

**NOTES OF  
PROGRESS MEETING 4: EXPERT PANEL ON NATURAL HAZARDS – Meteorological  
and Coastal Flood Hazards Sub-Panel**

**DATE:** Monday 20 May 2019

**VENUE:** ONR, Redgrave Court, Merton Road, Bootle, UK

**OBJECTIVES**

- Share knowledge on recent advances in climate science including UKCP18
- Update the group on current ONR assessment work regarding Meteorological and Coastal Flood hazards
- Discuss on-going ONR and panel research project collaboration and develop ways forward

**ATTENDEES:**

[REDACTED]

**Actions**

No	ACTION	Responsible
1/4	Engage with EA re their National Strategy consultation.	[REDACTED]
2/4	Set up regular phone calls to improve communications between the EA and ONR - frequency to be discussed.	[REDACTED]
3/4	Send two reference papers to [REDACTED] for [REDACTED] to provide comments.	[REDACTED]
4/4	Send papers to [REDACTED] that are related to [REDACTED] research work on heat waves.	[REDACTED]
5/4	Present the current ONR expectations for beyond design basis resilience against External Hazards at the next Panel meeting.	[REDACTED]

6/4	Check if the Lead Local Flood Authority is a statutory consultee.	█
7/4	Obtain Met Office hourly data and pass to █ for █ research work.	█
8/4	Circulate a draft scope for the research topic on "Investigation of weather data trends and the effect on Extreme Value Analysis".	█
9/4	Add to and advise on the best way to deliver the research on Extreme Value Analysis - possibly through an Expert Panel Paper.	██████████
10/4	Develop a methodology to access the NERC research portal.	██████
11/4	Discuss internally the best way to proceed with research topic RRR-079.	█
12/4	Present and publish work on Heat waves and their Relevance to the Safety of Nuclear Plant.	██████
13/4	Keep a watching brief on the release of new information in relation to UKCP18 and take forward any issues related to nuclear.	██████
14/4	Map out the projected work anticipated for the Panel over the next 9 months and re-distribute funds accordingly.	██████
15/4	Consider updating the Met and Coastal Flood Hazards Expert Panel papers.	█
16/4	Send lightning research and any related questions to █.	█

The agenda is included as an appendix. PowerPoint (ppt) presentations can be found at 2019/145101.

## 1. Introduction

█ welcomed everyone to the meeting and, in particular, █ thanked █ from the Environment Agency for attending. █ invited introductions around the table and reminded everyone that this was a meeting of the Meteorological and Coastal Flood hazards sub-panel, which, together with the Seismic Hazard sub-panel forms the basis of ONR's Expert Panel on Natural Hazards. █ emphasised that everything that is discussed at the meeting together with the presentations are subject to FOIs and advised everyone to treat everything they write or present as if it will be released. █ added that ONR had received a number of FOI requests recently, and these will be discussed later. █ further emphasised that the work conducted by the Expert Panel is used by ONR to apply the SAP and TAG guidelines and this allows the Panel to remain independent.

For the meeting, █ summarised the agenda (see appendix to these notes), reported we had a challenging schedule, and asked the speakers to keep to time.

## 2. UKCP18

█ invited █ and █ to deliver their presentation on the comparison between UKCP09 and UKCP18. They gave a history of UK climate projections, highlighted the

key differences between UKCP09 and UKCP18 and reported on the uncertainties in the projections.

■ added that the headline result from UKCP18 was: “A greater chance of warmer, wetter winters and hotter, drier summers”. ■ felt that they were the same conclusions that were drawn from UKCP09.

■ asked if they were collating all the comments and feedback from the UKCP18 launch, and ■ said that ■ will be asked to review some aspects of the work. ■ added that a review already exists and this document will evolve over time. ■ noted that UKCP18 was RGP at present. ■ added that RCP6.0 had not been used for marine projections in UKCP18; ■ explained that it did not show significant differences from RCP4.5 so they omitted it.

