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FEAT - Flash Environmental Assessment Tool to identify acute environmental risks following disasters

The tool, the explanation and a case study

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This investigation has been performed at the request of the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) by the National Institute for Public Health and the Environment (RIVM), within the projects E/609000 ‘Rapid Environmental Assessment Tool’ and S/607001 ‘Environmental Impact Assessment’, with support from the Inspectorate of the Ministry of Housing, Spatial Planning and the Environment of the Netherlands (VROM) and from the Director-General of RIVM within the framework of the Strategic Research program of RIVM, Spearhead Environmental Quality and Health. DHV-Engineering Consultancy also contributed to the development of FEAT.

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Abstract

FEAT – Flash Environmental Assessment Tool to identify acute environmental risks following disasters
The tool, the explanation and a case study

The Flash Environmental Assessment Tool (FEAT) was developed for use by field teams of the United Nations that are deployed in the case of (natural) disasters. Its primary aim is to facilitate the identification of existing or potential acute environmental impacts that pose risks for humans and nature following the release of chemical compounds. FEAT prioritizes disaster-stricken facilities on the basis of potential risk in order to prevent further impacts. It is specifically designed to be used in the immediate aftermath of a disaster (hours and days) and can be used on location. The starting point is the maximum area that can be affected by the disaster. This assessment tool was developed by the National Institute for Public Health and the Environment (RIVM), the Dutch Ministry of Spatial Planning, Housing and the Environment (VROM) and DHV Engineering Consultancy.

FEAT translates large quantities of scientific information on compounds, their environmental behavior and their toxicity into three basic effect types. These are direct effects on humans, direct effect on nature and so-called life support functions (such as drinking water, agriculture and fisheries) and long-term effects on humans and the environment. The area around the facility where possible effects can be expected is presented in the form of a risk contour area.

FEAT processes available information in a stepwise manner, which enables the user to feed in increasingly more detailed information as the situation develops. The availability of relevant information and site specificity of the risk assessment are positively correlated; as such, the less information available, the lower the site specificity of the risk assessment (a worst case approach). This mode of operation provides the user with a rapid and reliable insight into those areas that can be expected to bear the effects of the disaster.

This report comprises three sections. Section I describes the underpinning of FEAT, section II provides an example of how to use FEAT and section III contains the complete FEAT user version (FEAT 1.0), which is used by the UNDAC field teams of the United Nations.

Key words:
United Nations, emergency response, (natural) disaster, environmental impact assessment, FEAT

Rapport in het kort

FEAT - Flash Environmental Assessment Tool voor het snel identificeren van acute risico's volgend op calamiteiten
Het instrument, de onderbouwing en een case study

Voor veldteams van de Verenigde Naties die bij (natuur)rampen worden ingezet is de methode Flash Environmental Assessment Tool (FEAT) ontwikkeld. Hiermee kan worden ingeschat in welk gebied effecten van vrijgekomen chemische stoffen voor mens en milieu te verwachten zijn. De methode geeft aan welke van de getroffen bedrijven het meeste gevaar voor mens en milieu vormen, zodat daar met prioriteit naar kan worden gehandeld. FEAT is bedoeld voor de eerste uren en dagen na de ramp, en is op locatie te gebruiken. Uitgangspunt is de maximale omvang van het gebied waarin risico's te verwachten zijn. Het instrument is ontwikkeld door het RIVM, het ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieu (VROM), en DHV-Raadgevend Ingenieurs.

De methode vertaalt een grote hoeveelheid wetenschappelijke informatie over stoffen, hun milieugedrag, en hun toxiciteit naar drie soorten effecten. Dit zijn directe effecten op de mens, directe effecten op natuur en zogeheten *life support* functies (zoals drinkwater, landbouwgewassen en de visstand) en langetermijneffecten op mens en milieu. De mogelijke effecten worden weergegeven in een zone rond het bedrijf waarbinnen risico's kunnen worden verwacht.

FEAT verwerkt de beschikbare informatie trapsgewijs. Hierdoor kan steeds gedetaileerdere informatie worden ingevoerd. Hoe minder details beschikbaar zijn, hoe 'ruimer' de indicatie van gevaren wordt (*worst-case*-inschatting). Op deze wijze geeft FEAT snel en betrouwbaar inzicht in welk gebied de te verwachten risico's hun weerslag hebben.

Dit rapport bestaat ut drie secties. Sectie I beschrijft de onderbouwing van FEAT. Sectie II geeft een voorbeeldstudie van het gebruik van FEAT. Sectie III omvat de complete gebruikersversie (FEAT 1.0), zoals die door UNDAC-veldteams gebruikt wordt.

Trefwoorden:
Verenigde Naties, natuurrampen, chemische stoffen, milieu-effectbeoordeling, FEAT

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Preface

This report has been prepared by various parties, working together to transfer a large body of scientific data into a workable system for UNDAC-teams when they are sent to an area with a natural disaster which might involve a secondary release of vast amounts of chemicals.

The development of this tool was initiated at the recommendation of the Sixth Meeting of the Advisory Group on Environmental Emergencies (AGEE), convened by the United Nations Environment Programme (UNEP) and United Nations Office for the Coordination of Humanitarian Affairs (OCHA). At the request of OCHA, the Flash Environmental Assessment Tool (FEAT) has been developed by the National Institute for Public Health and the Environment (RIVM), with support from Inspectorate of the Ministry of Housing, Spatial Planning and the Environment of the Netherlands (VROM). DHV-Engineering Consultancy also contributed to the development of the FEAT).

Initially, the outlines of the method were developed by VROM and DHV-Engineering Consultancy, supported by the department Inspection, Environmental Accidents and Drinking Water (IMD) and the Centre for External Safety (CEV), both of the Dutch National Institute for Public Health and the Environment (RIVM). IMD and CEV together have compiled models, data and approaches to address direct environmental hazards for man in case of emergencies. In this phase, a first prototype of FEAT was developed. However, since impacts on man can occur also through ecosystems – for example, through those ecosystems providing foods for local populations – the team was extended with the Laboratory for Ecological Risk Assessment (LER). Through that addition, the scope of FEAT was widened, thereby making the method a tool that addresses both the direct and the indirect effects of environmental disasters involving chemical releases on man.

The final concept of FEAT was determined in close collaboration between the development team and the United Nations. Sander van Dijk guided the development of the overall concept of the methodology and acted as liaison between developers and end-users, and as liaison between theory and practice – the latter based on his practical involvement in various UNDAC-deployments. The final concept of FEAT was discussed with 7th AGEE-meeting in Geneva, July 2007. Thereafter, different processes started, with two major steps: first the final development of the tool according to the adopted final concept, and second the description of the tool for different reader groups. These steps resulted in the current report, and the publication of the User Version of FEAT. The targeted readership consists of (potential) UNDAC team members, while in practice there can be extended readership when local authorities use FEAT to derive a local Hazard Identification Tool (so called HITs; these are incidentally prepared directly after a disaster occurs). The report provides the information on FEAT in such a way that it can serve in e.g. training situations for potential UNDAC team members. Neither in this report nor in the User Version there is emphasis of scientific details, or of precise assumptions being written out extensively for this readership; the scientific details will be published elsewhere.

It is to be expected that FEAT leads to practical experiences and suggestions, either from UNDAC field teams during training or real disasters, or from cases where local HITs are prepared using FEAT, as well as from increasing scientific insights. The Dutch Ministry of VROM and the CEO-RIVM, who both supported the development of FEAT, support this future process. The development team also welcomes feedback on the method in practice and on its scientific underpinning, to eventually improve FEAT as considered appropriate.

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Summary

United Nations emergency response teams require operational tools to assess and help to reduce potential damage in case of general environmental disasters that involve chemical releases as by-product. This need is addressed by the development of FEAT, a Flash Emergency Assessment Tool. FEAT is meant as a tool which can be used in field conditions, from the first hours after a disaster. It consists of a logical user guidance, which ends up in look-up tables. One of the key issues of the tool is, that it summarizes a huge body of scientific information on the chemicals, their environmental behaviour, and their (eco)toxicity. Moreover, it is categorized in the main type of impact expected and calculated into easy-to-apply units, that is: metres of impact distance. In addition the tool consists of a tiered system, whereby increasing amounts of site-specific information can be used to derive appropriate impact assessments. The method can be used quickly, without requiring complex facilities or time-consuming calculations. The three main impact types distinguished are: direct impact on human health, direct impacts on life support functions and nature (e.g. water supply, agricultural land and fish resources) and long-term impacts (on life-support functions, nature and humans).

The method aims to quickly assess the type and magnitude of impacts to help setting priorities in handling the disaster, which results in minimizing direct and indirect impacts of chemical releases after natural disasters. This report (in three sections) describes the current version of the tool and its underpinning, illustrated by a case study. Section I provides the underpinning of FEAT. Section II presents a case study, to illustrate the use of FEAT. Section III presents the user version of FEAT (Version 1.0) for field teams. The tool has been developed by the Dutch National Institute for Public Health and the Environment (RIVM), the Dutch Ministry of Housing, Spatial Planning and the Environment (VROM), and DHV-Engineering Consultancy.

