TOPIC

Risk Analysis at a Societal Level

Method and Process for Producing
'Analyses of Crisis Scenarios (ACS)'

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Through the Agreement on the European Economic Area (EEA), Iceland, Liechtenstein and Norway are partners in the internal market with the Member States of the European Union.

In order to promote a continuous and balanced strengthening of economic and trade relations, the parties to the EEA Agreement have established a and trade relations, the parties to the EEA Agreement established a multi-annual Financial Mechanism, known as the EEA. known as EEA Grants.

The EEA Grants aim to reduce social and economic disparities in Europe and to strengthen bilateral relations between these three countries and the beneficiary countries.

For the 2014-2021 period, a total contribution of 2.8 billion euros has been agreed for 15 beneficiary countries. for 15 beneficiary countries. Portugal will receive 102.7 million euros.

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CONTENTS

CHAPTER

01

Background

BACKGROUND

In February 2019, the Norwegian Directorate for Civil Protection (DSB) published a new edition of Analyses of Crisis Scenarios (ACS) (previously called the National Risk Assessment) containing a compilation of 25 different risk analyses of serious adverse events that could strike Norway. This methodology document describes the method and process behind the work on ACS 2019. The hope is that it will facilitate transparency and verifiability of the assessments and results, as well as describe a method for risk analyses that, after the necessary adaptations, can also be used in other contexts.

According to the Civil Protection Instructions[1], ACS forms part of the primary basis for planning ministries' civil protection work. ACS also functions as a common backdrop for risk and vulnerability assessments in government agencies, counties and municipalities. In other words, ACS's target group is every public body that has responsibilities within the area of civil protection.

This document covers the first three steps of a risk management process, as described in NS-ISO 31000:2018 Risk management - Guidelines, i.e. the steps scope, context and criteria, hazard identification and risk analysis. The two final steps of the risk management process, risk evaluation and risk management, are not covered by ACS. Responsibility for these lies with the individual ministry, which also has to conduct more detailed analyses of risk and vulnerability within their areas of responsibility.

Risk is always about what might happen in the future and therefore about uncertainty. The uncertainty relates to whether a specific adverse event will occur and, if it does, the consequences such an event would have. At the same time, these assessments are themselves encumbered with a larger or lesser degree of uncertainty. We use concepts such as likelihood, consequences, vulnerability and uncertainty to assess and describe risk.

Risk analyses can be conducted in various ways and the methodological choices and understanding of concepts are crucial for how we analyse and present risk. We report the results from each analysis individually, but also summarise them in tables and diagrams. Meanwhile, a good overview requires methodological consistency and that is why we use the same template for all of the analyses in ACS.

ACS takes a social science approach and uses qualitative data, expert assessments and broad participation in the analysis processes. In some analyses, especially of natural events, we also use technical and natural science methods and quantitative data, especially in assessments of likelihood.

Two factors indicate that a broad social science approach should be used for ACS:

1. We are analysing rare events where the source data is limited.
2. We describe consequences such as the loss of various societal assets and these must largely be qualitative assessments.

The analysis results are subjective assessments based on the background knowledge of those involved in the analysis and the available source data. Nobody knows the true or 'objective' risk. However, who the risk is being assessed by does matter. DSB does not possess technical expertise in all of the areas in which analyses are conducted in ACS. Therefore, the involvement of experts in the process is essential for the quality and credibility of the analysis. Good cooperation with sectoral authorities and independent specialist environments is important for obtaining the necessary background knowledge and for conducting the actual analysis process. As the agency responsible for the method and process, DSB is ultimately also responsible for the analysis results and conclusions we present in ACS.

[1] Instructions for the ministries' work with civil protection and emergency preparedness, Ministry of Justice and Public Security (2017)

CHAPTER

02

Changes since the previous edition of the methodology document (2015)

CHANGES SINCE THE PREVIOUS EDITION OF THE METHODOLOGY DOCUMENT (2015)

The most important changes since the previous edition of this document are:

- We no longer categorise risk areas and scenarios into three main groups: natural events, major accidents and intentional acts. The reason for this is that many of the scenarios can be triggered in different ways without this necessarily being of significance for the sequence of events or consequences. For example, forest fires can be caused by lightning strikes, sparks from forestry machinery or goods trains, or they can be started deliberately.
- System descriptions and vulnerability assessments are more explicitly described as separate process steps in the analyses.
- We now present possible risk mitigation measures after each analysis.
- We now describe likelihood in a 100-year perspective, i.e. how likely it is that the event will occur in a 100-year period. We also indicate the annual likelihood. This change was made in order to provide an indication that can be more readily understood than is the case if one only indicates annual likelihood. Nevertheless, the indication of likelihood is still an expression of how likely it is that the event could occur given the current situation. In other words, expected future trends with respect to, for example, the climate, technology, etc. are not taken into account (apart from in some individual analyses where this is explicitly explained).
- Transferred likelihood: we no longer only indicate the likelihood of the concrete scenario that has been analysed, we also indicate the likelihood of similar events in the country as a whole. However, this likelihood cannot simply be compared with the consequences described in the analysed scenario.
- Consequence type '1.1 Deaths' has been simplified by us no longer assessing accelerated deaths separately.
- We have made some minor changes with respect to what is included in consequence types '3.1 Direct financial losses' and '3.2 Indirect financial losses'. The first now also includes costs for cleaning up and hospital treatment, while in the second we allow the inclusion of falls in property and share values, as well as costs linked to increased security requirements.
- Under consequence type 4.1 we have added an extra indicator that takes account of the degree to which the population as a whole identifies with the victims of the event.
- We now state total uncertainty on a five-part scale and not on a three-part scale as before.
- Consequence type '5.2 Loss of territorial control' is not used in the 25 analysed scenarios. The reason for this is that none of the events that have been analysed entail such consequences. The contents of this consequence type need to be revised before analyses in which it could be used are conducted.
- Otherwise, we have made a few minor clarifications and concretisations under several of the other consequence types, without this having had a material impact on the results of the risk analyses.