■ asked whether Hansen’s climate projections were not as extreme as first thought – ■ reflected that his predictions were not far off the mark. ■ thanked ■ and ■ for their presentations and invited ■ to deliver his presentation on Marine projections – overview and gaps. ■ reported that projections from the UKCP18 Marine Report (Palmer et al., 2018), supersede those of UKCP09 (Lowe et al., 2009), and that projections for the year 2100 (relative to the 1981-2000 average) contain considerable uncertainty. ■ concluded with three key future research challenges:

- Improved understanding of dynamic ice processes to better quantify and constrain high-end scenarios.
- Future storm surges and the response of the Atlantic storm track under climate change.
- Translating updated sea level science into resilience planning.

■ invited ■, from the Environment Agency, to deliver his presentation on the EA’s guidance to implement UKCP18, climate change allowances, and other issues. ■ reported that the EA had been involved in the National Strategy Consultation. ■ reported that they had published the consultation online and all supporting documents can be found at: <https://consult.environment-agency.gov.uk/fcrm/national-strategy-public/>. The deadline for responses is 4<sup>th</sup> July 2019, and ■ invited ONR to take part in the consultation. ■ said that ■ was not aware of this work and that ■ would ensure that ONR provides some input.

#### ■ to engage with EA re their National Strategy consultation (Action 1/4)

■ suggested that ONR should set up regular phone calls to engage with EA and improve the communication between the organisations. ■ was happy to establish this connection through these phone calls and act as a focal point. It was also important that any FOIs are coordinated between the EA and ONR. ■ added that, although this is currently taking place, it would benefit from the regular engagement suggested above. ■ also reported that the EA had been involved in developing a National Policy Statement in relation to new nuclear build. This had been proposed by BEIS and would commence operation from 2026 to 2035.

#### ■ and ■ to set up regular phone calls to improve communications between the EA and ONR - frequency to be discussed (Action 2/4).

■ also reported that the EA was engaged in a Shoreline Management plan re-fresh and that a coastal flooding and adaptation to climate change inquiry has been

launched. They were also engaged in a research project on cliff and shore erosion under accelerated sea level rise, which WSP was conducting in collaboration with BGS, the Met Office, the Channel coastal observatory and the Technical University of Delft. It aims to support better prediction of how receding coastal cliffs will respond to sea level rise. Following his presentation, it was clear that there were a number of synergies between ONR and EA that needed to be explored further.

### 3. Climate Change – Update

■ invited ■ to deliver his presentation on new estimates on forcing, sea-level rise and Antarctic responses. ■ reported that first assessments from the new CMIP6 projections suggest that climate sensitivity may have been underestimated in CMIP5. In recently published papers by Golledge et al, 2019, and Edwards et al, 2019, they provided alternative views to Antarctic response, and that Golledge et al, 2019 had concluded that: “even with ocean temperatures held constant from 2020 and without including meltwater feedback, the loss of a substantial portion of the West Antarctic Ice Sheet may already be committed. However, the rate of future greenhouse gas emissions will dictate the magnitude and timing of this committed loss.” ■ added that, by mid-century, in our simulations, meltwater from the Greenland Ice Sheet will noticeably disrupt the Atlantic Meridional Overturning Circulation (AMOC), which could exacerbate the recently observed slowing trend. Globally, the inclusion of ice-sheet meltwater fluxes in climate simulations appears to result in a complex pattern of atmospheric and oceanic changes that include heightened interannual variability in some areas, which could result in more frequent extreme weather events.

When asked how long would this process take to occur, ■ said between 10-100 years if the glaciers collapse. ■ added that licensees would have time to implement the Managed Adaptive Approach if there was any disruption to the AMOC. ■ responded that we will get decades to do something. ■ reported that ■ has been working on a project (Rapid - <https://www.rapid.ac.uk>), which has deployed an array of instruments to measure how the AMOC is changing.

