As a working party we are working through how to best support the profession in understanding the impact of climate change on reserves. Any and all feedback you have after implementing the material below will be well received.

This is a non-peer reviewed paper issued by working party members to promote ideas and stimulate discussion amongst reserving actuaries and other interested readers. We would like to encourage readers to test out the ideas set out in this paper and provide feedback to the working party on their experiences.

This work comprises the thoughts of individual working party members and does not necessarily reflect the views of all working party members. Nor does it reflect the position of the IFoA, nor the employers of the authors. Readers choosing to apply approaches and ideas set out in this paper do so at their own risk. The authors, working party and IFoA do not accept any responsibility for any loss suffered by any party arising from reliance placed on this paper.

1. Introduction

In our 2023 paper[1], we discussed various aspects of reserving relating to climate change and, within this, identified a number of challenges relating to communicating reserve uncertainty in respect of climate change.

In that paper, we discussed the articulation of climate risk specifically within the format of the large loss wordings used in Statements of Actuarial Opinion ("SAOs") provided for Lloyd's syndicates. These wordings follow a defined structure which is specific to these opinions but the broad questions that guide the wordings are equally relevant in a wider context. Fundamentally, the opinion wording requires the actuary to consider for a given issue:

- Whether the issue has a material impact on the reserves overall
- Whether the impact of the issue is materially uncertain
- Whether the level of uncertainty relating to the issue is sufficient to materially increase the uncertainty of the reserves overall

In practice, this then leads to three key steps in assessing the issue – firstly, considering materiality based on the current reserve estimate, secondly, considering the uncertainty around that estimate and, thirdly, considering the issue in the context of the reserves overall.

In this paper, we have built on our work around SAO opinion wordings and considered feedback received from the profession to our 2023 paper to consider a more general approach to the communication of uncertainty relating to climate risk. In this paper, we set out a structure for describing and reporting on climate change reserve exposures, presentation of risk assessments and uncertainty relating to these, consideration of the

[1] Reserving for Climate Change 2023 Working Party Update: Litigation, Wordings and Qualitative Tools (Institute & Faculty of Actuaries, September 2023) - https://actuaries.org.uk/media/cfhhpdtf/reserving-for-climate-change.pdf

role of reserving philosophy and suggestions for the areas to be addressed in report wordings relating to climate change.

2. Approach to reporting on climate risk exposures

It is not the role of the working party to specify the content or structure of any actuary's reporting on the impact of climate change for their firm. However, we have considered a potential outline for reporting within an Actuarial Function Report as an illustration of some of the areas which might be considered and communicated to the Board and other stakeholders to develop understanding of the risks arising from climate change. We do not recommend that this is used as a checklist and give no assurance that it is complete or comprehensive. Rather, we hope it serves as a base on which actuaries can start to build a view of the key issues affecting their own firm.

Depending on the particular circumstances of an actuary's reporting, it may be that the actuary chooses to prepare a standalone report on climate change. This might be a one-off exercise, updated from time to time, or an annual, biennial or triennial review, with further updates prepared should specific matters of importance have developed between update cycles. Alternatively, this structure might be adopted for inclusion in each actuarial report or in ORSAs or Board papers though we would anticipate a shorter, higher-level presentation of the facts would be more appropriate in this case.

We would not expect that initial iterations of a report would have extensive detail on all sections. Rather, we believe that a structured reporting approach as we describe in this paper could be developed and extended over time as appreciation and understanding of the key issues develops.

A possible reporting structure would be built along the following six sections. While we expect each actuary to have their own preferred structure, we hope that this set of headings will provide a helpful set of prompts:

a) **Describing the risks** – A broad assessment of the types of climate risk e.g. starting from the board categories of Physical, Transition and Litigation and identifying the underlying risks which may be relevant for a particular insurer.
b) **Assessing risk by line of business** – A review by class of which types of climate risk are likely to have an impact and a qualitative assessment of this risk.
c) **Assessing the current state of knowledge** – An outline of the limitations in information currently available and the steps which may be taken, or may already have been taken, to address these.
d) **Performing detailed analysis for high-risk lines of business** – Following from the above, either more detailed qualitative analysis or quantitative analysis for those classes identified as higher risk and/or analysis at a more granular, sub-class level.
e) **Developing risk metrics** – Based on the exposure analysis performed, presenting a means of describing the risks in a consistent fashion. This can then be used to rank and, in time, to quantify the risks for users of the actuarial report.

f) **Determining next steps** – Identifying key knowledge gaps and priority areas for further investigation.