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SECTION I Underpinning of FEAT

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1 Introduction and context

1.1 What is FEAT

The Flash Environmental Assessment Tool (FEAT), described in this report, provides a rapid scan to identify the most acute environmental hazards immediately following the occurrence of a natural disaster, whereby release of vast amounts of chemicals has occurred, or is possible. FEAT focuses primarily on the acute hazards arising from released chemicals. It also provides general indications of the type of impact to be expected from physical impacts such as erosion of fertile soil and salt water intrusion.
United Nations emergency response teams require operational tools to assess and help reduce potential damage in case of general environmental disasters that involve chemical releases as by-product. This need was addressed by the development of FEAT, a Flash Environmental Assessment Tool. FEAT is meant as a tool that can be used in field conditions, from the first hours after a disaster. It consists of a user guidance, which ends up in look-up tables.
The key issue of the tool is, that it summarizes a large body of scientific information on the chemicals, their environmental behaviour, and their (eco)toxicity into easy-to-apply units. That is: metres from the disaster. By applying impact perimeter as key endpoint in FEAT, the method can be used quick and anywhere, without requiring complex facilities or time-consuming calculations.
The method consists of a series of look-up tables and a user guidance, formatted in modules that can be used separately or consecutively, as related to the amount of information available. The user guidance and the Likely Scenario Module (LSM) provide support to manage the assessment. The so-called First Alert Module, Priority Scan Module and Facilities and Objects Assessment Module, operate through associated look-up tables (FT1 through FT3), providing the risk assessors and managers with useful information on potential impacts, useful in the sense that they can prioritize contingency- and relief actions.

1.2 Disclaimer on FEAT

The FEAT method aims to help setting priorities in handling the disaster, which should result in minimizing direct and indirect impacts of chemical releases after natural disasters. FEAT combines large amounts of scientific insights and data into one simple tool for use in field-based situations. Assumptions are made in the FEAT, some of them approximate. FEAT outputs will help prioritize the activities of relief and risk management teams, but cannot provide definitive scientific assessments or analyses. For example, FEAT cannot provide exact impact perimeters. Exact results will depend on individual cases and conditions. Users will need to set priorities based on actual field situations, which may differ from those presented in this document. The outcomes of FEAT, although presented in specific potential damage perimeters, should thus *not* be interpreted as absolute perimeter damage, but as guidance to the most hazardous aspects of a disaster, and subsequently, the most effective measures to reduce (further) impact.

1.3 This report

This report describes underpinning of the first version of the tool (section I), and illustrates its use with an imaginary but realistic case study (section II). The tool itself is presented in section III. The tool consists of a tiered system, whereby increasing amounts of site-specific information can be used to

derive appropriate risk management measures. The tool has been developed by the Dutch National Institute for Public Health and the Environment (RIVM), the Dutch Ministry of Housing, Spatial Planning and the Environment (VROM), and DHV-Engineering Consultancy.

2 Scope, users and use of FEAT

2.1 Scope and intended use

2.1.1 Scope

The disasters that are addressed by FEAT are general natural disasters (earthquakes, landslides, tsunami's, floods, volcanic eruptions, forest fires, et cetera), and involve the (potential or actual) release of chemicals to the environment.

The method starts with the impact assessment of a specific effect that is caused by a disaster, regardless of what type of disaster. Consequently, this approach facilitates the impact assessment of a wide range of possible disasters. Physical impacts of the actual disaster are also taken into account to a certain extent. Assessing the impact of released chemicals is the main focus of FEAT.

The FEAT-method is meant:

1. to identify and prioritize various impacts, potential impacts and secondary environmental risks after a natural disaster that caused the release of chemicals, and thereby to support a structured decision process by addressing all information relevant to the impact or potential impact;
2. to be used by field teams (including UNDAC teams) in the first hours and days after a natural disaster, which generally implies the absence of advanced facilities;

and therefore:

3. to present impacts in easy-to-handle units, i.e. in terms of distance to the source (impact perimeter) where preset impact levels are exceeded.

Based on practical requisites, like use in remote areas in the first hours after a major disaster, the method was developed to consist of:

1. a user guidance and a Likely Scenario Module, which should function to address and keep track of all (potentially) relevant hazards in a systematic and efficient way;
2. three other modules, each with an appropriate look-up table, to:
    a. recognize whether the disaster area harbours one or more of the presence of *extremely hazardous facilities* immediate after the disaster (first hours after warning);
    b. consider a broader set of facilities, with potential specific acute hazards for man, life support functions, nature and/or longer-term effects (from few hours to days after the disaster);
    c. provide gross effect distances and classes for specific chemical facilities or objects (when sufficient data are made available).

The key target of the FEAT method is to facilitate decision making for the impacts or potential impacts of chemical releases, by expressing the most threatened expected receptor (humans, livelihood or nature), the expected duration of the impact (immediate/short-term or long-term effects) and its expected size expressed in terms of the size of the impact area (in metres). Given this information, prevention or mitigation measures can be prioritized and taken, in order to avoid or minimize the exposure of humans and the environment within the gross estimate of the effect zone. With FEAT thus *being a prioritization tool for use in the absence of advanced facilities*, the outcomes of FEAT should **not** be interpreted in an absolute sense (that is: 'exact meters with exact impact magnitude').

The FEAT methods and look-up tables have been developed on the basis of a large body of scientific knowledge, in combination with a series of necessary but gross assumptions. In its design, FEAT was meant to be biased, if at all, to conservatism. That is: FEAT likely provides impact magnitude information that is relevant for worst-case conditions (that is: when a large factory completely releases all stored chemicals at once, whereby there are pathways of exposure for man and ecosystems, and where environmental 'dilution' is minimal). Without any information to modify the results of FEAT-usage, the local response team thus takes measures when there are indications of possible threats, and prioritizes actions within the set of possible threats.

2.1.2 Impact types addressed in FEAT

The following impact types are distinguished in FEAT:

1. direct impact on human health;
   - immediate death and immediate adverse health effects (explosion, immediate toxic effects);
2. direct impact on life-support functions and nature;
   - humans are impacted through effects on their life-support functions e.g. direct impact on crops, fish resources, agricultural land, water supply;
   - same direct impacts that affect life support functions can also threaten biodiversity and specific species or ecosystems;
3. long-term impact on life-support functions, nature and humans (toxic persistent substances entering the food chain and natural ecosystems and effects of carcinogenic substances).

2.1.3 Acute and indirect impacts

The primary focus of the method is on the identification of acute impacts. Nonetheless, the method also addresses longer-term issues to help preventing secondary or long-term impacts when there are hazards of this kind. Quick preventive measures could be taken to avoid such impacts when they are recognized by FEAT, such as 'blocking a pathway of exposure' with physical means (e.g., to decide to keep a lock system closed, to prevent chemicals to reach and affect a river system downstream of the locks).

2.2 Profile of the intended user

The intended users of FEAT are specifically trained first responders, such as UNDAC team members.

These users are familiar with field assessments, but have no specific background in assessing the magnitude of impacts of released chemicals. The users have attended a basic training programme on the use of FEAT and are assumed to be familiar with the method before applying FEAT in disaster situations. The user understands that FEAT not only delivers impact magnitude information, but also highlights the most likely types of impacts. The field workers are therefore able to identify the type of expertise that will most likely be required, so that the relevant experts from around the world can be recruited. In turn, these experts can confirm or refine the flash assessment of FEAT, in order to mitigate or prevent further impacts.

It is assumed that the user knows how to obtain the relevant information that is needed to perform the impact assessment. Relevant web references or information resources are provided for only some cases. Field assessments – especially those involving surveillance of situations with hazardous chemicals – require a basic understanding of safety practices and precautionary measures. The field teams are assumed to have the general knowledge to perform a field assessment, also at sites with hazardous substances. If there is doubt about the personal safety of the team, field visits should never be conducted. The knowledgeable assessor is facilitated in his/her decisions on personal safety issues by

using the human-toxicity feature of FEAT. This can provide some initial indications of precautionary measures, expressed in terms of the hazardous perimeter distance from the contamination source.

2.3 Reader's guide to this report

This report consists of three different sections.

Section I describes the FEAT-method in a classical report style, and provides detailed background information on FEAT, its assumptions, and the steps made. This second part contains three Appendices, providing information on generic theory underpinning the stepwise approach followed in FEAT (Appendix 1), and the scientific underpinning of the human- and ecosystem related hazard assessments (Appendix 2 and 3, respectively).

Section II presents an imaginary case study, which is addressed according to the FEAT-method, and which shows how read-offs from the look-up tables (in section II) provide increasingly specific impact information as more details on the disaster become available over time.

Section III contains the so-called 'user version' of the FEAT. The user version is a stand-alone version of the tool, only containing essential information to understand and use the tool. Within this report this first part serves as executive summary and provides the main (look-up) tables and figures of the method.

3 FEAT's basic structure and principles

3.1 Preconditions for FEAT

The most important precondition of the FEAT method is that it must be user friendly and appropriate for UNDAC teams operating in disaster conditions. The method should be both simple and sensible, and it should support decision-making in a disaster environment with few facilities.