■ was interested in obtaining the references (Golledge et al., 2019 and Edwards et al., 2019) and ■ agreed to send them to ■. ■ also offered to provide an opinion on the research in relation to his area of expertise.

**■ to send ■ two reference papers listed above and ■ to comment on the papers in relation to his area of expertise (Action 3/4).**

■ invited ■ to present on extreme storms resulting from natural variability. ■ reported on the results of SUCCESS (Synthesising Unprecedented Coastal Conditions: Extreme Storm Surges), a NERC-funded project, which has synthesised extreme but physically plausible storm surge levels and waves (so called “black swans”). ■ said that they add significant understanding to future extremes and the quality of our current statistics for sea-level extremes. ■ added that the project partners included the Environment Agency and EDF Energy. His final key messages were that: small changes to UK storm systems can alter the height of storm surges significantly; in the North Sea, the most severe storm surges are caused by very slow-moving depressions; long term sea level rise remains an important driver of future coastal flood risk, with the UKCP18 Marine Report advising of (central estimate) sea level rises for the East Coast of the UK of between 0.2 and 0.8m by the year 2100; for storm surges and waves, it is well recognised that all projections of future storminess

are limited by the capability of climate models to accurately simulate extreme winds; multi-decadal variability of winter storms and, therefore, of storm surges, is dominated by natural variability, and that their new research shows, that for a 50-year planning horizon, the greatest threat for coastal extreme sea levels comes from the unobserved variability in storminess. ■ announced that he had approval from NERC to make the datasets available and was happy to be contacted if anyone required access.

#### 4. Meteorological Hazards & Coastal Flood Hazards

■ invited ■ to give ■ presentation on Heat waves. ■ explained that ■ had been working with ■ looking at data from Bradwell B and Hinkley Point C. ■ reported that Heat waves have the potential to challenge nuclear safety-related equipment. The study aimed to compare the observational data (MIDAS – Met Office Integrated Data Archive System) with model data (WISER – Weather Information and Climate Services) to help ascertain the limitations of model data. They concluded that the model data under predicts both maximum and minimum temperatures. ■ noted that this was not unusual. They aim to organise a cross-cutting meeting with mechanical & electrical engineers to determine the HVAC design requirements so that they can better characterise the hazard. ■ concluded with a number of questions: Does UKCP18 under-predict temperatures?; should a 1 in 10,000 year heat wave encompass extremes of all of the following – duration, max and min temperatures, humidity and wind speed?; are there other common issues which should be considered when using models/model data to determine the 1 in 10,000 year event? ■ offered to send ■ some papers to help with ■ studies. ■ asked if there is any move to try to explain these differences in the observed and modelled data, and ■ said that there is still a vast amount of information to look at to improve their understanding. ■ thanked ■ and ■ for their work so far.

**■ to send papers to ■ related to ■ research work on Heat waves (Action 4/4).**

■ invited ■ to present on regional weather observations - modelling and future numerical modelling of the atmospheric system. ■ reported that, in a recent paper by Cheng et al (2019, Science), they suggested that the oceans are warming much more rapidly (40%) than UN estimates of 5 years ago; i.e. IPCC underestimates the growth in warming. He concluded that: climate and weather models are not good enough; If you believe some of the most basic of science predictions, the crunch time for the planet is within 20 years; ONR should be aware of some of the science predictions/approaches, as extreme weather events are likely to happen. He added that, the 1703 (cat 2 hurricane) or 1607 (2.4m surge) storm could happen and worse; significant Heat waves of persistent, high temperatures are likely to occur if the current Earth System models are underestimates and the Charney curve is followed.