CHAPTER

03

The main steps in producing Analyses of Crisis Scenarios

As mentioned above, ACS covers the initial steps of a risk management process: context and scope, hazard identification and risk analysis.

The work on ACS can be divided into seven more detailed process steps as shown in Figure 1.

3.1 DETERMINE THE PURPOSE OF THE ANALYSIS

The perspective of ACS is national. The primary purpose is to provide input for the risk management in ministries and sectoral authorities. The document is also intended to serve as a backdrop for risk analyses in sectors, counties and municipalities, as well as in other bodies.

The purpose of the document constitutes an essential part of the context for the analyses and is of relevance for all steps of the process.

The purpose of the individual analyses in ACS may be a wish to concretise the risk associated with an event, to explore the potential risk of an unknown event or to take an in-depth look at the system's vulnerability and find concrete measures, etc. The purpose of the analysis can be formulated as follows: what questions is the risk analysis supposed to help answer?

FIGURE 1. The main steps in producing Analyses of Crisis Scenarios

3.2 DEFINE SOCIETAL ASSETS THAT MUST BE PROTECTED

The point of departure for conducting a risk analysis is that there are assets that we want to protect from the consequences of adverse events.

We assess the consequences of the adverse events in ACS based on how they affect five fundamental societal assets:

- Life and health
- Nature and culture
- Economy
- Societal stability
- Democratic values and capacity to govern

These are operationalised into ten consequence types, ref. section 4.2.5.

3.3 IDENTIFY HAZARDS AND THREATS

The risk analyses in ACS are scenario based. The events for which scenarios must be designed are chosen on the basis of a broad analysis of existing knowledge about risk, emergency preparedness and prevention within various *risk areas*. This is partly done by obtaining information from the sectoral authorities and various research and specialist environments. Other sources of knowledge about potential hazards and threats can be regional and municipal risk and vulnerability assessments, sector analyses and various reports and studies, both Norwegian and international.

ACS 2019 discussed 16 risk areas:

1. Extreme weather and flooding
2. Landslides and avalanches
3. Infectious diseases
4. Forest and wilderness fires
5. Space weather
6. Volcanic activity
7. Earthquakes
8. Chemical and explosive incidents
9. Nuclear accidents
10. Offshore accidents
11. Transport accidents
12. Supply failures
13. Politically motivated violence
14. Revenge motivated violence
15. Security policy conflicts
16. Cyber attacks

The categories do not cover the entire spectrum of risk, and nor are they mutually exclusive. A cyber attack (no. 16) can, for example, result in supply failures (no. 12).

3.4 IDENTIFY ADVERSE EVENTS

Based on the knowledge we have collected about relevant risk areas, hazards and threats, we decide the types of events we are going to analyse. As a rule, we conduct a preliminary analysis of relevant events in order to assess which best meet the criteria below.

The events we analyse must:

- potentially have serious consequences that threaten one or, preferably, more of the societal assets
- be able to occur in the near future, i.e. the prerequisites for the event occurring must be in place today
- have cross-sectoral consequences and require cross-sectoral management
- entail a need for extraordinary government action in their management

The following other considerations may also be of relevance when choosing the type of events that will be analysed:

- The assumed usefulness of the analysis for the most important user groups (ministries, sectoral authorities, counties and municipalities)
- Estimated total risk (an assumption that there is a high risk could be an argument in favour of moving forward)
- Other factors:
  - A lack of knowledge about the area.
  - Attention being paid by the media and by political bodies
  - Opportunity to link to the analysis to other ongoing processes in or outside DSB.

3.5 DEVELOP SCENARIOS

We cannot analyse an event type in detail without concretising it. Such concretisation of a sequence of events is called a *scenario*.

Figure 2 shows the relationship between a risk area, event type and scenario. A number of different types of events could occur within the risk area 'extreme weather': e.g. torrential rain, heavy snowfall, heatwaves and storms. A storm of a given strength will have different consequences in different parts of the country, and wind direction, duration and precipitation volume are other variables that will also determine how serious an event becomes. In ACS 2019, one of the scenarios we described was a specific hypothetical storm event, a storm in inner Oslo Fjord.

The scenarios can be composed of several different events:

- Events that contribute to triggering the main event[2] (torrential rain triggers landslides).
- Any events that occur at the same time as the main event (lightning strikes result in power outages that complicate rescue efforts).
- Events that are a consequence of the main event (a landslide damages road and electronic communications infrastructure) but do not have further consequential events.

The scenarios description should normally contain the following elements:

- A description of the main event (strength, duration, scope).
- Triggering and any simultaneous events, as well as consequential events.
- Geographical location and the characteristics of the affected area (location specification, extent, infrastructure, population size, etc.).
- Timing of the event (season, working day/public holiday, time of day) to the extent that this may be of relevance for the likelihood and/or consequences.
- Weather conditions to the extent that this may be of relevance for the consequences.

The scenario description must also contain all of the important assumptions for the analysis. Factors that may be of relevance for the consequences, include, for example, estimated response time of the emergency services and number of people exposed to the event. Meanwhile, new information may become available in the analysis seminar that could have an impact on the analysis results. This is especially true with respect to consequential events.

The level of detail in the scenario description must be sufficient to provide a basis for assessing and specifying likelihood and consequences in as concrete and quantifiable a manner as possible.