3.2 Question-oriented, stepwise and modular approach

To meet the preconditions of FEAT-development, three essentially independent FEAT modules have been designed based on the following criteria:

- the assessment question and time frame of the assessment;
- spatial scale;
- detail in data availability and requirement;
- accuracy and detail of the impact assessment.

An impact assessment can be carried out for different types of impact and on different spatial scales.

To guide the user through different steps of the assessment, FEAT has been made 'question-oriented'. Regarding the presence of an current situation at chemical facilities within or near the disaster area, this takes account of users (UNDAC teams) who, stepwise, get hold of increasingly specific information, as follows:

- have little or no information (hours after the disaster);
- are superficially informed by local or regional authorities (hours till one or two days after the disaster;
- are informed in detail about the quantities and types of hazardous chemicals and the possibilities of exposure of specific sites (two or more days after the disaster).

Thereby, it was assumed, as worst case, that no specific contingency plans are available for the disaster area, so that immediate and short-term actions can be derived from the FEAT-method solely. However the method also indicates which specialized help should be called in for assistance. Parts of the method, are no longer useful when specialized, (site-)specific contingency plans are available, or when the experts, who are called in, are able to generate tailored contingency advices.

Depending on the degree of detail of the question, the user is aided with different modules, which are all based on one basic and fairly simple concept (see chapter 4).

The modules and their dependence on the different preconditions are shown in the user guidance-summary (section III).

- FEAT offers a complete impact assessment in the form of a specific look-up table in the 'Facilities and Objects Assessment Module'.

However, this look-up table is not immediately useful when the UNDAC teams have little or no information, or only gross information on the disaster area. In these cases, the user is directed to essentially independent modules of the FEAT method, specifically designed for information-poor conditions.

The other two modules present a rough impact assessment of:

- the spatial magnitude of the entire effected area ('First Alert Module'), and
- a more detailed assessment of facilities to prioritize the field assessments ('Priority Scan Module').

This is done by gross screening of the potential impacts of the facilities actually present within the disaster area. The stepwise approach that is followed in FEAT has been derived from classical stepwise approaches in practical (eco)toxicological risk assessment (Figure 1).

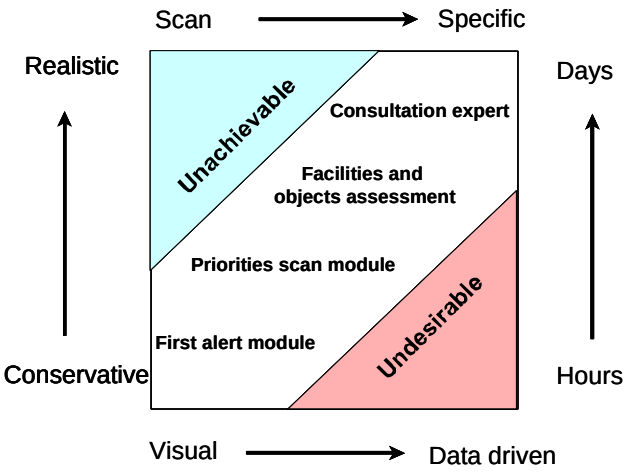

Figure 1. FEAT modules and their characteristics

3.3 Same assessment methodology for each module

Each assessment module applies the same basic concept of impact assessment. This involves **three main impact determining factors**:

- quantity;
- hazard;
- the possibility of exposure (pathway and receptor present).

Together, these factors determine the magnitude of the impact. Depending on the required detail and available information, the impact determining factors are considered roughly or in more detail in accordance with the requirements and specifications of the different modules.

3.4 Focus on relevant combinations of impact-determining factors

To keep FEAT comprehensive and useful in a disaster environment, the complex matter of a detailed impact assessment must be simplified. The method is designed to provide quick insight into and consideration of *only the most likely and highest-impact combinations of pathways, receptors and type of impact to be expected from a certain hazard*. This insight limits the assessment efforts needed and still provides focus to suitable mitigation or preventive measures and/or the required type of expertise.

3.5 Predefined assessments and underlying reasoning

Providing predefined assessments and the underlying reasoning is considered very helpful to the users in a disaster environment. Assuming that the method has appropriate underpinning (from science and practice), they can use the look-up tables, and generate and implement contingency actions quickly. To support ease and speed of use, predefined FEAT impact assessment results as obtained by experts are thus presented in the format of the look-up tables. The data as presented in the look-up tables can provide rapid answers to regular situations, since those situations have been analyzed in detail by experts based on realistic disaster scenarios.

However, there are unforeseen situations and local conditions can vary greatly. Users can also be faced with unexpected variations on the predefined scenarios. To help them handling these cases appropriately too, the FEAT-methodology is also explained in detail, so that the local team can address peculiarities in local disasters by following the line of reasoning of the method. That is, if the amounts of chemicals being released are e.g. halved as compared to the predefined condition, the field team (by simple calculations) can derive a locally expected impact perimeter. The explanation concerns – on a basic level – the logical steps taken previously by the experts. In this way, the user is encouraged and enabled to keep thinking and to become aware of the ideas that underpin the assessments and the predefined figures.

3.6 Current impacts, future situations and secondary risks

The primary impact is defined as the impact directly caused by the natural disaster. Secondary (or higher-order) impacts may occur when a disaster causes e.g. the release of toxic chemicals. Most secondary adverse effects, such as soil erosion or chemical spills, occur during or quickly after the actual occurrence of the natural disaster. In some situations, the effects of the secondary event can be delayed (by a considerable amount of time), or they can slowly increase (e.g. dispersion of chemicals through water systems).

When such a secondary event has not yet occurred, but the initial disaster has increased the probability that a secondary event will occur, reducing the probability of this secondary event to occur is an opportunity to take preventive action. If the secondary event and its impact depend on a probability of an event to occur, we generally refer to risk assessment instead of impact assessment (like in FEAT). However, actions may be possible and may be needed to prevent the event from occurring. The FEAT method can also be used to assign priorities to various potential situations. The priority for preventive action in FEAT is based on the potential impact of the future events as if they are sure to happen. FEAT does not take the probability of the occurrence of the event into account; this must be based on local conditions and the opinion of the assessor.

3.7 Towards mitigation measures

The three impact-determining factors (quantity, hazard and pathway) are combined in FEAT to provide directions to appropriate mitigation or preventive measures. In the case that serious impacts are predicted, these predictions themselves do not necessarily identify the mitigation activities.

The local team, by considering the outcomes as data to prioritize remedial actions, should use the outcomes in the context of the local conditions, and derive appropriate actions for priorities as defined, e.g. like the following:

- hazard and quantity can be reduced through e.g. absorption/immobilization of an organic toxicant by charcoal or coverage with foam;
- a pathway of exposure can be blocked, amongst others by removal of the receptor (e.g., evacuation of people) or by blocking the physical pathway (keep a locks-system closed).

4 FEAT's general underpinning of impact assessment

4.1 One universal impact assessment formula

To evaluate the three main factors that together determine the magnitude of the impact of a disaster, only one basic assessment formula has been used by the experts in the different situations and modules of FEAT (Equation 1).

Equation 1 Impact= F (Hazard, Exposure, Quantity)

In other words, the impact of a (chemical) disaster is determined by three variables, namely:

- the (intrinsic) toxicity of a chemical compound for a receptor (which can differ between receptors);
- the possibilities of exposure, which is modulated by the presence of a pathway from source to receptor;
- the quantity of the substance (released and exposed to).

A disaster situation has a significant impact only if the hazard, the exposure and the quantity are all significant. For instance, if the impact of a chemical spill on human health is evaluated using this method, this means that the substance that is spilled must be toxic (significant hazard), that contact between the chemical and humans needs to be present or possible (pathway), and that a significant amount must be spilled (quantity). If one of these factors is not relevant or substantial, then it is unlikely that there is substantial impact – and such situations are of low priority as compared to situations where all aspects are relevant. The magnitude of the impact is always determined by the proportional contributions of each of these three main factors. A large quantity of highly toxic material has a small impact if minimal exposure takes place, whereas a smaller quantity of material with moderate toxicity has a high impact if people or the environment are exposed at a higher level. The following paragraphs explain the three main impact-determining factors in greater detail, after an introduction of the impact types that are considered.

4.2 Impact types considered

Since impact is a result of a receptor that is exposed to a certain hazard, different impacts are distinguished, representing typical combinations of a hazard and a receptor.
The following impacts are distinguished in FEAT:

1. direct impact on human health
   - immediate death and immediate adverse health effects (explosion, immediate toxic effects);
2. direct impact on life-support functions and nature
   - humans are impacted through effects on their life-support functions, e.g. direct impact on crops, fish resources, agricultural land, water supply;
   - the same direct impacts as those on life support functions can threaten the intrinsic value of nature, biodiversity and certain species or ecosystems;
3. long-term impact on life-support functions, nature and humans

– toxic persistent substances entering the food chain and natural ecosystems and effects of carcinogenic substances.