We have not considered section d) in more detail in this paper as that relates primarily to the analysis as opposed to the communication of the analysis. We discuss the remaining areas further in the following sections. We have also set out a potential report structure based on these in Appendix A.

We note that the sections above are likely to be interlinked, for example while the development of risk metrics is likely to be informed by analysis performed, it may also be the case that once a risk metric has been devised this could direct analysis performed in future. It may therefore be more helpful to think of the above list in the context of the actuarial control cycle – with a feedback loop through specifying the problem, developing a solution and monitoring the emerging experience such that the understanding of the problem can be refined and the cycle repeated.

3. Describing and assessing risk by line of business

We discussed in our 2023 paper[2] the broad categories of climate risk as physical, transition and liability risk. In order to assess risk more specifically within a given portfolio, it will however be necessary to break these risks down further and to identify claim types to which the portfolio may be exposed. Below we consider a small number of examples of sub-risks that might be considered. As we have only presented a few examples, a more comprehensive view will need to be developed considering the key risk areas for a given insurer.

- Physical risk
    - Increase in frequency and/or severity of severe weather events
    - Emergence of new event types and/or events in new geographical locations
- Transition risk
    - Changes in material/commodity prices due to changes in supply and demand
    - Impact of changes in government policy and regulation
- Liability risk
    - Mitigation/loss and damage
    - Adaptation and failure to adapt
    - Regulatory and governance

In order to first describe the risks, it will be necessary to consider a broad range of potential risks and how these could hypothetically affect both the current portfolio and any historical exposures. This will initially rely on judgement gathered from a range of

[2] Ibid.

stakeholders, including representatives from Exposure Management, Underwriting, Claims and others, in order to inform a view of risk based on qualitative factors.

While the initial view of potential risks may be fairly broad and general, assessing these risks in more detail by line of business will help in refining the view. For example, the long list emerging from the initial assessment may provide the structure for a workshop for a given class of business in which risks may be identified as priorities or removed entirely based on more detailed discussion of, for example, geographies or industries covered or policy wordings. At this stage the class of business assessment would involve qualitative assessment of the risks by class, using a structure such as agreeing High/Medium/Low ratings for the likelihood of a given risk emerging and the impact of that risk if it were to emerge. While this assessment will not provide quantification of the impact of potential risks, it will formalise the gathering of knowledge from across the business and will allow risks to be appropriately prioritised when beginning more detailed quantitative analysis.

4. Presenting exposures and uncertainty

In our 2023 paper[3] we set out a five-state maturity model to present the reserving actuary's view of the state of a firm's understanding of its climate exposures. This table, with an update in formatting, is reproduced in Table 1.

Table 1 - Five-tier model of an insurer's state of knowledge

<table>
<tr><th>Tier</th><th colspan="2">State of knowledge</th></tr>
<tr><td>1</td><td colspan="2">Little or no knowledge or information regarding the firm's historical underwriting activities.</td></tr>
<tr><td>2</td><td colspan="2">Partial awareness of underwriting periods, lines of business, basis of cover and industry sectors covered.</td></tr>
<tr><td>3</td><td rowspan="3">Complete awareness of underwriting periods, lines of business, basis of cover and industry sectors covered.</td><td>Little or no details surrounding underlying insured names, policy limits, coverage, terms and conditions with which to determine extent of exposure to liability from specific litigation or general classes of litigation.</td></tr>
<tr><td>4</td><td>Partial details surrounding underlying insured names, policy limits, coverage, terms and conditions with which to determine extent of exposure to liability from specific litigation or general classes of litigation.</td></tr>
<tr><td>5</td><td>Comprehensive details surrounding underlying insured names, policy limits, coverage, terms and conditions with which to determine extent of</td></tr>
</table>

[3] Ibid.

		exposure to liability from specific litigation or general classes of litigation.

While it may be subjective to determine, the term "partial" was intended to suggest 40% to 80% coverage of the issue for the portfolio in question, with "little or no" corresponding to less than 40% and "comprehensive" corresponding to more than 80%.