■ reported that ONR has expectations for beyond design basis resilience against External Hazards. ■ said that it was important to present these at the next progress meeting. ■ added that, whilst ONR values the independent view of the Expert Panel, it was important that they also understood these expectations

**■ to present the current ONR expectations for beyond design basis resilience against External Hazards at the next Panel meeting (Action 5/4).**

█ invited █ to present on the assessments of the temperature hiatus 1998-2015. █ reported that 1998 was the biggest El Nino in the historical record, and many people who believe that global warming stopped in 1998 have “cherry picked” the data and chosen 1998 as a starting point. █ added that newspapers were publishing articles reflecting this conclusion and that this damages the public trust in science and affects the politics of climate change issues. █ reported that, in a paper by Risby et al in 2017, they showed that there was “little or no statistical evidence for a lack of trend or slower trend in GMST (Global Mean Surface Temperature) using either the historical data or the current data. The perception that there was a pause in GMST was bolstered by earlier biases in the data in combination with incomplete statistical testing”.

█ thanked █ and invited █ to present on Meteorological and Coastal Flood hazards for the operating reactors. █ highlighted that there were 8 operating reactors - 1 PWR and 7 AGRs at various locations around the UK. █ added that they were all on coastal sites and used sea water for cooling. █ highlighted a number of features of the operating reactors that are sensitive to Meteorological and Coastal Flood hazards (listed in his presentation). █ reported that, relevant OPEX (Operating Experience) from Fukushima, Japan, had led to a review of the Dungeness flooding safety case. █ added that this resulted in a CAT 1 engineering change with the building of a flood wall around the site. █ added that EDF had taken their experience at Dungeness, re the flood wall and have used the learning from this at other sites to improve their resilience to external flooding. █ highlighted that the nuclear sites become more vulnerable to external hazards (EH) as they age, and that ensuring ongoing qualification of degrading plant against EH is a major challenge.

█ raised the issue of the use of the terms “Climate sceptic” or “Climate denier”. █ said that you cannot be a sceptic if you do not know anything about the subject. █ added that it was important to explain any misinterpretation of data that had been published in newspapers, and █ added that we needed to produce simple arguments for Public consumption so as not to mislead them.

## 5. Project Work - Summary of Progress

█ invited █ to give an overview of the progress on HPC (Hinkley Point C). █ reported that a significant amount of work is being done and showed pictures of the on-going work to build a sea defence - this was the first sea defence for a new nuclear build site. █ added that HPC was a dry site and that SZC (Sizewell C) was not. █ announced that the EA had been involved in some work re flood planning at HPC. █ added that █ will make enquiries whether the Lead Local Flood Authority is a statutory consultee, and report back to █.

**█ to check if the Lead Local Flood Authority is a statutory consultee (Action 6/4).**

█ invited █ to give an overview of progress on the Bradwell B (BRB) site. █ reported that █ had taken over from █ on both BRB site characterisation and the HPR1000 Generic Design Assessment (GDA). █ added that █ continues to lead on the PSHA and CF studies, and that █ will lead the BRB platform height ALARP study. █ said that the BRB project was in the early stages of engagement but that there had been workshops and Level 4 meetings to discuss Seismic hazards - in particular, on their PSHA and CF studies. █ added that, BRBGenCo had been engaging with EDF on Sizewell and sharing information. █

asked if they were planning to install a Met. station at the new site. ■ confirmed that there would be one at HPC following construction of a building to house it and that they would encourage BRBGenCo to install one at Bradwell B. ■ said ■ would obtain hourly meteorological data from the Met Office for the existing Hinkley and Bradwell sites and pass it to ■ for inclusion in ■ study.

**■ to obtain Met Office hourly data and pass to ■ for ■ research work (Action 7/4).**

■ presented the progress on Sizewell-C (SZC). ■ gave some background and said that, following a project board meeting in October 2013, it was decided to conduct ALARP studies on the platform height. The study concluded that a 7.3mOD height would reduce risks ALARP.

## 6. Items for Research

■ invited ■ to update the group on the research projects that are currently on-going at ONR in relation to External Hazards. ■ reported that there were four topics of research relevant to the Meteorological and Coastal Flood Hazards part of the Panel:

- Investigation of weather data trends and effect on Extreme Value Analysis.
- Investigation into the application of a storm hazard curve.
- Heat waves and their Relevance to the Safety of Nuclear Plant.
- Review of relevant good practice for climate change - UK Climate Projections 2018.