For all direct impact categories, FEAT calculates probable impact distances in similar ways. By choosing a set of pre-defined impact criteria for humans, life-support functions and nature, the zone in which these impact criteria (with corresponding critical concentration levels) are exceeded is calculated by assuming immediate and perfect distribution of the released substance into the environment. Regarding the long-term impact of persistent, bio-accumulating and carcinogenic substances, all exposure must be prevented. The impact area is therefore defined as being equal to the actual dispersion of the substance.

4.3 Hazard

4.3.1 Hazard *sensu stricto*

The impact of a disaster on human health, life support functions and nature can originate both from chemical hazards that are caused by chemical spills and from physical hazards such as landslides, waves of water and saltwater intrusion. The physical threats play a role mainly during the first screening of potential impacts ('First Alert Module'). Within FEAT, hazardous chemicals are the main focus and are specified for different types of chemical hazards, i.e. groups of chemical compounds.
On the gross impact estimation scale of this tool, the intrinsic toxicity of hazardous substances is considered to be equal for humans, livestock that play a role in life support functions and nature. The intrinsic toxicity for aquatic and soil-dwelling organisms (including those on farms and in ecosystems) is derived from acute aquatic toxicity data. The main difference that determines the distinction between intrinsic toxicity (potential impact of a compound) and impact (actual exposure and associated effects) is considered to be mainly caused by the difference in the exposure route (the pathway, through air, water or soil).

The types of hazards that are considered by FEAT are based on a set of (eco)toxicological effects and on relevant physical and chemical characteristics of hazardous substances that define the exposure route.

4.3.2 Hazard combined with pathway issues

The combination of hazardous compounds with the key exposure routes (e.g., gas through air, liquid through water) has yielded the key information for the overall design of the look-up tables. In other words, a combination of a gas and an aquatic endpoint are not considered as priorities, because the gas must first dissolve in water before it can result in damage to fish and other aquatic organisms. The FEAT look-up tables (only) focus on realistic priority combinations of a hazardous compound type, priority of the exposure route and priority of the endpoint of concern.

The main groups of hazard types defined are:

- toxic gas, explosive, flammable, combustible, small containers;
- toxic liquids (to human and environment);
- persistent and accumulating substances;
- natural impacts on nature and infrastructure.

The basic subdivision and the most detailed sub-division of this main hazard types that are used within FEAT is provided in the first column of the Likely Scenario Table and the Facilities and Objects Assessment Module respectively (see section III).

There are also substances that pose more than one type of hazard. The hazards of secondary concern are accounted for by an extra iteration of the assessment process.

4.4 Exposure and pathway issues

Exposure is only possible if a receptor and a transport mechanism or transport medium are present. Possible receptors of concern are humans (direct exposure through air), elements of the environment that play an important role in the life support function (e.g. fish, cattle, water, crops and fertile soil) and valuable ecosystems.

The estimation of the extent of exposure is conceptually difficult. Many factors are known to influence the transport mechanisms and the vulnerability of the receptor. Local conditions are often important, and specific expertise would be required to evaluate the local situation.

The predefined impact assessments of FEAT are based on the assumption that the receptor is present, that the transport mechanism is present and that the extent of exposure is maximized. The factually used assumption of instantaneous dispersion of the emitted quantity in the environment implies that the time period for the dispersion process is ruled out. All these assumptions imply that the potential effect distances after full dispersion can be considered realistic under worst-case conditions. However, if the quantity is smaller, the volume of environment is larger, the dispersion is minimized or vulnerability is low, these distances over-estimate the true impact distance in the field. This could be taken into account when specific information on the case suggests any of these factors being lower than the standard scenarios.

4.5 Quantity

The quantity of a substance present and/or released after a disaster must be estimated and quantified. An expert inventory, involving possible quantities of hazardous substances that are present in typical chemical facilities around the world, has been used as input for assessing the worst-case scenario of potentially released quantities. Within the predefined impact estimations, such quantities have been tabulated, prioritized and used to provide quantity information for situations that are often present with a specific type of industry or process. In the first hours after a disaster, the quantities released are usually unknown. During the first screening – made in the ‘First Alert Module’ (Module 1) – the quantities generally needed for the specific industrial processes are assumed to be present.

4.6 Focus on key combinations of impact-determining factors

The most likely and highest-impact relationships between the type of hazard, pathways of dispersion, threatened receptors and the resulting type of impact have been determined To focus and simplify the assessment process, only these general combinations are initially taken into account. For example, a toxic gas is hazardous primarily due to exposure through the air and primarily impacts human health. Other possibilities of exposure (via rivers), and other types of impact (such as the impact on fishing grounds) are unlikely and are not the primary focus during in the first run. Quick insight into and consideration of only the main relevant pathways, receptors and types of impact to be expected from a certain hazard limit the required assessment efforts. This enables the user to focus on suitable mitigation or preventive measures and/or on the required type of expertise. The most likely and highest-impact scenarios used within FEAT are presented in the Likely Scenario Module (section III).

5 General assessment issues and user guidance

This chapter describes the general aspects of the assessment process, including:

1. navigation; description of the general 'user guidance' on how to navigate through the different modules;
2. the general features of actual use explained along the assessment steps
3. additional considerations during impact assessments such as safety in the field and sources of information

Use the general user instructions in this chapter together with the specific directions for the different modules. A detailed description of the actual application of the individual modules and the Likely Scenario Table is provided in the chapters 6 to 9.

5.1 Navigation and overview of processes

5.1.1 Overview

FEAT consists of three essentially independent modules and the Likely Scenario Module (and Table) that is used throughout the assessment to distinguish the most likely and highest-impact scenario. The guidance for the user is provided in the summarizing flowchart 'user guidance-summary' and in a more detailed flowchart 'user guidance', both presented in section III of this report.

Each module is designed to answer a specific question and reflects a situation the user may encounter. The modules are intended for independent use, but together represent the typical steps usually followed when going from the first notification until the end of the initial response. Starting with an initial screening of the big and obvious potential secondary disasters (Module 1: 'First Alert'), the user can identify and prioritize the additional objects of interest within the region (Module 2: 'Priority Scan') and finally perform an actual impact assessment of a specific object (Module 3: 'Facilities and Objects Assessment').

Each impact assessment (using one of the modules) is based on the same universal impact assessment concept (see paragraph 4.1) and is performed following the same steps: the 'standard impact assessment steps'.

The user facing a specific situation or having a specific question can go directly to the appropriate module to conduct an impact assessment. Nevertheless, a probable use and sequence of the modules has been envisioned: 'the standard route through the FEAT modules'.

FEAT focuses on typical cases. The concept is based on the most likely general relationships between the type of hazard, pathways of dispersion, threatened receptors and the resulting type of impact. These general relationships are captured in the Likely Scenario Table (section III) and used throughout the assessment to focus on the most likely and highest-impact scenarios.

5.1.2 The standard route through the FEAT modules

5.1.2.1 Immediately after the emergency

The 'First Alert Module' (abbreviated as FEAT Module 1, or FM1) is used within the first hours after a disaster to screen for the 'big and obvious' potential impacts and possibilities of secondary disasters (the associated look-up table is FEAT table 1, abbreviated as FT1).

If one of the facilities from this list is present in the area, immediate direct follow-up action is recommended: check the actual status of the facility (the hazard and quantity) and the possibilities of exposure by evaluating the presence of receptors (humans, life support functions and nature) and dispersion routes such as wind, slopes and water. Consult the 'Likely Scenario Table' (LST) to determine the main type of impact to be expected; this provides focus regarding the type of receptors and exposure routes that must be given priority to be checked. If the actual information is available, an impact assessment can be performed using the 'Facilities and Objects Assessment Module'
(see paragraph 5.1.2.3).

5.1.2.2 First (on the ground) assessment of areas of interest to determine priorities based on local (spatial) information.

During the second phase of the response to an emergency, a team of assessors arrives in areas of interest; they must plan the field actions and priorities for actual field visits based on expert knowledge (what facilities and processes potentially pose a risk to the humans and environment) and local (spatial) information (actual presence of facilities, spatial situation of receptors). This prioritization is performed with the 'Priorities Scan Module' (FEAT Module2, or in short FM2).

5.1.2.3 Actual impact assessment

The actual impact assessment of the selected objects, facilities or cases is performed with the 'Facilities and Objects Assessment Module' (FEAT Table 3, or in short FT3). This is done by using actual information for all three impact-determining factors: the hazard, the possibilities of exposure and the quantities involved.

5.1.2.4 Obvious shortcuts from the standard route

1. *Using the Likely Scenario Table (LST) in a specific local situation.*
   If the user is confronted with a specific case or object (physically or for instance by phone) and from the information available only the type of hazard to be expected can be derived a first impact assessment can be performed using the Likely Scenario Module. If the user is for instance informed about the leakage of a toxic gas in a specific facility, he or she is able to determine from the Likely Scenario Table that this will mainly impact humans and most likely pose a limited threat to life-support functions (agriculture, fisheries, drinking water) or nature.
2. *The use of the 'Facilities and Objects Assessment Module' during the first hours of the emergency.*
   After the onset of the emergency, it is possible that detailed information is available, for example, on the failure of a chemical facility involving a specific hazardous substance in specific quantities. This information can be used in the 'Facilities and Objects Assessment Module' to facilitate a flash impact assessment. An impact assessment can be quickly conducted, even from a distance and/or a desk, with the most detailed module of FEAT. This module is normally used in the phase of more detailed and well-supported impact assessments.