In evaluating the state of knowledge, it will be necessary to obtain information relating to a wide range of factors, a non-exhaustive list might include:

- Periods when the business has been underwritten
- Coverage provided and changes, if any, in terms over time
- Timing of introduction of key exclusions
- Geographical and industry sector exposure
- Basis of cover and any changes over time e.g. between losses occurring (LOD) and claims made bases

Depending on the availability of historical data, gathering this information will likely require a number of approaches, including for example a combination of:

- Sampling of policies from particular prior year periods
- Assessment of own portfolio diagnostic information using historical records of portfolio mix, including basis of cover, geography and industry and exposed policy limits
- Assessment of historical market data on insurance coverage and statistics on own portfolio market share

Care is needed to ensure portfolios are considered and results are presented at a sufficiently granular level[4].

Broken down in this manner, a simple dashboard – such as is shown in Table 2 – might help present the relative significance of portfolios when determining areas of focus. For ease of reference, in this table, we assume that the output of the qualitative risk assessment (as discussed in Section 3) is ranked on a scale of 1-5. This could however be adapted in line with the structure chosen for the qualitative assessment, for example, with separate High/Medium/Low assessments for likelihood and impact. The simple aim of the dashboard however is to capture a view of the risk presented by a

[4] For example, it may also be appropriate in some cases to consider and present risk types separately for a given line of business/portfolio grouping where the qualitative risk assessment and/or state of knowledge differs significantly. Generally, while there remains a challenge in assessing trends and considering attribution, physical risks may be relatively more straightforward to assess in terms of exposure and potential outcomes. In contrast, there remains greater uncertainty over how climate litigation may develop and there is the additional challenge of potentially assessing exposure in historical periods for which data is not readily available.

given class of business by combining the output of the qualitative assessment of the class with a view of the state of knowledge in respect of that class.

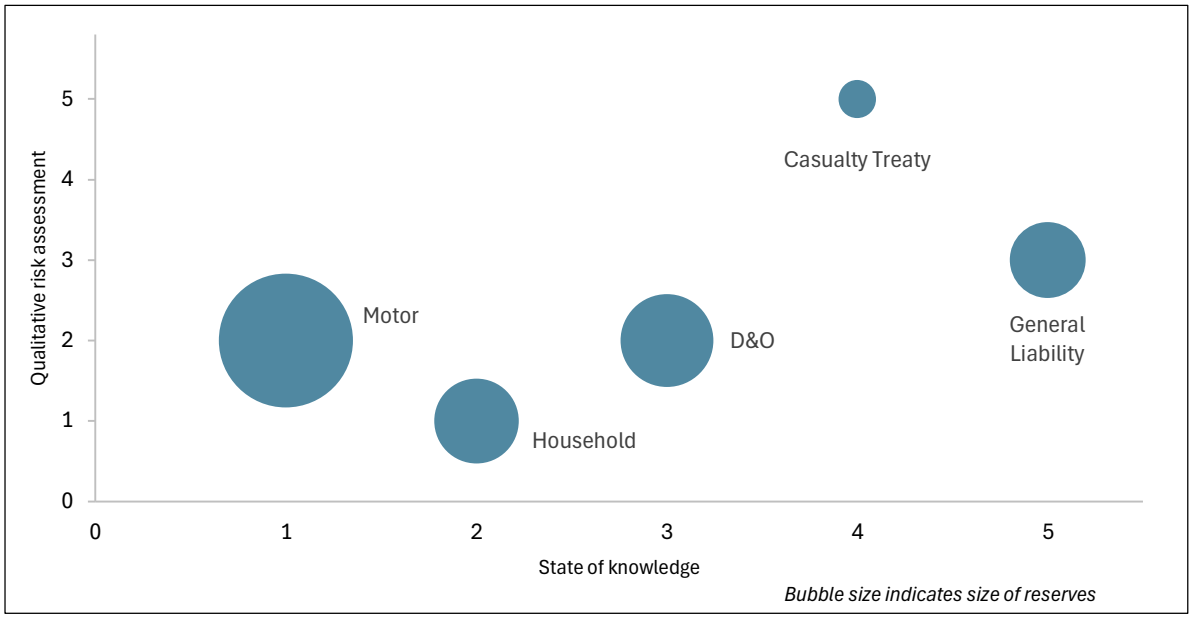
Table 2 – Dashboard combining qualitative risk assessment and state of knowledge

Class of Business	Size of reserves £m	Qualitative risk assessment	State of Knowledge	Overall Risk Score
		A	B	C = A x (6 – B)
Motor	800	1 - Low	4	2
Household	300	1 - Low	5	1
D&O	250	3 - Medium	4	6
General Liability	100	5 - High	3	15
Casualty Treaty	50	4 - High	1	20

The approach to determining an overall risk score is illustrative in this case but could easily adapted to align with risk assessment approaches of different firms. In this example though, the overall risk score is increased by either a high qualitative risk assessment outcome or a low state of knowledge. The approach to the qualitative risk assessment itself is discussed in Section 3.