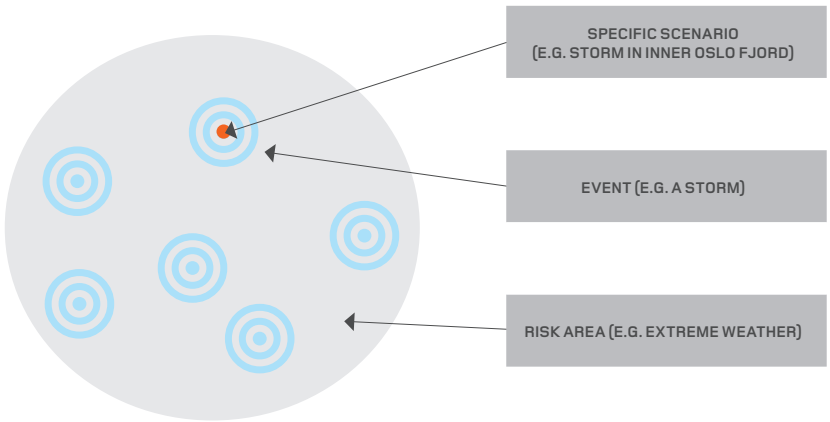

FIGURE 2. The relationship between risk areas, adverse events and scenarios

[2] In some cases, the term 'top event' or 'adverse event' is also used to refer to what we here call the 'main event'.

CHAPTER

04

The risk analysis

4.1 PROCESS

The risk analysis process has three main phases:

1. Preparatory work/information collection.
2. Analysis seminar.
3. Processing and quality assurance.

Information is collected in order to establish a basic understanding of the system or systems we are going to analyse. We collect statistics, factual information and/or various types of studies and analyses conducted by municipalities, county governors, sectoral authorities, research institutions and other specialist environments. We also collect relevant knowledge about, and experiences from, similar events in Norway and abroad.

The preparatory work also includes designing a scenario to analyse. The work on indicating the likelihood of the scenario occurring also starts now. Both are done in close dialogue with competent authorities and other expertise in the area. Potential triggering events and vulnerabilities (failures of – or missing – barriers) are key in assessing likelihood. We document the basis for the assessment of likelihood in writing. The indication of likelihood is later discussed and anchored in the analysis seminar.

We usually need to involve far more specialist environments in the assessment of the consequences of an event than in the assessment of the likelihood of it occurring. For example, a single meteorologist can assess the likelihood of extreme weather based on statistics and their expert knowledge.

However, when assessing the consequences of extreme weather, we need to involve the police, the health service, infrastructure owners and many others. This is an important reason why impact assessments are based on an analysis seminar, which often involves 20-40 participants. Such an analysis seminar is also a suitable forum for discussing the effects of consequence mitigation barriers (including emergency preparedness) and finally the overall consequences for the population of the event within the various types of consequence types. The participants in such analysis seminars come from sectoral agencies and specialist environments with expertise in assessing the various aspects of the sequence of events in the scenarios and the consequences they will have. The experts take part as specialists and not as formal representatives of their employer. If the scenario is particularly complex, there may be a need to hold several analysis seminars.

Another important effect of an analysis seminar is that it promotes knowledge sharing and creates a shared understanding of a phenomenon across subject and agency boundaries. As a method, expert seminars have their strengths, such as the transfer of knowledge and effectiveness, but they also have certain weaknesses. The quality and accuracy of the assessments depend on the expertise represented and the process in the seminar. Therefore, after a seminar there is often a need to collect further information and process and quality assure the conclusions.

The follow-up work results in a draft report. All of the seminar participants should be given an opportunity to read the draft analysis and comment on it. DSB is responsible for the final assessments. Since 2014, the analyses have been documented in separate sub-reports.

FIGURE 3. The three main phases in the conduct of risk analyses in ACS

4.2 METHODOLOGY

The risk analysis represents one step in the risk management process (ref. the second to last step in Figure 1). The analysis itself can be divided into six steps as shown in Figure 4.

FIGURE 4. Steps in a risk analysis

The risk analyses in ACS are based on a description of the system within which the event occurs. The system may be society as a whole, a local community, a societal function or a physical installation like, for example, a tunnel or a drilling rig.

The analysis itself concentrates on:

- Vulnerabilities in the system that influence the likelihood and consequences.
- The likelihood of the adverse event occurring.
- The consequences the event would potentially cause.
- The uncertainty associated with the analysis results.

  - The strength of the knowledge base.
  - The sensitivity of the results to changes in the assumptions.

Figure 5 shows a bow tie model of the sequence of events before and after an adverse event and provides a framework for the analyses in ACS.