5.1.3 Standard steps to assess a specific case

Every impact assessment (using one of the modules to assess a specific case) is based on one/the same universal impact assessment concept and is performed following the same steps: the 'standard impact assessment steps' (see the first column of 'user guidance-summary' or 'user guidance' in section III of this report).
The standard assessment steps are the following:

1. **step 1:** define your question or situation and select the appropriate module by matching your situation with the characteristics of the individual modules.
2. **step 2:** perform the impact assessment with the selected module, following steps 2a to 2e. This step includes gathering actual information to complement the predefined estimations as provided in the FEAT modules:
    a. what is the hazard?
    b. what are opportune receptors and pathways of dispersion to consider that determine possibilities of exposure?
    c. what quantity is involved?
    d. process the information
    e. check for exceptions
3. **step 3:** generate and/or evaluate the output
4. **step 4:** consider follow-up actions
5. **step 5:** exit or perform next impact assessment

The steps within each module are standard, but the detailed application differs for each module, depending on the goal of the module. The detailed application of the standard steps in the various modules and the actual use is described in chapters 7 to 9 for the First Alert, Priorities Scan and Facilities and Objects Assessment modules, respectively.

5.1.4 Repeating loops within the assessment process

Two loops are included in the total assessment process:

1. the first loop is to assess several single cases repeatedly. This loop is included to make sure that all relevant cases and objects are assessed. A single case is assessed by completing a single assessment sequence by going through steps 1 through 4. Each case is reported and followed up separately. A case can essentially be defined as the impact that emerges from a specific object of interest. At a single facility, several objects or processes may be distinguished as relevant separate cases that must be reported on and followed up individually.
2. a second loop is nested in this first loop. The first loop is to assess one complete case, while the second loop ensures that all distinct aspects of one case are considered; within step 2, the user is asked to consider other possible impacts of the case being assessed. For instance, if a single substance has multiples types of hazards, the sequence from step 2a to 2e is performed repeatedly to take these different types of hazard into account. This repetition is seen as a sub-assessment of the same case and is evaluated and reported as such. In a sub-assessment, only one aspect of a case is evaluated at a time, while taking account of a single set of input figures (or estimations) of the impact-determining factors (hazard, exposure, quantity and the resulting impact).

The user is asked to determine what repetitions of the single assessments are needed (which separate cases must be defined), taking the local situation into account and using common sense. The exact definition of a single case or a sub-assessment of a case is not relevant, and the user is authorized to choose the suitable level of detail. For instance, it does not matter whether you define two substances in one process to be separate cases or you define the total process to be a single case. If you define the

process to be a single case, both substances are evaluated as sub-assessments, while in the other option you report the impact of the two substances of the same process as separate cases.
Advanced users can process different sub-assessments simultaneously. The less advanced user is advised to follow the steps more precisely.

5.2 General features of impact assessment for all modules

From a conceptual point of view, the individual FEAT modules are designed based on features such as the assessment question, the spatial scale, the appropriate accuracy and the need for actual information versus predefined estimations. In actual use, the difference between the FEAT modules mainly concerns the difference in the requirement for actual information versus assumed and predefined information on the three impact-determining factors.

The steps within each module are standard, but the details within the steps differ for each module, depending on the goal of the relevant module. Each FEAT module contains a different look-up table that provides the user with the information needed to perform the standard impact assessment using that module. The look-up tables are numbered in accordance with the corresponding module (the 'First Alert Module' is synonymous to FEAT-Module 1 (FM1), and its corresponding look-up table is therefore called FEAT Table 1 (FT1). Every module and its corresponding look-up table provide the same types of information: the expected type of hazard, the quantities involved and the estimated magnitude of the expected impact. However the format and details of this information differs between the Modules, and the exact use of the various look-up tables requires explanation. The steps in a standard impact assessment and the specifications for each of the modules are summarised in the 'user guidance' presented in section III of this report.

5.2.1 Step 1: select the appropriate module

If you do not follow the standard route through the FEAT modules, then choose a specific module by matching your question to the characteristics of the modules (as described and summarized in step 1 of the user guidance).

5.2.2 Step 2: perform the impact assessment

5.2.2.1 Step 2a: what is the hazard?

The various hazard types
Each chemical compound has a corresponding hazard. It is not feasible to include this amount of detail into a flash impact assessment performed by non-experts. Therefore the wide range of specific hazards is simplified and reduced to a few basic types of hazards; the FEAT impact assessment is based on these basic types of hazards. These basic types of hazard essentially convert chemical names – which are often complex and obscure – to an understandable set of hazard classes. Do not bother about thousands of substances with all their chemical properties and exceptions, but use the estimated main hazard corresponding to the substance in question as an indication of the 'hazard setting'. Each type of hazard is represented by the most hazardous substance of this group (as indicated in the first column of Table FT3 next to the hazard type). The hazard look-up table, which is mainly used in the 'Facilities and Objects Assessment Module', converts the chemical names to the hazard types.
The hazard types are listed as abbreviations, which are the key to using most of the tables. In the individual tables, a categorization method is used that is explained in varying detail. The Likely Scenario Table (LST; refer to Part 1 of this report) contains the basic categories, whereas Table FT3

uses subdivisions and contains the most fully-explained list of hazard types. The first letters of the abbreviation of the hazard type indicate the main hazard type. In addition, the number reflects a subdivision and indicates the severity of this hazard. As an example, the hazardous gasses range from GT5 (an acutely toxic gas such as chlorine) to GT1 (a very low-toxicity gas). These abbreviations are listed in the 'FEAT Abbreviations' list of section III of this report.

The type of chemical facility or processes indicates the type of hazard

In tables FT1 and FT2, the type of hazard is indicated according to the type of facility, process or substances presumed to be present. In these tables, the user can only indicate whether a specific type of industry, process or substance is actually present, in order to estimate the type of hazard from the look-up table. In the Likely Scenario Table (LST), physical hazards such as wind, mudflow and salt water intrusion are also included. In FT3, the user must first enter the actual type of hazard. Therefore, an indication of the main type of hazard resulting for the substance in question must be available. If information on the main type of hazard is missing, you can obtain indications of the type of hazard from the substance look-up table or the placard look-up table.

If more than one hazardous substance is associated with one chemical process

In some cases the type of process or industry is mentioned more than once. The process is repeated, and different hazardous substances are listed that are associated with this single process. Such processes involve more than one type of hazardous material that must to be taken into account. Start with the substance listed first (or the one that you think is most hazardous in your case, for instance based on the presence of certain types of receptors or the type of area you are dealing with). Decide whether you want to define the impact of the other substance involved in the process as a separate case or take it into account as a sub-assessment of the entire chemical process (for instructions on making this decision, refer to paragraph 6.1). If you define the second substance as a separate case, then you continue the assessment up to step 5 and repeat all single impact assessment steps again for the other type of substance; this results in a separate impact assessment with its own output and follow up. If you choose to perform a sub-assessment, continue the assessment until step 2e and repeat only steps 2a to 2e to take the second substance into account as a sub-assessment of the entire case.

A skilled user who is familiar with the method can simultaneously process these different types of substances and the corresponding types of hazard.

More than one type of hazard is associated with a single substance

To correctly define the type of hazard, you must understand that the distinction between the hazard types is essentially arbitrary. Some substances pose more than one type of hazard at the same time. For example, substances may not only have direct toxic effects, but can also be persistent and bio-accumulating. If a substance poses more than one type of hazard, both types of hazard are taken into account as different sub-assessments of the same case. Use the main type of hazard first (listed first) and return to the second type of hazard when you are asked in the last action of step 2 to check if all types of impact have been taken into account .

In the look-up tables, the main type of hazard from a certain substance determines the predefined allocation to a certain hazard type. The most relevant threat is indicated and determines the use of the FEAT tables and classification into categories (based on formulas that take into account of properties such as vapour pressure and boiling point).

Radiation hazard

Although somewhat outside the scope of FEAT, the processes or objects containing radioactive sources are included in table FT2 to provide a complete overview of objects of interest. If objects or processes

that use radioactive sources are present, the risk assessor should seek technical backstopping from the Joint OCHA/UNEP Environment Unit (JEU) or IAEA) to discuss follow up actions.

Classification of the listed facilities according to their expected type of impact

Within the First Alert Module the list of objects of interest is divided into three main types: those involving direct impact on humans, those involving long-term impacts on life support and nature and objects that mainly pose an immediate threat to life support and nature. This classification enables the user to quickly navigate to the facilities that pose the relevant type of impact according to the type of area an assessor is dealing with.