While this formulaic approach has some superficial appeal, providing as it does a single digit risk ranking, we highlight the dangers associated with such excess simplification. Even in the simple example above, note that the overall risk score does not take into account the materiality of the reserves for each class of business. A graphical presentation such as Figure 1 could be another approach to support a description of the portfolio and reduce these risks.

Figure 1 - Risk ranking chart (Reserves shown by size of circle)



5. Understanding and explaining reserving philosophy

We received feedback from a number of sources in response to the suggestions made in our 2023 paper[5] in respect of large loss wordings for Statements of Actuarial Opinion.

A key challenge in assessing the risks arising from climate change is the wide range of potential future outcomes. From the insurance perspective, this is perhaps most extreme in the context of litigation risk. In a scenario in which not only do future court rulings assign material liability to multiple insureds as major emitters of greenhouse gases, but these insureds are able to recover substantial insured sums from insurers and reinsurers over multiple periods of cover, climate risk can perhaps be considered as "the next asbestos" – a source of claims sufficient to require a bespoke, long-term approach across the market.

It is clear that there are several hurdles that must be cleared for extreme scenarios of this nature to come to pass. It is not the purpose of this paper to discuss them, nor the wider societal risks that proverbial "deep pockets" face. Rather, we wish to describe here two characteristic reserving philosophies that firms may adopt as the underlying reserving philosophy will guide the wider assessment of climate risk. We believe that it may be helpful for actuaries to discuss these reserving philosophies (or others) with their Boards and agree on a position so that a consistent and coherent position can be adopted.

The two characteristic philosophies that we see that firms may seek to adopt are:

i. A latent claims posture

> Here, the firm sets aside an additional amount of reserves each year notionally allocated towards climate change claims. Such an approach would not be specifically allocated to a particular climate liability scenario but would seek to ensure that there was a portion of provisions that was being built up to put towards such claims.
>
> An example (for numerical purposes only) of such an approach would be a firm deciding to allocate 2% of General Liability premium written for Energy industry insureds to a reserve for climate latent claims and to hold this reserve for twenty-five years. Assuming long-term premium growth of 5% per year, after twenty-five years the climate latent claims reserve will have reached a steady state of approximately 30% of annual written premium. This should be considered as an example only – the actual level and size of such a reserve would need careful analysis.

[5] Reserving for Climate Change 2023 Working Party Update: Litigation, Wordings and Qualitative Tools (Institute & Faculty of Actuaries, September 2023) - https://actuaries.org.uk/media/cfhhpdtf/reserving-for-climate-change.pdf

ii. An emerging risk posture

Here no explicit reserve is held for this type of climate risk. Instead such a risk is maintained on the firm's emerging risk register. Scenario modelling of the potential size and outcome of these emerging risks will be needed to inform the Board and interested stakeholders as to the ability of the firm to withstand them and to guide future management actions.

While the total financial resources a firm may hold after consideration of the climate risks may not necessarily differ between these options, the choice of approach may affect the balance of these resources held in a firm's technical provisions and in its net assets i.e. whether it is considered as a reserving or capital issue.

From a practical perspective, relevant considerations may be whether the work is led by the Reserving team, Capital team or Risk team. The opinions of other stakeholders will also be relevant, including key shareholders, regulators, auditors and other advisors. It may also be that for some exposures, a firm may wish to adopt one philosophy, while for others, the other is more helpful.

Whichever philosophy is adopted, it will be important for firms to consider the appropriate level of granularity and sophistication of modelling that is appropriate for each risk.

6. Report wordings relating to treatment of climate change liabilities

As our work has shown, there remains considerable uncertainty in the size and scope of future climate liabilities. Some of the feedback we received from our 2023 paper[6] suggested that model wordings that actuaries could adapt and adopt would be helpful to support a common language in our reporting.

