

Dealing with uncertainties in assessment

An EA (Environmental Assessment) predicts the environmental impacts of various plan or project alternatives. The impact predictions are often subject to considerable uncertainties, which need to be taken into account when determining whether objectives are met or limit values exceeded in impact assessments. This factsheet contains information about the nature of uncertainties and how to deal with them in an EA (both EIAs and SEAs).

How certain are predicted impacts?

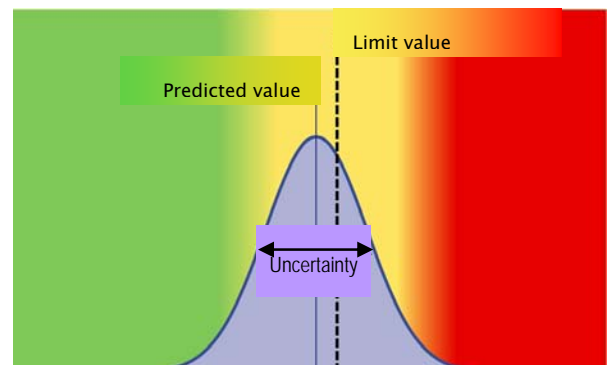
Expected changes in traffic, air quality, noise and nature values are often assessed with the use of models. The assessment results can have substantial margins of uncertainty. If the result of one calculation forms the basis for another, such as noise pollution and air quality predictions based on traffic forecasts, then the uncertainty in the assessment grows even larger.

Examples of uncertainty margins	
	Indicative margins
Traffic forecasts (numbers)	> 15–20%
Air quality ($\mu\text{g}/\text{m}^3$)	> 20%
Noise (dB)	> 2 dB
Effects of air quality on public health (DALY)	> 70%
Effects of noise on public health (DALY)	> 100%
Atmospheric nitrogen deposition ($\text{kg}/\text{ha}/\text{year}$)	> 70%
Environmental effects	small – very large
Greenhouse gas emissions (kg/year)	> 3–50%
Effects of climate change	large – very large

Are uncertainties bad?

Uncertainties in EA are a fact of life. Research can reduce, but never entirely eliminate uncertainties. This means that decision-makers have to make decisions based on uncertain information. It is important that the associated risks of the uncertainties are managed. Ignoring uncertainties leads to ineffective choices and actions.

In the implementation of plans and projects, the actual effects in the ground may be better or worse than predicted. If the impact is smaller than initially expected, some measures may have been taken unnecessarily. This can have both financial *and* environmental consequences. Consider for example the impact on the landscape of an unnecessarily constructed noise barrier. If the impact is greater than initially predicted, this could mean that statutory limit values are exceeded or that there are undesirable public health effects.



How to do deal with uncertainty?

A good way of dealing with uncertainties in EA is to apply an 'adaptive strategy'. An adaptive strategy works as follows:

- The uncertainty margins of impact assessments are explicitly recognised.
- Risk management measures are determined in advance.
- These measures are kept 'in reserve' in case the impact is worse than expected.
- The actual impacts are monitored.
- The measures in reserve are implemented to reduce unexpected impacts discovered during monitoring.

How can the EA be helpful?

EA can be helpful in identifying uncertainties and setting out suitable adaptive strategies. Below is a 5-step example of how this can work.

Step 1: Determine the uncertainty range of the impacts

Due to the uncertainties, the predicted value is probably not equal to the actual value on the ground. The actual value will be somewhere within a range above and below the calculated value. To determine the uncertainty range you could use the uncertainty margins in the table, or calculate the values for two impact scenarios, for example: one scenario with mild impacts and one with severe impacts.

Step 2: Determine the probability of the scenarios

The question here is: what is the probability that the best or the worst-case scenario will occur? If the decision-maker is able to understand how realistic the various scenarios are, this can help them to make a decision.

Step 3: Determine the importance of the uncertainties for comparing the alternatives

If the project or plan alternatives are very similar, it will be relatively easy to indicate which alternative will have the greatest environmental impact because the impacts will be similar too. However, more distinct alternatives make things more complicated, because the nature of the uncertainty will vary as well. In this case you need to take uncertainty margins into account when comparing the alternatives, and when determining which alternatives differ substantially.

Step 4: Determine the probability of the threshold values being exceeded

Uncertainties also play a role when impact scenarios are tested against regulatory norms and standards. A rule of thumb is that the actual value can be found within a range equivalent to the calculated value plus or minus half of the uncertainty margin. So the norm is unlikely to be exceeded if the limit value is greater than the calculated impact value plus half of the uncertainty margin. If the limit value is lower than the calculated value minus half of the uncertainty margin, then it is likely that the actual value *will* exceed the limit value. Values in between are uncertain.

Example: Exceeding the dust threshold value

The air quality norm for fine dust is $40\mu\text{g}/\text{m}^3$. Suppose that the uncertainty margin in the calculation is 20%:

- If the calculated value is $< 36\mu\text{g}/\text{m}^3$, then the limit value will probably not be exceeded.
- If the calculated value is $> 44\mu\text{g}/\text{m}^3$, then the limit value will probably be exceeded. In this case, the plan or project will need to be adapted, or measures will need to be taken;
- If the calculated value is between 36 and $44\mu\text{g}/\text{m}^3$, then it is uncertain whether the limit value will be exceeded.

Step 5: Determine whether and how the measures 'in reserve' will be implemented

It must be clear beforehand who will carry out a certain measure and when this is going to happen. Important points to be considered:

- What are the possible measures?
- What is the expected impact of these measures?
- How are actual impacts determined?
- What are the criteria for deciding whether and when a measure will be implemented?
- Who is responsible for implementation and its funding?
- In what order are the measures to be deployed?

Example: Impact of traffic

When comparing the environmental effects of two-lane and four-lane roads, the type of impact is the same for each type of road, but the extent of the impact will vary. It is clear that the four-lane road will have a greater environmental impact, irrespective of the uncertainty in the calculations.

Now suppose there are two alternatives that reduce traffic intensity on a road: the first focuses on traffic management and the second on stimulating the use of public transport. The uncertainties related to the effects of traffic management are of a different nature than the uncertainties involved in public transport. A statistical test needs to be carried out to determine whether – given the uncertainties – there is a significant difference between cases 1 and 2.

Knowledge gaps

Adaptive strategies are also useful in case of knowledge gaps.

Situation 1: A planned activity will lead to increased noise pollution in the habitat of a protected bird species. It is uncertain whether the population will decline, because the cause-effect relationship is unknown. The species may well suffer very little from the increased noise. Of course, an in-depth research project can be carried out to determine the cause-effect relationship. However, it is also possible to follow an adaptive strategy. The population can be monitored, and if it does decline, then the reserve measures (such as improving nesting or foraging opportunities) can be implemented.

Situation 2: Studies reveal that a certain region may host archaeological sites. It is uncertain if they really exist and if so, where exactly. This uncertainty could be dealt with by reserving a zoning category for archaeological excavation beforehand (e.g. green zones), without determining precisely where these areas will be located. If further investigation does indeed bring archaeological sites to light, the latter can be preserved as green zones and integrated as such in development plans.

Need to know more?

Additional information can be found at www.commissiener.nl (in Dutch) or at www.eia.nl (in English)

You can also contact our help desk:

- Phone: +31 30 234 7666
- E-mail: kennisplatform@eia.nl

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