If the disaster took place in a densely populated area, the user can start your investigation by checking for the presence of facilities that cause direct impact on humans. If the disaster location is an agricultural area or an area with important drinking water catchment areas, the user should check for facilities that mainly pose a potential long-term impact on life support functions and nature. The immediate impacts on life support and nature often involve aquatic ecosystems (because they are most vulnerable to this kind of hazard) and are thus most relevant in regions with ecologically important bodies of water, including coral reefs and fishing grounds.

Different types of impact also indicate a different window of opportunity to take preventive or mitigation measures. If the user expects the probability of a release of toxic gases to be greatly enhanced due to the actual natural disaster (e.g. foundations of installations weakened by floods), the user may wish to start with the inventory of impacts that cause direct impact on human health; this is because most of these hazards are caused by gaseous substances. In case of gaseous releases, action must be taken to prevent the actual loss of containment. Once the gas is released, the window of opportunity to take mitigation measures is often too narrow to be effective. On the other hand, if the user assumes that all secondary events have already happened and the actual loss of containment of the substances has already taken place, the user may want to focus on the facilities and processes that potentially cause long-term impacts, which are often caused by toxic liquids. Prevention of dispersion of persistent and accumulating substances can greatly mitigate the extent of the impact in the long term.

5.2.2.2 Step 2b: what are possibilities of exposure?

Exposure is defined as a combination of a receptor and a pathway of dispersion. The combinations between the type of hazard, pathways of dispersion, threatened receptors and the resulting type of impact are used within all FEAT modules and are provided in the Likely Scenario Table (LST). For guidance on use of this specific table refer to chapter 7.

From the LST you obtained the opportune/relevant receptors and pathways of dispersion and than you assess which combinations of receptors and pathways are present and lead to actual possibilities of exposure. This is a qualitative judgement using common sense and is not quantified or calculated. The predefined impact figures assume that dispersion is homogeneous and instantaneous and that exposure is maximal. Exposures via respiration (air) or oral intake are the fastest and in many cases most hazardous routes.

5.2.2.3 Step 2c: what quantity is involved?

If a user wants to assess the impact of the actual situation, enter only the quantities of the substances that actually have lost containment. Of course, it is also possible to enter the quantities that are likely to lose containment in the near future to predict the expected impact and determine the appropriate mitigation or preventive measures. Only the ‘Facilities and Objects Assessment Module’ takes actual quantities into account. The other modules base the predefined impact figures on estimated quantities.

5.2.2.4 Step 2d: processing the information

Processing of the information in most cases means the reading of the type or magnitude of the expected impact and adapting the predefined figures to the actual and local situation by using common sense. To do so the user needs to understand some of the nature of the predefined figures.

Background information on the types of impact

Different types of impact are distinguished (as described in chapter 4). The two main types of impact are impact on human health and impact on life-support functions and nature. Within these main types, a distinction is made between the direct impacts and long–term impacts. The direct impacts have adverse effects that occur immediately after exposure (acute toxic effects). If exposure stops, the effects can be reversible, but they can also be irreversible.

Generally speaking the direct impact on life support functions and nature cause short-term problems, because the systems are able to recover after the loss of individual wildlife or livestock. In general, the humanitarian effect of this direct impact is limited to its impact on the life support functions for one or two years. For example, if a fishing ground is polluted with an acutely toxic substance, individual fish will die and the fish harvest of this season will be lost. However, in most cases the fish population will be able to recover (from the survivors or repopulation from other areas) and the toxic substances will be biodegraded (if a substance is persistent and is unlikely to biodegrade, the impact potential would be categorized as a long-term impact). After a relatively brief time period, the impact will be diminished. Direct impact to humans is valued differently, since we do not accept the loss of individuals. In case of direct impact to humans, it is important whether the effects are reversible or irreversible. This is because of the degree of detail and the expertise needed to make this distinction the FEAT method does not take this into account.

The long-term impacts have adverse effects that are not instantaneous and may have a delayed effect or require repeated exposure (often at low concentration levels) to cause adverse effects. These impacts are usually long lasting. They include the impact of toxic persistent substances entering the food chain or natural ecosystems and the effects of carcinogenic substances. Generally speaking, the humanitarian effect of a long-term impact on life support functions is serious, since the life support functions must be replaced or relocated for a long period of time, or different resources must be used.

In the Likely Scenario Table (LST) and FEAT Module 1 (FT1), the types of impacts are limited to the three main types. In the other, more detailed tables, these main types of impact are subdivided.

The predefined impact figures

In the look-up tables FT2 and FT3, you initially focus on the impact distances or severity indexes of the main type of impact. Take the other types of impact into account during a second repetition if they are assumed to be relevant.

For all direct impact categories, FEAT calculates probable impact distances in similar ways. By choosing a set of pre-defined impact criteria for humans, life-support functions and nature, the zone in which these impact criteria (with corresponding critical concentration levels) are exceeded is calculated by assuming immediate and perfect distribution of the released substance into the environment.
For long-term impact of persistent, bio-accumulating and carcinogenic substances, all exposure must be prevented, resulting in the definition of the impact area to equal the actual dispersion of the substance. For the long-term impacts, a severity index of the impact is provided, indicating the level of carcinogenicity and the severity of the accumulating and persistent properties. The indexes range from 1 to 5, where level 1 indicates a low level of severity and 5 indicates the most severe long-term

properties. The impact criteria used for the impact distances and severity indexes are listed and explained below and summarized in Table 1.

Direct impact to humans

1. Lethal: the distance within which the concentration of the toxic substance in air is expected to be lethal for 1% of the population exposed.
2. Health: the impact distance for adverse human health effects represents the distance from which one could escape within 30 minutes without incurring serious adverse health effects (based on the 'Immediately Dangerous to Life or Health' threshold values, often referred to as IDLH threshold values).

Long-term impact

1. The severity index of carcinogenic effects (CMR index) expresses the level of the carcinogenic, mutagenic and teratogenic properties and corresponding effects. This type of impact is mainly of concern for humans.
2. The severity index of Persistence and Bioaccumulation (PB index) indicates the level of the accumulating and persistent properties, representing the expected severity of the impact. Persistence and bioaccumulation mainly affect life support functions (accumulation into the food chain) and thus indirectly impact human health and sustainability over the long term.

Direct impact on life-support and nature

For all predefined impact distances for life-support functions and nature, the ecotoxicity criterion is set in such a way that at the impact distance, 50 percent of the biological species will seriously suffer from the chemical distributed in the environment as a result of the disaster; 'seriously suffer' means that at least 50% of the populations of those species are killed. To calculate the predefined impact distances, typical dimensions of several environmental compartments are fixed. The impact on soil is based on the assumption that the upper layer of 2 cm is polluted. A lake is assumed to be circular and 1m in depth. The assumed depth of a river is set to 1m with a width of 50 m. The methodology is explained in Appendix 3.

Table 1. Impact criteria that define the impact distance

Main Impact type	Secondary-impact type	Unit or evaluation mechanism	Impact criteria
Human, direct	Lethal	Mortality	1% human mortality
	Health	Mortality	Possibility to escape within 30 minutes without serious adverse health effects (based on IDLH threshold values)
Direct impact on life support and nature	Soil, lake, river	Mortality	Direct toxic effects on organisms: 50 % mortality of species population
Long-term impact on life support and nature	PB index	Index from 0 to 5; if index >1, impact distance equals actual dispersion	Effects through the food chain and long-term exposure from persistent substances
	CMR index	Index from 0 to 5; if index >1, impact distance equals actual dispersion	Carcinogenic, mutagenic and reprotoxic substances

In all calculations, the experts followed the hazard and risk assessment paradigm that is used by risk assessment experts all over the world (see Appendix 1).

What do the predefined impact figures mean?

The predefined impact figures are meant as guidance to the user and are under no circumstances meant to be used as true and accurate figures. Some remarks about the meaning of the predefined figures are therefore in order:

1. the predefined impact distances are on the safe side (based on 'realistic worst case scenarios') and concern severe effects (see Table 1). Less severe effects, such as nuisance and odour, can be observed at much greater distances. The human nose is sensitive to some chemicals and is able to detect some substances long before hazardous concentrations are reached. These are also impacts, but in FEAT they are not considered to be acute.
2. many assumptions are made to calculate the predefined figures. You should be aware and familiar with these assumptions in order determine to what extent the actual situation corresponds with the scenario used to calculate the figures in advance. The most important assumptions are:
    a. for dispersion through air, advanced dispersion models are used to estimate the exposure. Standard/average weather conditions are assumed. For the other environmental compartments, fixed dimensions of components of the receiving environment, such as lakes and rivers, are used and instantaneous and homogenous dispersion of the substances is assumed.
    b. a single substance is used to represent the impacts of all individual substances which are attributed to this group.
    c. in Modules 1 and 2, critical or typical quantities of the substances are assumed to be present.

More detailed scientific underpinning and explanation of the calculation methods are provided in Appendices 2 and 3.

Setting priorities

In all modules, but especially in the 'Priorities Scan', the user may want to prioritize the impacts of different cases. You can prioritize the listed objects of interest based on common sense and taking into account the local situation and the proportional contribution of the hazard, possibilities of exposure and predefined impacts as provided by the previous steps. The following examples, which generally indicate a high priority, are provided to give you some guidance on the process of prioritization.