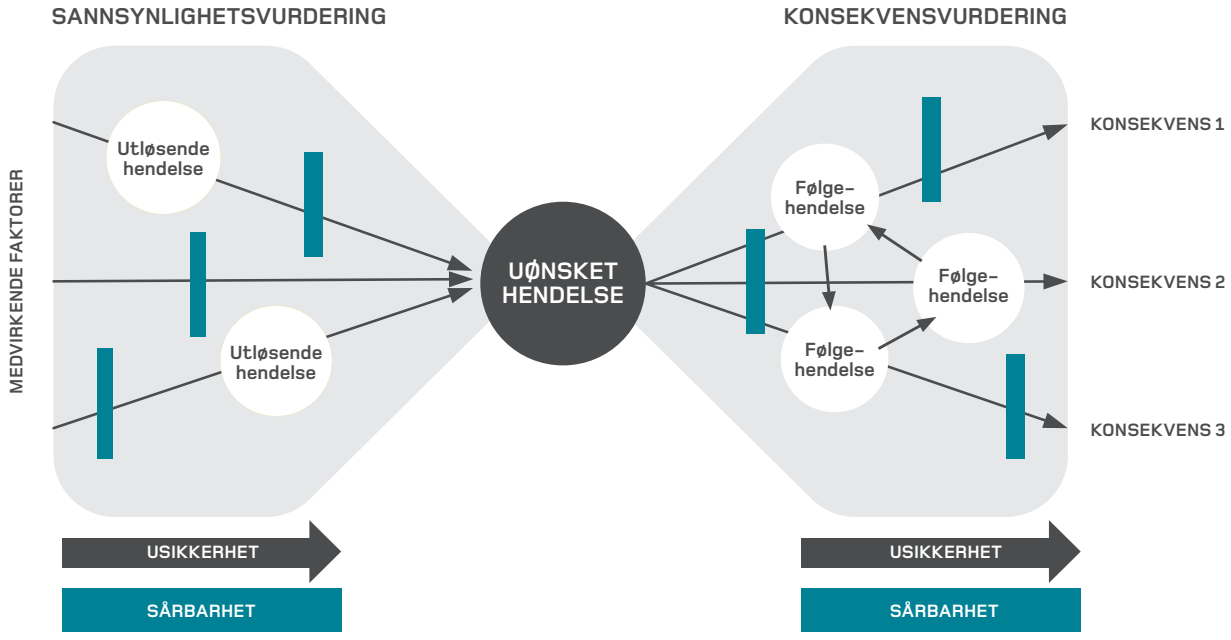

FIGURE 5. Bow tie model as a framework for risk analyses in ACS (finnes det en rapport med engelsk bowtie?)

4.2.1. SYSTEM DESCRIPTION

The system description is necessary to define and delineate what should be included in the actual analysis. The description provides an overview of the conditions in the community, function or installation that is the subject of the analysis and that may be of relevance with respect to whether the event occurs, for the sequence of events and for the consequences of the event. This includes the barriers that have been established to mitigate the likelihood of the event occurring, the barriers that can mitigate the scope of the consequences and the consequential events the event may trigger. We survey, for example, population number and composition (demographics), as well as technical and natural conditions.

4.2.2. ASSESS VULNERABILITY

Both the likelihood of an event we are analysing occurring and the consequences it may have are related to the resilience of the system. Inadequate resilience is an expression of vulnerability.

Vulnerability should be understood here as meaning a system's inability to withstand or tolerate an event without there being serious consequences. Likelihood depends on how effective and resilient the barriers supposed to prevent an adverse event are. Similarly, the consequences an adverse event will have greatly depend on the effectiveness and resilience of the barriers intended to mitigate the negative impacts of the adverse event.

Vulnerabilities are often identified through sensitivity assessments (ref. the discussion in section 4.2.5) of the results (e.g. that the stated likelihood or consequences depend on a specific barrier functioning as intended).

4.2.3. ASSESSMENT OF LIKELIHOOD

We use likelihood to express *how likely* it is that the scenario on which the analysis is based will occur. We express this as a percentage that indicates the likelihood of the event occurring in a 100-year period. The indication is really an expression of the likelihood of the event occurring today and is based on current social, technological and climatic conditions.[3] We express likelihood as likelihood in a 100-year period because this results in a larger and more readily understood figure than an indication of annual likelihood.

We categorise indications of likelihood into five intervals on a scale from *very low* til *very high*, ref. Table 1.

THE LIKELIHOOD OF THE EVENT OCCURRING IN A 100-YEAR PERIOD	
> 90%	Very high
70 – 90 %	High
40 – 69 %	Moderate
10 – 39 %	Low
<10 %	Very low

TABLE 1. Likelihood intervals in ACS

See Appendix A for a table for converting from annual likelihood to likelihood in a 100-year period.

We do not indicate the likelihood of intentional acts in ACS. There are a number of reasons for this. The most important is that the likelihood of such events can change faster than the likelihood of unintentional acts.

4.2.4. TRANSFERRED LIKELIHOOD

We indicate two different likelihoods in the analyses. Besides the likelihood of the specific scenario occurring, we indicate the likelihood of this type of event occurring on a national basis. Given that the scenarios are very specific (a given course of events in a specific location), the likelihood of them occurring will usually be relatively low. However, many are just as interested in getting an idea of how likely it is that an event of the relevant type may occur in the country as a whole.

The difference between likelihood and transferred likelihood can be illustrated with an example: The Norwegian Water Resources and Energy Directorate (NVE) has registered ten densely populated areas where a serious quick clay landslide could occur. The quick clay landslide scenario in ACS is set in one of

[3] I noen enkeltanalyser er det tatt hensyn til forventede klimaendringer. Dette er da beskrevet eksplisitt.

these, Øvre Bakklandet in Trondheim, and the likelihood of such an event occurring here is estimated at 4 per cent in a 100-year period. However, the likelihood of a landslide occurring in one of the ten quick clay zones is far higher and estimated as 35 per cent in the analysis. Meanwhile, it is worth noting that a landslide elsewhere would not necessarily have the same consequences as those described for the landslide in the scenario.

4.2.5. ASSESSMENT OF CONSEQUENCES

When assessing consequences, we take the five societal assets as our starting point. We have defined two consequence types for each of them. The impact assessments cover the main event itself, any simultaneous events and consequential events that are a direct consequence of the main event. These can be consequential events that were included as part of the scenario or events that have emerged during the analysis process.

We score the impacts of the event for each of the consequence types on a five-part scale from very small (A) to very large consequences (E). The consequence types are set out in Table 2.

