Understanding the problem

How will output ranges be used?

What information do we need from the decision maker to include uncertainty analysis at the right points?

Asking the right question

Decision-makers need information about uncertainty in the impacts of their decisions, as well as the most likely impact. This section looks at the steps to ensure that analysts and decision makers understand the question being asked, how analytical outputs will be used in the decision-making process, and how we can appropriately incorporate uncertainty into the analysis.

Agreeing what the question is

Before any analysis begins we should work with policy colleagues to define the question that the analysis will answer.

Understanding the problem

Clarify what the real question is

It is important to ensure that the question is correctly framed to address the problem. For example, are we really interested in 'how much money will my policy save?', or should we be asking 'what is the likelihood that this policy would save more than £x?'.

Identify the important sub-questions	As well as clearly defining the question, we should also ensure that any sub-questions to support the analysis are appropriately thought through. For example – in an education context we may be interested in uncertainty on both an academic and a financial year basis.

Appropriate use of outputs

Once the question and sub-questions have been agreed, analysts and decision makers should discuss how the outputs will be used. Understanding the role of the analysis in the decision-making process will help to inform which uncertainty techniques are appropriate and proportionate.

It is important to jointly identify sources of uncertainty that are so deep that little or nothing can be said quantitatively about their impact on the policy outcome. Deep uncertainties can have major implications for decision-making, and may call for a descriptive approach to the analysis and presentation of options.

How will output ranges be used?

Discuss the role for the analysis	Will the policy decision be based on the results of the analysis, or is it just one of a wider set of considerations informing the decision? The more influential the analysis is, the more important it is to build in robust uncertainty analysis.
Are there dependent models drawing on the analysis?	If the output is to be fed into 'downstream' models, then it is important to understand the requirements of the downstream model. For example, if scenarios are used to illustrate uncertainty, then these may not be suitable for a 'downstream' Monte Carlo simulation.

Incorporating uncertainty into analysis

Now that we know what the question is and the context in which the answers will be used, we should agree how to build appropriate uncertainty into the analysis. It is a good idea to work with the decision maker by asking what it is conceptually that they *would like* to be able to say. This is important as it frames how the analysis will be conducted.

What information do we need from the decision maker to include uncertainty analysis at the right points?

Explain how the uncertainty can be used to better inform decisions	Help the decision maker to understand how information about the uncertainty present in the analysis supports a better informed and more robust decision. Make it clear that not all sources of uncertainty will be quantifiable and/or supported by robust evidence. Jointly prioritise the key sources of uncertainty that need to be included in the model.
Avoid misleading results or spurious accuracy by choosing the appropriate technique	We can assess the impact of uncertainty using many different techniques. Not all will be appropriate for a given piece of analysis. A poor choice of technique may even give misleading results. For example, if there are many sources of uncertainty, the use of 95% confidence intervals to describe just one limited part of this uncertainty may be misleading, and modelling a range of described scenarios may be more appropriate. Appropriate presentation, such as rounding, is equally important to avoid spurious accuracy (covered further in Section x).
Check what the policy maker's risk appetite is and how the uncertainty will inform their decision	Discuss with the decision maker what level of uncertainty is acceptable. Do they want to know how wrong the forecast would need to be in order to change or rethink the policy? Or are they simply interested in an output "range"? If so, what does that "range" actually mean?
The uncertainty analysis may differ depending on whether it is a policy, operational or financial decision	Your analysis, including the treatment of uncertainty, may vary depending on whether this is a policy, operational or financial decision. Examples can be very helpful when discussing the analysis with the decision maker. An answer to the question of how much a policy would save may be £3m, with uncertainty analysis giving a broad range of £0.5-5.5m. You could discuss with the decision maker how they want to be able to frame the analysis, for example: *"A range of £0.5-5.5m";* *"The estimated savings are £3m, with analysis showing a 90% likelihood that savings will be between £1-5m";*

	"Analysis shows that there is an 80% likelihood that the savings will be greater than £2m"; *"The policy needs to have X amount of takeup in order to break even"* Operational decision makers may not want to see a range of results, but instead want to plan to a certain level of confidence, such as 65% or 95% rather than 50%. For example, when planning the number of schools, prison places or GPs we'll need over the next 5 years, it may be more appropriate to plan to a higher level of confidence than 50%. Financial decision makers may be interested in understanding the likelihood of receiving a certain level of income, or that risks and opportunities will materialise. Here, the analysis would need to go hand in hand with financial risk management to mitigate the risks materialising or crystallising the opportunities.
Analysis could advise customer on system drivers or resource planning	Your analysis could be used to provide advice on how a system is driven, and how each parameter interacts and impacts on the final output. Through scenario or sensitivity testing, you can find the dependencies and significances of the model parameters, and explore how these will feed through to affect the final output.