We do not think that it is possible to advance a generally applicable set of wordings that actuaries might choose to adopt. In our view, the wording will need to take account of several factors, including, but not limited to:

- The reserving philosophy of the firm (see our comments above in Section 5)
- The risk profile of the portfolio being addressed
- The assumed state of knowledge and understanding of risks of the intended audience
- The personal preferences of the actuary responsible for the work

The applicable uncertainties might be split into those that are generally applicable and those specific to the portfolio in question. Below are some elements to consider in each category.

[6] Ibid.

General uncertainty	Specific uncertainty
• Future climate pathways and impact on insureds and/or parties which may bring action against insureds • Adaptation, mitigation and other costs • Attribution of responsibility (including changing social and legal attitudes) • Defence costs • Policy and insurer identification	• Who and what lines of business were insured in the past? • What coverage wordings, exclusions and write-backs were in place over this period? • Where are climate claims emerging? How easily can they be identified as climate change related?

In Appendix B, we have set out an example of the type of uncertainty wording that an actuary might include in their report. The key features of the sample wording are:

- An overview of the risk considered from the industry perspective, including updates on current market developments, legal rulings etc.
- Identification of the key uncertainties
- Identification of the extreme loss scenario (where one exists) e.g. worse case adverse legal rulings
- Details of the insurer's specific exposures and, once available, the assessment of the risk presented by these (qualitatively or quantitatively)

It is particularly important (and expected under actuarial reporting standards) to outline clearly the assumptions which have been used in assessing the risk, highlighting the limitations of the analysis performed and making sure that the user of any report has sufficient information to place appropriate reliance on the findings.

Ideally, if a wider climate change reserving issues paper has been already prepared for the Board that provides greater context than is included in the reserve report. The reader may also find it helpful to refer to the example given in Figure 18 of our 2023 paper[7].

[7] Ibid.

7. Conclusion

As we remain uncertain over the long-term implications of climate change, there remains considerable uncertainty over how climate change may impact the insurance industry. While the emergence of claims and development of case law in this area will start to clarify the likely impact in some areas, this will take some time. However, there is still a role for the reserving actuary (and indeed all actuaries) in considering how climate change might impact the portfolios we work with and in supporting Boards, regulators and other key stakeholders in understanding this.

There may be a not insignificant amount of work required to gather information about business written historically to appropriately assess prior year exposures in particular. We consider it important though to communicate the risk, even if we remain at the early stages of developing our understanding of this. We acknowledge that initial efforts in this area will likely be relatively simplistic but, in raising the issue, seeking input and presenting a view, we can begin a conversation on the impact of climate risk and work towards more sophisticated analysis for those areas identified as being of greatest concern.

We recognise that approaches to communication differ greatly across the market and that it will be impossible for the working party to propose an approach that works for everyone. We are however keen to continue to develop material that can support the profession in this area and would welcome any feedback that will allow us to refine or improve the working party's output.

Appendix A – Illustrative reporting structure

(i) Describing the risks

Description of elements of climate change exposure in reserves, including:

a. Future claims on unexpired risks.
    i. Primary and secondary peak peril exposures.
    ii. Consider multi-year policy exposures.
b. Current open claims.
    i. Clusters or unusual patterns of claims.
    ii. Trends in notifications on claims-made policies.
c. Trends in closed and open claims.
    i. Degree to which climate change effects may be impacting claims frequencies and severities.
    ii. Potential difficulties with identification of climate-specific elements.
d. Future, unreported claims.
    i. Emerging trends in claims reporting.
    ii. Potential for latent/emerging risk claims.
e. Expected impact of outwards reinsurance
    i. Exposures expected to be covered/not covered (subject to review of contract wording)

(ii) Assessing risk by line of business

Line of business-based assessments to assign H/M/L assessments for likelihood of exposure and impact of exposure along with associated time horizon (short/medium/long):

a. Base definitions
    i. Materiality – Definition of H/M/L
    ii. Risk definition e.g. How much have you assumed is already implicitly in the reserves and are you then considering only "excess" climate risk?
b. Descriptions/heatmaps of exposure to each element of risk taxonomy
    i. Physical risks
    ii. Transition risks
    iii. Liability risks
c. Liability risk breakdown by type of liability
    i. Mitigation/loss and damage
    ii. Adaptation (and failure to adapt)
    iii. Regulatory and governance
    iv. Other (given the evolving liability and litigation landscape)

(iii) Assessing the current state of knowledge

a. Current underwriting.
b. Tracking of historical wordings/coverage.
c. Legal review of sample contract wordings
d. Identification of known information gaps e.g. missing policy documentation

e. Information on aggregate exposures by coverage, industry, geographic, time-based splits