SOCIETAL ASSET	CONSEQUENCE TYPE
Life and health	Death – number
	Serious injuries and illness – number
Nature and culture	Long-term damage to natural environment
	Irreparable damage to the cultural environment
Economy	Direct financial losses
	Indirect financial losses
Societal stability	Social and psychological reactions
	Effects on daily life
Democratic values and capacity to govern	Loss of democratic values and national capacity to govern
	Loss of territorial control

TABLE 2. The five societal assets and the associated consequence types

A more detailed description of the consequence types, how they should be understood and measured, is provided in Appendix B.
We add together the consequence scores by assigning each of the scoring categories A-E a numerical value (1–2–4–8–16). This results in a numerical expression of the total consequences, which is in turn categorised using a scale of very small to very large, ref. Appendix C. Together with the assessments of likelihood, this makes it possible to assess the risk associated with different scenarios in relation to each other.

4.2.6. ASSESSMENT OF UNCERTAINTY

We conduct risk analyses because we are unsure about what the future may bring. By assessing the likelihood and consequences of possible future events, we are attempting to provide a picture of this uncertainty.

In addition to this, the knowledge base on which the analyses are based can be strong or less strong, which can result in different degrees of uncertainty in relation to the analysis results. The assessments of uncertainty can in themselves also be more or less uncertain. The degree of uncertainty in the assessments of likelihood and consequences is therefore subject to special review.

In such assessments of uncertainty, we look at:

- The knowledge base for the assessments of likelihood and consequences (epistemic uncertainty).
- The results' sensitivity to changes to the assumptions (sensitivity).
- *Epistemic* uncertainty is linked to the scope and quality of the knowledge on which the analysis is based. We know a lot about some phenomena and some effects of phenomena. In other areas our knowledge is poorer. Information about the strength of the knowledge base on which the analysis is based is important for the interpretation of the results.

We use three indicators, suggested by Flage & Aven (2009), to assess the strength of the knowledge base:

1. *Access to relevant data and experience.*

2. *Comprehension of the incident/phenomenon that is being analysed (how good is the explanatory model?).*

3. *Degree of agreement among the experts participating in the risk analysis.*

The *sensitivity* of the analyses should be understood as the degree to which the analysis results rely on uncertain assumptions. If small adjustments to the assumptions change the analysis results a lot, this indicates that the uncertainty is great.

In addition to these forms of uncertainty there are other forms that are less relevant in the context of ACS. The methodological uncertainty will depend on the degree to which the method used is suitable for identifying risk within an area. An assessment of the current risk associated with terrorism based on statistical materials would, for example, have major weaknesses.

Statistical or aleatoric uncertainty can be quantified mathematically. Such uncertainty assessments are important for analyses based on statistical materials. However, the analyses in ACS are generally linked to events that are so rare that it is impossible or meaningless to indicate a statistical likelihood (with associated random variations/uncertainty) that they will occur. However, prior events can contribute to our comprehension of the phenomenon we are analysing – how it arises and develops.

We describe the overall assessment of uncertainty (the strength of the knowledge base and sensitivity) on a scale from very low to very high, ref. Appendix D.

CHAPTER

05

Presentation of the results of the analysis

PRESENTATION OF THE RESULTS OF THE ANALYSIS

Each scenario analysis in ACS contains a description of the sequence of events and assessments of the vulnerabilities in the system, likelihood of the scenario, likelihood of a similar event occurring on a national basis (*transferred likelihood*), and consequences within each of the five societal assets, as well as an overall assessment of the uncertainty and possible risk mitigation measures.

We indicate the likelihood on a five-part scale from *very low* to *very high*. The same applies to uncertainty. Similarly, we indicate the consequences on a scale from *very small* til *very large* for each consequence type and overall.

The basis for setting the score of each individual consequence category is summarised in Appendix B. This also shows how the overall consequences occur.

We also present the analysis results collated in figures and diagrams, including in a risk matrix that provides an overview of how the various scenarios relate to each other with respect to risk. Such matrixes have some weaknesses and cannot simply be used for further analysis and prioritisation. Nevertheless, such collation can provide a good starting point for reflection and discussion.

The prioritising of measures cannot only take account of risk, it must also take account of the potential for risk mitigation within the various types of event. This also includes an assessment of the effects of the measures in relation to their associated costs.

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- Terminology

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Appendices

APPENDIX A: ANNUAL LIKELIHOOD AND LIKELIHOOD IN A 100-YEAR PERIOD

ANNUAL LIKELIHOOD IN PER CENT	LIKELIHOOD IN A 100-YEAR PERIOD IN PER CENT.	LIKELIHOOD INTERVALS
0,0001	0,01	<10% Very low
0,001	0,1	
0,01	1	
0,1	9,5	
0,2	18,1	10-39% Low
0,3	26,0	
0,4	33,0	
0,5	39,4	
0,6	45,2	40-69% Moderate
0,7	50,5	
0,8	55,2	
0,9	59,5	
1,0	63,4	
1,5	75,1	70-90% High
2,0	86,7	
3,0	95,2	>90% Very high
5,0	99,4	

APPENDIX B: DESCRIPTION OF CONSEQUENCE TYPES AND DETERMINATION OF SCORE

We assess the direct consequences of the adverse event and of consequential events (in one paragraph).

The consequence scores are:

A	Very small
B	Small
C	Moderate
D	Large
E	Very large

1. LIFE AND HEALTH

1.1. CONSEQUENCE TYPE: DEATHS

Deaths include those who die as a consequence of the adverse event or its direct consequential events.

The score is determined on the basis of the number of people it is estimated will die due to the event.

NO. OF PEOPLE	0	1–5	6–20	21–100	101–300	> 300
Score	-	A	B	C	D	E

1.2. CONSEQUENCE TYPE: SERIOUS INJURIES AND ILLNESS

By *serious injuries* we mean all injuries that require hospital treatment and/or that may result in prolonged impairment, for example fractures, head injuries, burns and internal injuries.