<u>Presence of highly vulnerable and valuable receptors</u>

Determine the presence of highly vulnerable receptors within the estimated impact area; for example, human settlements, water catchments (including drinking water), coral reefs are general given a high priority.

<u>Preventable release of toxic gas upwind of humans</u>

The situation where a release of toxic gas is expected, but preventive measures are possible, is usually not encountered, but a field check to determine if preventive measures are needed and possible still deserves a high priority.

<u>Continuous sources</u>

Obviously, expected continuous sources of all kinds should be given priority to be inspected. This category includes pipelines, large chemical complexes having substantial amounts of hazardous

material undergoing processing and large storage facilities for liquids. Moreover, liquids with high volatility are potentially a continuous source of toxic gas, even though although the actual spill of the liquid may have been stopped. In all cases where a toxic liquid is concerned, it is advisable to check if this liquid is volatile.

Extensive dispersion of persistent substances
Check for the combination of substantial amounts of persistent and bio-accumulating substances and extensive possibilities of dispersion and exposure. Examples are reservoirs or facilities containing persistent liquids located near flowing water with a intensive downstream use (agricultural, fisheries, coral reefs).

Volatile toxic liquids that are easily spilled within a urban area.
In most cases, the quantities involved in facilities that are located within a densely populated area are limited when compared to large chemical plants. The reason to highlight such cases here is the fact that these situations are often encountered in the field, where they are not big and obvious but may still have serious health impacts on a local scale (also because of the continuous character of the gaseous source). Because the prioritization takes place on a relative scale, these cases are given priority if no major industrial sites or facilities are present within the area of interest.

5.2.2.5 Step 2e: check for other impacts

The FEAT concept is based on a simplified version of reality; it uses general and common combinations of specific hazards, main receptors, pathways and expected impacts. However, the local situation may be different, so you should be aware of any exceptions to these general combinations.

To ensure that all the aspects of a case are considered, this second loop is nested within the loop of a total impact assessment for a specific case. The explanation of the step ‘defining the hazard’ previously explained that more than one type of hazard can be associated with a single substance or additional routes of exposure can be present. For instance, if a single substance poses multiple types of hazard, the sequence of step 2a to 2e is performed repeatedly to take these different types of hazard into account. This repetition is seen as a sub-assessment of the same case and is evaluated and reported as such. If you are an advanced user, you can simultaneously process different sub-assessments as soon as you identify them in the previous steps. If you are less familiar with the method, we recommend that you follow the standard steps.

A common combination of hazards results from a liquid that is both toxic and volatile. This substances will pose hazards as both as a toxic liquid and a toxic gas (which emerges as a more or less continuous source from the evaporating liquid). In case of toxic liquids, always inquire about the expectation of substantial amounts of toxic fumes.

Another common combination of hazards is posed by liquids that not only have acute toxic properties (the hazards of a toxic liquid), but also persistent characteristics. These substances will have both immediate and long-term effects on life support and nature

The common pathways of dispersion and exposure are included in FEAT. Of course, it is possible that local situations are exceptional and other possibilities of exposure are present. Rubble cleaning activities, playing children, animals like gulls feeding on contaminated material, drainage through an underground drainage network or vehicle movement are examples of possible means of dispersion that are not inherently part of FEAT.

5.2.3 Step 3: output

Each single impact assessment is processed, reported and followed up separately. The format of the Likely Scenario Table is useful for listing, evaluating and reporting on the various assessments if supplemented with a description of the actual objects of interest and remarks on findings.

5.2.4 Step 4: follow-up actions to consider

The user can apply the result of the impact assessment as input for decision making outside the FEAT method. FEAT does not give specific recommendations for action because this largely depends on specific disaster conditions. However, the assessor using FEAT can use the information from the Look-up Tables to identify logical actions that are site-specific. The look-up table of impact distances for humans, life-support functions and the environment provides an overview of possible threats – each of which can be counteracted, minimized or prevented by actions taken. In case of a FEAT-based warning, the specific set of potential impacts directs the user to the most important actions or required expertise and to effective management options.

The three main impact-determining factors provide indications of appropriate mitigation or preventive measures. Since the impact depends on the proportional contribution of the impact-determining factors, impact may be prevented or mitigated by affecting or diminishing one of these factors:

1. reduce hazard and quantity. The quantity and hazard are reduced by stopping the source, re-containment or additions that promote chemical reactions to neutralize the hazard.
2. prevent exposure. To reduce the possibilities of exposure, dispersion can be reduced or the receptor can be removed. Evacuation of humans or relocation of livestock prevent or reduce exposure. Several measures are possible to minimize or prevent dispersion:
    a. absorption or coverage (with charcoal or foam) to prevent evaporation;
    b. secure/fence off the area;
    c. dam or relocate flowing water (close the sluice);
    d. prevent usage of contaminated water (for washing or drinking):
    e. prevent usage of contaminated goods (crops, fish, et cetera).

5.2.5 Step 5: exit or next impact assessment

The user is asked to determine what repetitions of the single assessments are needed (which separate cases must be defined) taking the local situation into account and using common sense. This loop is included to make sure that all relevant cases and objects are assessed. Each case is reported and followed up separately.

At one facility, several separate objects or processes may be determined to be relevant separate cases that you must report and follow up individually.

In the objects of interest list (Table FT2), it is possible that a type of process or industry is mentioned more than once. The process is repeated and different relevant hazardous substances are listed that are associated to this single process. In this case, these processes use more than one type of hazardous material that must be taken into account. You start by assessing the substance listed first (or the one that the user thinks is most severe in the pertinent case, for instance based on the presence of certain types of receptors or the type of area one is dealing with).

5.3 Additional considerations for impact assessment

5.3.1 Safety in the field

Field assessments – especially surveillance in situations involving hazardous chemicals – require basic understanding of safety practices and precautionary measures. The field teams are assumed to have sufficient general knowledge to perform a field assessment, also at sites with hazardous substances.
In addition, here are some important reminders:

- chemical pollution cannot always be detected before serious adverse effects take place;
- always approach a site from the up-wind side;
- use binoculars for the initial surveillance (from a safe distance);
- wear suitable clothing (especially boots);
- respiratory protection aids that depend on ambient air, such as dust masks, do not ensure full protection; expertise is required to ascertain and use the appropriate type of protection. In very hazardous situations, self-contained breathing apparatus is required;
- the impact distances of the look-up tables provided in FEAT may provide the knowledgeable assessor with some initial indications of precautionary measures, expressed as a hazard distance perimeter from the contamination source.

5.3.2 The background/reference situation

In general terms, the environmental assessment aims at mapping out the impact caused by the disaster. This is defined as the additional environmental impact to the normal background/reference situation. For example, there is a major difference between a spill of lubricants in a pristine, vulnerable ecosystem or the same spill in an industrial area where the environmental hygiene standards are not very strict and emissions and spills take place regularly. Generally speaking, additional pollution on a site that is already polluted has a smaller impact than the same pollution on a relatively clean site, especially regarding the intermediate and long-term impact on life support functions and nature. It is not feasible to fully assess the additional impact, including all details and qualifications, in a flash assessment. Therefore, it is important to stay on the practical side and note and report the degree of background pollution. Make a rough estimation of whether the additional impact of the disaster will make a significant change in the prevailing environmental conditions, and take this into account in your final impact assessment and follow-up measures.

5.3.3 Sources of information

It is assumed that the user knows to obtain the relevant information that is needed to perform the impact assessment. As a reminder, several sources are listed below:

- local authorities and regional or national authorities, especially the environmental departments;
- environmental working groups/ Environmental protection organizations;
- personnel or help desks of chemical facilities;
- inhabitants / local population.

6 The Likely Scenario Table

FEAT helps the user to determine the most likely and highest-impact combinations of hazards, receptors, and pathways. These general relationships are captured in the Likely Scenario Table (see section III). Understanding and using only the main relevant pathways, receptors and type of impact to be expected from a specific hazard, simplifies the system and limits the assessment efforts needed. It provides focus to suitable mitigation or preventive measures and/or the required type of expertise; this approach is used in all FEAT modules.

6.1 General use of the LST

The Likely Scenario Table (shown in section III) lists the main types of hazard (first column). Find the actual hazard of your situation/case (in most cases derived from step 2a of the single impact assessment) in the first column of the table, and follow the rows of this hazard type to determine the relevant receptors for this hazard, the relevant pathways of dispersion and the expected main type of impact. The relevant receptors and pathways are indicated by the presence of a checkbox. The main type of impact is indicated with colour codes and priority numbers that are explained below the table.

For example, if you are dealing with a toxic gas or smoke, Table LST indicates that humans are the main relevant receptors and wind is the main dispersion pathway. Direct impact to humans is the most likely type of impact and is a high priority concern. This knowledge provides focus to your follow up measures and assessment process. You would then make it a priority to check for the presence of human population downwind of the expected source. Possible mitigation measures include providing protective shelter or evacuation.