(iv) Performing detailed exposure analysis for high-risk lines of business

Additional consideration for exposures for lines of business identified as higher risk either due to exposure or overall materiality

a. Industry splits, and specific exposure of portfolio segments to climate risks, by taxonomy
b. Geographic splits, and nature of political, social and legal attitudes towards climate change.
c. Time periods over which material exposures might be considered to arise i.e. when particular lines of business were underwritten
d. Extent to which coverage provided over time may respond to climate-related claims.
e. Inwards coverage:
    i. Legal review of wordings.
    ii. Timing, nature and prevalence of pollution and climate change exclusionary wordings; use and prevalence of cover write-backs
    iii. Prevalence and effectiveness of anti-stacking/accumulation wordings and interlocking clauses
f. Outwards reinsurance coverage:
    i. Legal review of wordings and coverage reliability.
    ii. Reliability/resilience of reinsurance.

(v) Developing risk metrics

Assigning risk relativity scores, using qualitative and quantitative means to support risk ranking; a range of techniques might be suitable, particularly given where information is limited

a. Scenario analysis using a range of sources and consider for example:
    i. Ranges of likely and unlikely scenarios
    ii. Orderly and disorderly global responses to climate change effects
    iii. Impact of particular litigation outcomes
b. Qualitative/expert-assessed index measures across the portfolio to describe/track the risks.

(vi) Determining next steps

a. Extent to which climate change can be considered part of insurance risk BAU, and where it requires closer monitoring
b. Immediate actions based on analysis above
c. Areas of focus for further analysis

Appendix B

An example of the sort of wording that an actuary might use to explain general uncertainties is shown in Figure 2. As can be seen, the passage starts with a general description of uncertainty before highlighting some more specific commentary on particular sources of exposure and how this is addressed under the reserving philosophy of the insurer.

Figure 2 Example climate change wording

Climate change presents a material source of uncertainty to insurance industry reserves. The portfolio has material exposure to the following types of uncertainty:

- *Physical risk losses from future catastrophic events affecting existing policies that are greater, in either frequency or severity, than anticipated by current models.*
- *Transition risk losses, both in respect of past events and periods of cover and future events affecting existing policies, arising from changes in claim costs or new types of losses arising as a result of the response of insureds, regulators, governments and society to anticipated or actual effects of climate change.*
- *Liability risk where insureds are subject to litigation or are found to be liable in respect of past failings under contract, tort, regulatory or other areas of law.*

These risks are amplified by uncertainties surrounding:

- *Future changes to the Earth's climate and how this will affect insureds and those who may bring proceedings against insureds.*
- *Financial costs associated with adapting to or mitigation of the effects of climate change and other costs arising to members of society connected to or arising from responses to climate change.*
- *Attribution of these financial costs, including any regulatory fines applied to, and any associated legal defence costs for, insureds.*
- *The process of identifying insureds from historical periods and the nature and extent of coverage provided to them at that time.*

Even if the chance of success of current climate litigation is considered to be low, it is possible that in the face of severe climate change related impacts, over time legal and judicial attitudes may change and result in substantial costs falling to insurers, particularly those who have provided coverage to firms and industry sectors most associated with greenhouse gas emission.

For this portfolio, the insurer has underwritten for many years the following portfolios which may present particular concerns:

- *Between [year] and [year] a material portfolio of general liability in [industry/sector], which is generally regarded to have been a major emitter of greenhouse gases.*
    - *From [year], the portfolio included limited pollution exclusions; and*
    - *From [year], absolute pollution exclusions were applied.*
    - *Despite the existence of these exclusions, there remains potential exposure because (a) claimants may seek to argue that carbon dioxide is not a pollutant; and (b) there is some anecdotal evidence that during the period [year] some limited cover for certain pollution events was provided.*
- *We have noted a pattern of emerging claims in our Professional Indemnity/Directors and Officers portfolios which cite [details of claim narrative/indicators of potential links to climate change].*
- *[Other observations of own portfolio; identification of developments for peers writing similar business]*

[Depending on the approach followed, include details of qualitative/quantitative assessments of the risk as well as a view of the state of knowledge (see Section 4).]

[Detail next steps required to refine the assessment of risk in this case, including a realistic timeline over which a more refined view can be formed.]