By *serious illness* we mean all illnesses triggered by the event that require hospital treatment and/or result in prolonged impairment, including infectious diseases, poisoning, post-traumatic stress syndrome and other mental health disorders.

People who are not directly affected by the event, but who develop (mental health) disorders due to their relationship to those directly affected should not be included.

NO. OF PEOPLE	0	1–20	21–100	101–300	301–1200	> 1200
Score	-	A	B	C	D	E

2. NATURE AND CULTURE

2.1. CONSEQUENCE TYPE: LONG-TERM DAMAGE TO NATURAL ENVIRONMENT

In this context, the term the *natural environment* means the natural world as the living environment of plants and animals. The natural environment is limited to including nature's intrinsic value. This means that its recreational value for people is not included in the assessments.

We assess consequences based on geographical distribution, duration and the damaged area's national value. In those cases where the event results in long-term or permanent damage to inland nature (e.g. due to radioactive fallout), we indicate the scope of the damaged area measured in km^2. In those cases where the event primarily impacts coastal nature, lakes and watercourses, we indicate geographical distribution such as length (in km) of the affected beachline [1] or the affected watercourse.

We indicate duration in years and this covers the time it takes from the damage occurring until the natural environment has been fully restored, that is until it is back to its normal condition.

GEOGRAPHICAL DISTRIBUTION (KM^2 OR KM)	**<3**	**3–30**	**31–300**	**301–3000**	**>3000**
DURATION					
3-10 years	-	A	B	C	D
More than 10 years	A	B	C	D	E

If the same event results in multiple types of damage due to natural disaster, the highest score applies.

If the damaged natural environment is of special national value, the score is adjusted upwards by one level. The area impacted by the event is of special national value if:

a) endangered plants and animals ('red list' species) and/or important habitat for such plants and animals will be permanently weakened
b) nature conservation areas (national parks, landscape protection areas or other protected areas) will be affected

2.2. CONSEQUENCE TYPE: IRREPARABLE DAMAGE TO THE CULTURAL ENVIRONMENT

Cultural heritage sites are physical traces of human activity related to important historical events, beliefs, traditions, etc. A *cultural environment* is an area in which cultural heritage sites form part of an intrinsic whole. In order for the damage to an object or an area to be covered by this category, the object or area must have *formal protection status*. Generally, one can distinguish between two forms of protected status:

a) protected cultural heritage sites and environments pursuant to the Cultural Heritage Act
b) cultural heritage sites and environments worthy of preservation based on a decision made by local or regional authorities

Irreparable damage means that the cultural heritage site or environment will lose significant value even if the damage is repaired or the site/environment is restored.

[1] A beachline is a dividing line between land and a water surface in the sea or in lakes (Store Norske Leksikon).

DEGREE OF CULTURAL HISTORICAL VALUE NO./TYPE	WORTHY OF PRESERVATION BASED ON MUNICIPAL OR COUNTY AUTHORITY DECISIONS	PROTECTED PURSUANT TO THE CULTURAL HERITAGE ACT.
1-2 cultural heritage sites	A	C
More than 2 cultural heritage sites	B	D
1-2 cultural environments	B	D
More than 2 cultural environments	C	E

If the event damages both cultural heritage sites and cultural environments, the highest score is used. In practice, this means that the damage to cultural environment(s) is decisive.

In special cases, judgement can be exercised within this consequence category and a higher score than the one stated in the table can be determined. An example of where this might apply would be the loss of cultural heritage sites or environments on the UNESCO World Heritage List.

3. ECONOMY

3.1. CONSEQUENCE TYPE: DIRECT FINANCIAL LOSSES

This consequence type includes material damage to property and the loss is indicated based on repair costs or replacement value.

We assess the value of damage to:

- Buildings and other infrastructure.
- Inventory, machinery, equipment, etc.
- Forest, cultivated land and wilderness.

The consequence type also includes extraordinary direct costs to society associated with:

- Clean-up
- Hospital treatment

Costs linked to the efforts of the Norwegian Armed Forces, rescue services and voluntary organisations. [2]

LOSS IN NOK	<100 MILLION	100-500 MILLION	0.5-2 BILLION	2-10 BILLION	>10 BILLION
Score	A	B	C	D	E

3.2. CONSEQUENCE TYPE: INDIRECT FINANCIAL LOSSES

The consequence type includes obvious business and socioeconomic losses due to the event. Losses that are scored within other consequence types (loss of human life, cultural heritage sites, etc.) are not included in the assessment of socioeconomic costs.

[2] In this context 'rescue services' means the police, fire and rescue services, ambulance service, accident and emergency departments, Norwegian joint rescue coordination centres, rescue helicopter services and the Norwegian Civil Defence.

The following cost elements must be assessed:

- Loss of income from business operations as a result of material damage and reduced production capacity.
- Loss of income from business operations as a result of disruptions in operations, failure in the delivery of goods and critical inputs, loss of reputation and loss of market shares.

To the extent they are relevant, permanent falls in property and share values can also be included. The same applies to permanent costs due to changed security requirements due to the event.

LOSS IN NOK	<100 MILLION	100-500 MILLION	0.5-2 BILLION	2-10 BILLION	>10 BILLION
Score	A	B	C	D	E

4. SOCIETAL STABILITY

4.1. CONSEQUENCE TYPE: SOCIAL AND PSYCHOLOGICAL REACTIONS

This consequence type is meant to provide a picture of the effect the event has on the population in general. We determine the score based on an analysis of the characteristics of the event. These are characteristics we assume are of relevance with respect to the degree to which the event will trigger social and psychological reactions *in that part of the population that is not directly affected by the event*. Such reactions can be anxiety, frustration, mistrust, anger, etc. and can manifest themselves socially through participation in demonstrations, debates in social and other media, etc.

