20 years. There is no valid reason why the bureau is unable to issue accurate annually trend type forecasts to the relevant fire authorities for going fires. The trigger for the BOM to issue trend type forecasts should be determined by set criteria—for example, the size or the severity of the fire. To minimise transmission time for trend type forecasts, the bureau must establish real time links to the relevant fire authorities. Relevant fire authorities should have dedicated media liaison officers responsible for forwarding those trend type forecasts—vetted if necessary—to ensure the safety of those in the path of the fire. The transmission of fire information and fire specific forecasts must be given priority over other radio programs.

To summarise, I believe that that should be a review of the automatic weather stations for fire management purposes. There should be no delay in updating automatic weather station data on the internet. The bureau should produce charts similar to those of Laurier Williams and make them available to everybody on their web site. Fire weather forecasters should receive specialised training so that they appreciate the dangers faced by fire-fighters and fire-fighters should be trained in weather observation and its importance to forecasters. Finally, trend type forecasts should be issued for major fires and relayed to the general public through the relevant fire authority.

CHAIR—That was a very comprehensive presentation. Thank you very much. I have one question that kept coming to mind as you went through all that. Why is it that the bureau does not provide the sorts of information that you have identified as being necessary and that others are doing?

Mr Carpenter—I have approached the bureau through Barry Wakelin to get an automatic weather station on Flinders Island without any success. They said that they did not have any money for it. I have not discussed the relocation of the Coles Point station and nor have I discussed the trend type forecasts. I have thought about those for a while, but have not brought them up with the bureau. I have developed this over some years. We have been circumventing the bureau. These wind streamline charts have been very useful. We are not supposed to use them, because of liability. But to give you some idea of what is going on, if you walk in and there is a fire going and you have not got any forecast and that is the only option you have, they give you and idea of what is going on.

CHAIR—You have identified areas that can be best described as having serious shortcomings in terms of the provision of data to people like you and others who are at the coalface and have

to deal with extremities. The suggestion is that the bureau does not make charts and other material available that is needed immediately. Why is that the case? How open is the bureau to suggestions from others who are not directly employed by the bureau?

Mr Carpenter—I believe the answer is money. It costs money to do these bits and pieces. That is one of the prime things. To some extent, the forecasters are not really that aware of the dangers faced by people on the eastern front of fires.

Mr RAMSEY—Thank you for coming in. You contacted me before this inquiry. While it is not particularly about long-term weather forecasting, in the light of many areas we have gone to it is very relevant. You have first-hand experience. I was very taken with the maps when you showed me. As a CFS volunteer, when you get that type of map put in front of what are basically amateurs, when we are out there running a fire, I found so much extra information. It is so easy to read. I think it is important that the committee sees that today. The question we will ask of the bureau is: why can't you produce maps like this on an ongoing basis throughout the day? I think that would be a great help. That is more a comment than anything. Thank you for coming in to show us.

Mr Carpenter—I would agree with that.

Dr JENSEN—I can read synoptic charts, but that is far easier to assimilate. I was a volunteer with the CFA when I was in Victoria for a while, and that would be far easier in order to quickly see what is happening. The other aspect is that you were talking about the issue when the tuna boat had notified the Bureau of Meteorology of a wind shift 20 minutes prior to it making landfall. Is it your view that the weather bureau did not put that out because they wanted to ensure that they had perfect information rather than timely information?

Mr Carpenter—I will clarify. The first time they attempted to get to the bureau, they could not get the information through. That is why it was not brought to anyone's attention. It was only some years later that I found out about that. When Richard Leech, who was on the rock lobster boat off Elliston, rang me and told me about the change, that was relayed through to the bureau straightaway. You have to understand that on the Black Tuesday fire day it was peaceful and quiet and then you went into a war situation—everybody was flat out and the meteorologists at that stage were flat out. They tried to work out where Flinders Island. I think the transmission time was the delay.

Dr JENSEN—Do not get me wrong; I am not casting any aspersions on the bureau. The bureau would obviously have concerns about potential litigation further down the track and would want to make sure that the information that they get is the best information that they could possibly give. My concern—and it is something that the bureau and, indeed, maybe parliament need to think about—is about drawing the line and basically having a situation where, in a litigation type scenario, you are covering yourself and comparing that with having the information that may not be perfect but timely. This is something we will have to make some hard decisions on.