■ was keen to engage the panel to help write a paper to address the issues raised in the Investigation of weather data trends and the effect on Extreme Value Analysis. A discussion ensued, and it was concluded that this work may form the basis of an MSc or a NERC case study. It was suggested that ■ circulates a draft scope for ■ and ■ to add to and advise on the best way forward to deliver the research. In parallel, ■ said ■ had contacts in Lancaster University and ■ would explore their possible involvement in the work.

**■ to circulate a draft scope for the research topic on Investigation of weather data trends and the effect on Extreme Value Analysis. (Action 8/4).**

**■ ■ and ■ to add to and advise on the best way to deliver the research – possibly through an Expert Panel Paper (Action 9/4).**

■ added that ■ had initial discussions with NERC and that ONR are hoping to gain access to a portal. ■ and ■ will follow this up with a methodology on how to deal with this access.

**■ and ■ to develop a methodology to access the NERC research portal (Action 10/4).**

In relation to the research topic, Investigation into the application of a storm hazard curve, ■ suggested that he would have an internal discussion and look for the best way to proceed.

**■ to discuss internally the best way to proceed with research topic RRR-079 (Action 11/4).**

█ reported that █ and █ were working on the research topic on Heat waves and their relevance to the safety of nuclear plant. This will be published as soon as the work is finished. It was suggested that the work could be submitted as a conference paper and delivered at a relevant nuclear conference, eg Smirt (<https://www.smirt25.org> - 4-9 August 2019 In Charlotte, North Carolina, USA).

**█ to present and publish work on Heat waves and their relevance to the safety of nuclear plant (Action 12/4).**

█ has been engaged in work on the UK Climate Projections 2018 with █. It was agreed that new information would be released on UKCP18 at some point during the year and █ said that ONR would need to reflect on the implications of this new information. █ agreed that █ and █ should keep a watching brief on developments and take forward any issues related to nuclear.

**█ and █ to keep a watching brief on the release of new information in relation to UKCP18 and take forward any issues related to nuclear (Action 13/4).**

## 7. FOI Requests

█ reported that ONR had been receiving a number of FOI requests and █ would coordinate the responses to them. █ stressed that, if a Panel member receives an FOI through their institution and it is related to their work for ONR, they must communicate this to █ so that they can provide a coordinated response. █ reported that █ would be taking part in a webinar this week with █. █ added that █ may seek the Panel's advice re their experiences with their organisations approach to responding to FOIs. █ asked █ to summarise the recent requests. █ reported that most of the FOI requests come from journalists, NGOs, the Public and ex ONR Inspectors. █ added that information about the panel and its discussions is accessible through FOI requests. █ also added that it is important to be aware of the language you use in emails as they are also subject to FOIs. So far, in relation to the Expert Panel, ONR have been asked about membership; terms of reference; minutes of meetings; interpretation of minutes of meetings, and meeting frequency.

## 8. Miscellaneous Panel Business

█ reported that the finances for the Expert Panel were healthy. █ added that the present contracts run until March 2020 and that █ had received requests from some Panel members that they would prefer their next contract to be independent of their organisations. █ said they may need someone else on the Panel to look at coastal issues, and asked the panel if they had any views. █ said that █, along with █ will look at the projected work and finances across both sub-panels and redistribute money among the members, if required. █ said that this would help the Panel members plan their work schedule and focus their efforts on delivering the work to ONR. █ added that the TAG13 Expert Panel Paper for Seismic hazard would be reviewed this year and revised in early 2020. █ suggested that █ should consider making some modifications to the Expert Panel papers on Met and Coastal Flood Hazards. This may include new references and information about UKCP18. █ said it would be useful to update the papers together and publish them on the web-site by March 2020. █ said █ would discuss this task and make a decision soon.