CHARACTERISTIC	EXPLANATION
Unknown incident	The event, its cause or its consequences are unknown in the sense that it has not been experienced previously, or one did not think it could occur in Norway. *The more unexpected or unfamiliar an event is, the greater the anxiety we assume it will create.*
The incident affects vulnerable groups in particular	The event largely affects groups that society has a special responsibility to protect. Such vulnerable groups include children, people with disabilities, the sick and others who particularly need help. *The greater the degree to which the incident affects vulnerable groups, the stronger the emotional reactions we assume it will create.*
Deliberate act	The event was an act planned and carried out by a person, a group of people or a state where the primary purpose is to take revenge, express hate, create fear and/or put pressure on the authorities. *The clearer it is that it was a malicious act, the stronger the emotional reaction we assume the act will cause.*
Inability to escape	The nature of the incident is such that the people impacted are unable to escape from it or protect themselves from the consequences. Those impacted cannot influence the sequence of events. *The less opportunity the directly impacted have to help themselves, the stronger we assume the emotional reactions in the population will be.*

CHARACTERISTIC	EXPLANATION
Breach of expectations	An impression is formed (rightly or wrongly) that the event or its consequences could have completely or partially been avoided with better prevention and/or emergency preparedness on the part of the authorities. *The greater the impression of failure in prevention and/or management is, the greater the population's mistrust in the authorities will be.*
Inability to manage the event	Rescue personnel and the emergency services have problems reaching the site of the event, and/or lack sufficient equipment and/or expertise to deal with it. *The harder it is to manage the event (purely physically), the greater the degree of anxiety and feeling of powerlessness we assume the event will cause.*
The event strikes randomly	The event could just as easily have affected me. *The easier it is to identify with the victims, the greater the degree of anxiety we assume the event will cause.*

We assess the degree to which the event is characterised by the points in the table above. We assess each of the characteristics on a six-part scale in which each step has a numerical value from 0 to 5:

TO WHAT DEGREE IS THE CHARACTERISTIC PRESENT?	NOT PRESENT	VERY SMALL DEGREE	SMALL DEGREE	MODERATE DEGREE	LARGE DEGREE	VERY LARGE DEGREE
Numerical value	0	1	2	3	4	5

We determine the total score based on *an average of the three characteristics that we consider most present* (the three highest scores), rounded off to the nearest tenth in line with the normal rules.

AVERAGE OF THE THREE CHARACTERISTICS	<1	1–1,4	1,5–2,4	2,5–3,4	3,5–4,4	4,5–5,0
Score	-	A	B	C	D	E

4.2. CONSEQUENCE TYPE: EFFECTS ON DAILY LIFE

Events that can cause a temporary loss of welfare in the form of a variety of hardships in everyday life. This could involve insufficient access to food and water, heat, electricity, electronic communications, etc. The hardships are often caused by the failure of critical infrastructure or critical societal functions.

We base the assessments on three different indicators:

I. DISRUPTION OF THE POWER SUPPLY

We determine the score on the basis of the number of subscribers who lose power supply and the duration of the loss of power. People who are evacuated are not included.

NO. OF PEOPLE / DURATION	100 – 1000	1001 – 10 000	10 001–100 000	>100 000
1-2 days	A	A	B	C
3-7 days	A	B	C	D
1 week to 1 month	B	C	D	E
>1 month	C	D	E	E

The highest score will apply if more than one applies.

II. FAILURE OF OTHER CRITICAL SOCIETAL FUNCTIONS

We assess whether or not the event and/or any consequential events will cause the following services or deliveries to fail:

- Food supply.
- Ordinary drinking water supply from waterworks.
- Electronic communications.
- Supply of medicines and medical consumables.
- Means of payment and/or payment transfer services.
- Goods and passenger transport.

The failure must be material in the sense that those affected experience it as a hardship. We determine the score based on the number of affected people and duration. Those who are evacuated are not counted. We conduct an assessment for each of the five services/deliveries mentioned above.

NO. OF PEOPLE / DURATION	100 – 1000	1001 – 10 000	10 001–100 000	>100 000
1-2 days	A	A	A	B
3-7 days	A	A	B	C
1 week to 1 month	A	B	C	D
>1 month	B	C	D	E

The highest score applies if two services/deliveries are impacted. If three or more are impacted, adjust the score upwards by one level.

III. EVACUATION

We determine the score based on how many are evacuated and for how long they are evacuated. The highest score applies if more than one is relevant.

NO. OF PEOPLE / DURATION	100 – 1000	1001 – 10 000	10 001–100 000	>100 000
1-7 days	A	B	C	D
1 week to 1 month	B	C	D	E
>1 month	C	D	E	E

The highest score for the three indicators (I-III) applies for the consequence type 'Effects on daily life'.

5. DEMOCRATIC VALUES AND CAPACITY TO GOVERN

5.1. CONSEQUENCE TYPE: LOSS OF DEMOCRATIC VALUES AND NATIONAL CAPACITY TO GOVERN

This consequence type has two elements. Firstly, it should capture the effects of an event on the specific capabilities of important national institutions. Secondly, it should capture the degree to which the event is an attack on fundamental values and rights in Norwegian society, e.g. the rule of law, equality, freedom of expression and personal safety and integrity.