Mr Carpenter—I would agree. Having worked in the bureau for years and answered phones there many times, people give you some information that you doubt and there is information from others, like tuna boat skippers, who are in the middle of the bight giving you an exact

position and saying, 'The wind has just gone round at this time.' I believe that is to be listened to. I believe that is very vital information. On the point of litigation, I am not too certain how that goes. It would have to be up to the bureau to comment on that. I was providing them with observations for Port Lincoln after the Black Tuesday fires because the automatic weather station at the Port Lincoln airport was virtually destroyed—the wiring to it was destroyed. I have been doing it for a long time and they knew they could trust my observations. I am not certain about the litigation. I am certain that, if they can get this information from the skippers and compare it with their satellite pictures, providing there is cloud around the wind change, then they support each other.

Ms RISHWORTH—I imagine that there are a lot amateur weather watchers who would ring into the bureau with their views. How does someone quickly sort out that information from the bureau to actually know what to rely on and what not to? If one fishing boat calls in then that is one lot of information, but if you have got a lot of people calling in, it takes time to sift through that and work out what is reliable and what is not. If you do start, as Dennis suggested, relying on some of that timely information, how would you be able to sort it through in a way that does not take extra time, because time is of the essence?

Mr Carpenter—Many years ago the bureau set up a storm watchers log where to ask people to report in certain things they have seen—various types of clouds, for instance. But I guess you have to play it by ear. When I was in Sydney some guy used to ring up regularly and scream and shout at us, and you could not take him for granted. But, yes, you tend to work out very quickly what is going on. Being in the bureau, you have generally got the charts in front of you and you can actually look at them and decide whether something is right or not right.

Ms RISHWORTH—In terms of the automated weather stations, apart from whether they are damaged in a fire, can you see any reason why that information cannot go fairly quickly to the CFS?

Mr Carpenter—The aviation sites like Port Lincoln go directly to an aviation site and when there is a wind change and that comes up on the aviation site virtually instantaneously, but it is in code. The other one is open to the general public, and for the Port Lincoln's observation to get onto the other one it could take up to eight minutes or up to an hour and seven minutes depending on which automatic weather station it is and where it is located. The aviation ones have generally got the ability where you can actually ring up the station and it will give you a wind direction speed and, I think, cloud heights as well for some of them. So you can call in. But we do not the facility at Coles Point to ring that one up.

In the last fire season we were watching Ceduna and as the wind started to move from the north slowly around and started dropping off, I kept ringing up their AWS and so we were able to pick up exactly when the wind change got to Ceduna within a minute or so. That would have come up sooner on the aviation site but on the other sites it would have taken some time to get there.

Ms RISHWORTH—And that is personnel resourcing and decoding it or—

Mr Carpenter—No, I think it is just the computer program they are using. I think that the computer program could be amended so it spits it out straightaway.

Mr SYMON—I know that some of the AWSs these days are Doppler-equipped as well for wind measurement. There are not many though, as I understand it.

Mr Carpenter—I could not answer you on that.

Mr SYMON—I think there is one in Adelaide now, but they are few and far between, as I understand it.

Mr Carpenter—I think there is a Doppler radar in Adelaide.

Mr SYMON—Yes.

Mr Carpenter—Okay, that is great, and in fact in a recent fire I was actually watching that radar site. You can track the wind change coming up the gulf and you can see the idiosyncrasies, because that actually shows you what winds are moving towards the Doppler radar and what winds are moving away.

Mr SYMON—So if there were more sites like that—

Mr Carpenter—Yes, but they become very expensive. Adelaide has got one and there is one in Yarrawonga. I cannot say where the others are for certain. If we had one in Port Lincoln or off Coffin Bay, that would be beneficial. But the costs I think are pretty enormous; they are not a cheap item. And then you have got all the expenses of people servicing them all the time for minor technical problems.

Mr SYMON—But in terms of providing near real-time information, is that better than the existing standard weather station?

Mr Carpenter—Yes, it is much better to have a Doppler radar on the Eyre Peninsula or somewhere where you can actually see the fronts coming through or the wind changes coming through.

CHAIR—There being no other questions, I would like to thank you, Geoff, for your evidence today. I am sure we have all found it fairly insightful. Thank you very much.

Is it the wish of the committee that the exhibit be accepted by the committee? Moved by Ms Rishworth, seconded by Mr Ramsey. Motion carried.

Resolved (on motion by **Mr Symon**, seconded by **Dr Jensen)**:

That the committee authorise publication of the transcript of the evidence given before it at this public hearing.

Committee adjourned at 11.21 am