█ and █ to map out the projected work anticipated for the Panel over the next 9 months and re-distribute funds accordingly (Action 14/4).

█ to consider updating the Met and Coastal Flood Hazards Expert Panel papers (Action 15/4).

#### **9. AOB**

█ asked if █ would help █ in relation to some questions █ had on lightning research which was being conducted by Innsbruck University. █ will send the details to █ for his input.

█ to send lightning research and any questions █ has in relation to this work, to █ (Action 16/4).

█ thanked everyone for their presentations and useful discussions and closed the meeting.

█  
14 August 2019

**AGENDA****PROGRESS MEETING: EXPERT PANEL ON NATURAL HAZARDS – Meteorological and Coastal Flood Hazards****DATE:** Monday 20 May 2019**VENUE:** ONR, Redgrave Court, Merton Road, Bootle, UK**OBJECTIVES**

- Share knowledge on recent advances in climate science including UKCP18
- Update the group on current ONR assessment work regarding met and coastal flood hazards
- Discuss on-going ONR and panel research project collaboration and develop ways forward

**ATTENDEES:**

Serial	Timing	Item Description	Introduced
<b>Monday 20<sup>h</sup> May – Room 6.1.028</b>			
<b>1</b>	<b>09:00 – 09:15</b> 09:00 – 09:15	<b>Introduction</b> Review of agenda and welcome	■
<b>2</b>	<b>09:15 – 11:00</b> 09:15 – 09:55 09:55 – 10:15 10:15 – 10:45 10:45 – 11:00	<b>UKCP18</b> Comparison of UKCP09 and UKCP18 Marine projections – overview and gaps EA's guidance to implement UKCP18, climate change allowances and other issues Discussion	■ ■ ■ ■
	<b>11:00 – 11:15</b>	<b>Tea</b>	
<b>3</b>	<b>11:15 – 12:15</b> 11:15 – 11:35 11:35 – 12:00 12:00 – 12:15	<b>Climate Change - Update</b> New estimates on forcing, sea- level rise and Antarctic responses Extreme storms resulting from natural variability Discussion	■ ■ ■
<b>4a</b>	<b>12:15 – 13:00</b> 12:15 – 12:30 12:30 – 13:00	<b>Meteorological Hazards &amp; Coastal Flood Hazards</b> Update on Heat wave work	■ ■ ■

		Regional weather observations – modelling and future numerical modelling of the atmospheric system	
	<b>13:00 – 13:30</b>	<b>Lunch</b>	
<b>4b</b>	<b>13:30 – 14:30</b>	<b>Meteorological Hazards &amp; Coastal Flood Hazards (Contd)</b>	
	13:30 – 13:50	Assessments of the temperature hiatus 1998-2015	■
	13:50 – 14:10	Met & Coastal Flood Hazards for the operating reactors	■
	14:10 – 14:30	Discussion	■
	<b>Tea</b>		
<b>5</b>	<b>14:30 – 16:00</b>	<b>Project Work - Summary of Progress</b>	
		<b>Summary of HPC Progress</b>	
	14:30 – 14:40	Overview	■
	14:40 – 14:50	Status of regulatory permissioning	■
	14:50 – 15:05	Discussion	■
		<b>Summary of Bradwell B Progress</b>	
	15:05 – 15:15	Overview	■
	15:15 – 15:30	Discussion	■
		<b>Progress on other projects</b>	
	15:30 – 15:45	Sizewell C and GDF	■
	15:45 – 16:00	Discussion	■
<b>6</b>	<b>16:00 - 16:20</b>	<b>Items for Research</b>	■
<b>7</b>	<b>16:20 - 16:35</b>	<b>FOI Requests</b>	■
<b>8</b>	<b>16:35 - 16:45</b>	<b>Miscellaneous Panel Business</b>	■
<b>9</b>	<b>16:45 - 17:00</b>	<b>AOB</b>	■
	<b>17:00</b>	<b>Close</b>	