The score is based on an assessment of the extent to which the incident has the following characteristics:

CHARACTERISTIC	EXPLANATION
The event represents a threat to the functioning of national elected bodies	The event could reduce the ability of the Storting (Norwegian parliament) and the government to perform their duties and fulfil their functions
The event represents a threat to the functioning of key institutions	The event could reduce the ability of the central administration, courts, financial sector and media to perform their duties and fulfil their functions
The event represents a violation of key values in Norwegian society	The event is perceived as an attack on key values such as equality, freedom of law and expression and democracy
The events represent a violation of the individual's security and integrity	The event is perceived as an attack on the individual's basic security and integrity

TO WHAT DEGREE IS THE CHARACTERISTIC PRESENT?	NOT PRESENT	TO A LIMITED EXTENT	TO A CERTAIN EXTENT	TO A GREAT EXTENT
Value	0	1	2	3

We determine the overall score based on an average of the values determined for the four characteristics, rounded off in line with the normal rules to the nearest tenth. The average value determines the score, as shown in the table below:

AVERAGE VALUE	<1	1–1,3	1,4–1,7	1,8–2,1	2,2–2,5	2,6–3,0
Score	-	A	B	C	D	E

5.2. CONSEQUENCE TYPE: LOSS OF TERRITORIAL CONTROL

This consequence type is not used in ACS 2019 because none of the scenarios result in a loss of control over Norwegian territory. The description of the consequence type in the method document from 2015 has many weaknesses. Therefore, before analysing scenarios that assume Norway's sovereignty is impinged, the content of this consequence type and the scoring of loss of sovereignty and control must be reviewed.

The consequence type and the scoring must reflect the fact that it is unacceptable for a foreign power to take control of Norwegian territory, irrespective of whether this only involves a small area for a relatively short period of time.

The threat picture has changed since the framework for this consequence type was produced. The boundary between war and peace is not as clear as it was. The use of hybrid means may result in Norwegian sovereignty being challenged without this necessarily involving the conquest of Norwegian territory or Norwegian sovereignty being completely eliminated. More thought must be given to how minor violations of Norwegian sovereignty and Norwegian territory should be assessed, including threats to use military or other forms of power aimed at getting Norwegian authorities to submit to a foreign power's demands. Similarly, consideration must be given to how acts by a foreign power that are clearly limited regarding duration, scope or degree of intervention in Norwegian authorities' control of its territory should be assessed.

APPENDIX C: TOTAL CONSEQUENCE SCORE

The overall consequences for each scenario are collated by assigning the score (A-E) for each consequence type a numerical value. The value increases by a factor of two between the score categories.

SCORE	NUMERICAL VALUE
-	0
A	1
B	2
C	4
D	8
E	16

The numerical values for the ten consequence types are added together as shown in the example below:

CONSEQUENCE TYPE	SCORE	NUMERICAL VALUE
1.1	D	8
1.2	B	2
2.1	C	4
2.2	A	1
3.1	B	2
3.2	D	8
4.1	-	0
4.2	C	4
5.1	B	2
5.2	-	0
Total		31

The consequences' overall numerical value in this example is 31. The overall consequence score is expressed on a five-part scale from *very small* to *very large* consequences, where the intervals are provided in the table below:

TOTAL NUMERICAL VALUE	TOTAL CONSEQUENCES
1-10	Very small
11-20	Small
21-40	Moderate
41-70	Large
71-160	Very large

APPENDIX D: ASSESSMENT OF UNCERTAINTY

We assess the uncertainty associated with indications of likelihood and consequences by assessing the *knowledge base* for the analysis and the results' *sensitivity* to changes to the assumptions.

Knowledge base

We assess how the analysis relates to the following indicators:

- Access to relevant data and experiences: How good is the source data for the assessments? Are there specific experiences to build on? Good source data indicates a low level of uncertainty.
- Understanding of the event being analysed: How well known is the phenomenon? If the phenomenon is well known and has been well researched, this indicates a low level of uncertainty.
- Agreement among experts: How much agreement was there among the participants in the analysis seminar? A high degree of agreement indicates a low level of uncertainty.

Sensitivity

We assess the sensitivity of the results by looking at how sensitive the indications of likelihood and consequences are to changes in the scenario's assumptions. It is important to clarify which factors the results might be sensitive to and how much these factors affect the results of the analyses. We assess the sensitivity of both the likelihood and consequence indications.

We ask the following questions to identify the sensitivity of the results:

- What would it take for the likelihood of the event occurring to increase or decrease significantly?
- What would it take for the consequences to be significantly greater or smaller?

High sensitivity means that small changes to the assumptions can result in major changes to the analysis results (the risk) and this contributes to greater uncertainty.

Total uncertainty

We assess the strength of the knowledge base and sensitivity based on a three-part scale: low – moderate – high.

We assign each of the three score categories a numerical value:

KNOWLEDGE BASE/SENSITIVITY	LOW	MODERATE	HIGH
Numerical value	1	2	3

We calculate this based on the average value for the uncertainty linked to the strength of the knowledge base (from 1 to 3) and an average value for the degree of sensitivity (from 1 to 3).

We express the average value using a three-part scale: low – moderate – high, like this:

AVERAGE NUMERICAL VALUE	1.0–1.49	1.5–2.49	2.5–3.0
The strength of the knowledge base.	Low	Moderate	High
Sensitivity	Low	Moderate	High

We express the overall uncertainty using a five-part scale (very low – low – moderate – high – very high) and we determine this by comparing the assessments of the strength of the knowledge base and degree of sensitivity as shown in the table below.

UNCERTAINTY ASSOCIATED WITH THE STRENGTH OF THE KNOWLEDGE BASE / SENSITIVITY	LOW	MODERATE	HIGH
Low	Very low	Low	Moderate
Moderate	Low	Moderate	High
High	Moderate	High	Very high

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