If the Likely Scenario Table (LST) is used as part of a single assessment using another module, these receptors and sources are taken into account in the subsequent steps of the assessment. Always start your impact assessment with the relevant receptors, pathways and type of impact, and repeat the assessment for a next case or perform a sub-assessment to take the impacts of secondary concern into account. In Tables FT2 and FT3, you initially focus on the impact distances or severity indexes of the main type of impact. During a second round, you can take the other types of impact into account, if they are assumed to be relevant.

6.2 Special types of likely scenarios

6.2.1 Natural impacts

Most natural hazards, such as landslides and saltwater intrusion, cause direct impacts (on humans, life support or nature).

The expected type of impact from several natural hazards, such as landslides an saltwater intrusion, is also included in the LST. The effects often take place immediately during the natural disaster and cannot be prevented. In some cases, such as landslides, the risks of a second impact are enhanced by the first event, and preventive measures are possible if the hazard is recognized as such. The LST indicates that water waves, landslides and fires mainly pose an immediate threat to humans, while saltwater intrusion and erosion of fertile soil (e.g. caused by landslides or mudflows) lead to long-term effects on life support and nature. Saltwater may damage aquatic ecosystems that are not usually exposed to high concentrations of salt, and agricultural land (such as rice paddies) maybe damaged for

long periods because the usual crops are not tolerant of high salt concentrations that may persist for long periods in the soil. In addition, shallow wells may be affected. Mud has a direct impact on life support functions because of the devastation of crops. In some cases mudflow may cause human casualties because of its force. In addition, mud may cause long-term impacts on life support functions and nature if it is dispersed into aquatic environments. Excessive turbidity of the water caused by clay or mud particles may kill fish populations (as a direct effect). If huge amounts of mud settles upon coral reefs, such ecosystems will seriously suffer (resulting in long-term impacts). Fires that contain hazardous substances are not included as such, but may pose adverse health effects. In most cases these are not acute or life threatening, but may result in delayed effects or contamination of the surrounding area. To stay on the safe side, you should avoid contact with the fumes of these kinds of fires.

6.2.2 Exceptional type of hazard: small containers with chemicals

All chemical hazards are based on a mixture of toxicological effects and on relevant physical and chemical characteristics of hazardous substances that define the exposure route. The LST includes an exceptional type of hazard: ‘small containers with chemicals’. Of course, small containers with chemicals do not pose any hazard if the containment is properly secured. This exceptional type of hazard is included for a simple reason. Small containers with many different kinds of chemicals are often encountered during field assessments, and they do pose serious risks if not considered and identified as such. Because quantities are small, the impact will be relatively local and mainly effects individuals, but due to the potential mobility of these containers and the uncertainty about when the substance will lose containment, the effects may occur at unexpected locations and times. As shown in the LST, small containers mainly pose a risk to humans and aquatic environments if the substances lose containment. The most likely means of transport (‘pathways’) are running water, mudflows and especially humans who intend to reuse the contents or the container or simply do not recognize the hazard because the labels are damaged. Children may also move and open the container or damage the contents. If the containers are only moved and located resided outdoors, weathering may cause the release of the contents in the long term, resulting in possibly unknown exposure of humans, aquatic ecosystems or life support functions such as drinking water supplies.

6.2.3 Humans as a pathway of dispersion

Humans can transport substances, either intentionally or unintentionally, for resale, reuse or accidentally (e.g. playing children). In addition dispersion is possible through infrastructures such as drainage, sewage systems and vehicles (traffic).

6.3 Stand-alone use of Likely Scenario Table

The Likely Scenario Table (LST) can also be used separately from the other modules. For instance, the notification of an emergency may contain only sketchy information about a toxic spill. As soon as the type of hazard is known (e.g. does it concern a directly toxic gas, liquid or a persistent substance?) the expected impact can be roughly determined using this table, thereby giving focus to the information to be checked, follow-up actions, possible measures or the type of expertise needed.

6.4 Summary of hazard-impact relationships

To enhance understanding of the LST, Table 2 presents an even broader view of the most likely basic relationships between the type of hazard and the expected impact. In addition, this table indicates the corresponding environmental compartment, the areas and receptors of prior concern and the ‘window

of opportunity' to prevent exposure after loss of containment. Running sources should of course always be stopped as soon as possible to limit the quantities involved.

Table 2. Broad overview of the most likely relationships between chemical hazards, type of impact and the main receptors

Hazard	Impact	Transport route and receptor	Type of area, receptor of main concern	Window of opportunity to prevent exposure
Toxic gas, explosion, fire	Direct impact on humans	Air	Populated areas, large animals	Immediate
Toxic liquid	Direct impact on life-support & nature	Water	Fishing grounds, coral reefs, aquatic environments	Medium
Persistent substance	Long-term impact	Soil, sediment, particles, ground-water	Agricultural areas, drinking water catchments, following water, deltas	Long
Carcinogenic	Long-term impact (mainly on humans, but also on life-support and nature)	Particulates, soil, sediment	Populated areas	Long

7 First Alert Module and look-up

7.1 FM1, Step 1: select the appropriate module

Use the First Alert Module if your assessment question and situation is similar to: ‘what major potential impacts are present in the affected area?’ The First Alert Module provides an initial overview of the whole disaster area based on rough information. It is meant to be used directly after notification of an emergency to screen for potential secondary disasters. In addition, the expected type of impact (e.g. impact on human health, life support functions and or nature) is defined for a type of hazard presumed present (directly from table FT1 or using table LST).

7.2 FM1, Steps 2 through 3: one table to immediate output

Since speed and simplicity are crucial during this phase of the emergency, the ‘First Alert Module’ is kept as simple as possible and all steps of the single impact assessment are actually compressed into a single look-up action using look up table FT1. This table contains all information relevant at this time and spatial scales. The only action needed is to check whether one of the facilities as listed in table FT1 is present within the disaster area. If so, you have a high priority alert for possible secondary disasters. The table includes an indication on the type of impact to be expected (you do not need to use the LST for this in your first response).

The look-up table of the ‘First Alert Module’ consist of a list of facilities that are known to work with very hazardous materials in quantities that potentially cause major impacts. The presence of this kind of facilities is sufficient reason to be concerned about potential secondary disasters and take follow-up actions with priority. During the first response, it is assumed that the hazardous material is present in at least the critical quantities and that exposure will take place (receptors and pathway of dispersion present). The list of objects of interest is divided into three main types: those involving direct impact on humans, those involving long-term impacts on life support and nature and objects that mainly pose an immediate threat to life support and nature. You may want to focus on one of these types of impact based on the type of region in which the disaster took place (densely populated, agricultural, aquatic biotopes, fishing grounds, water catchments or coral reefs).

7.3 FM1, Step 4: consider follow up actions

The potential magnitude and complexity of the impacts dealt with in the ‘First Alert Module’ often require direct involvement of specific expertise. Consultation must be sought immediately if one of the listed facilities is present and damage cannot be ruled out. The expected type of impact provides directions to the type of expertise needed. The LST can be used to check what relevant receptors and pathways of dispersion might be involved.

If more information becomes available (e.g. type of hazard and quantities involved), a quick impact assessment can be performed from a distance using the ‘Facilities and Objects Assessment Module’ (FM3). In this case data that is estimated from a distance is used as input instead of actual on-site information (as in the usual on-site use of the ‘Facilities and Objects Assessment Module’).

7.4 FM1, Step 5: exit or next impact assessment

Apply the general procedure of this step as described in chapter 5.

8 Priorities Scan Module and look-up

8.1 FM2, Step 1: select the appropriate module

The goal of the 'Priorities Scan' is to select and prioritize the objects or facilities within a certain area of interest that has already checked for 'the big and obvious' potential impacts, but which require further investigation at a regional and local scale.
The 'Priorities Scan' is generally used when the user first arrives at a certain area of interest and if no prior objects of concern have been defined. The user must decide which facilities/objects potentially pose a significant impact on human health and the environment and must prioritize before making an inventory and performing a field check. Location-specific information is needed. This information primarily concerns the spatial situation of hazardous facilities, distribution mechanisms (rivers, slopes, drainage systems) and receptors (humans, life support functions and nature).

8.2 FM2, Step 2: perform the impact assessment

8.2.1 FM2, Step 2a: what is the hazard?

The 'objects of interest' list (Table FT2) provides the user with all types of processes and the corresponding hazardous substances that potentially have adverse effects on human health or the environment. Match the listed facilities and processes in the first two columns of the table with the actual regional situation regarding the presence of the facilities in the area of interest. You can do this either by listing all processes present and comparing this actual list with the objects of interest list, or by going through the objects of interest list with local respondents and checking which processes are actually present in the area. Note that the main type of hazard is indicated in the column 'hazard type'. In several cases more than one type of hazard is indicated with the listed processes. Make an assessment of the type of hazard listed first; if you are asked to perform a sub-assessment during step 2e, return to the second type of hazard.

8.2.2 FM2, Step 2b: what are possibilities of exposure?

The relevant receptors and pathways of dispersion that match with the hazard type you are dealing with are found in the LST. Local geographical information needs to be obtained. This information includes the presence and location of relevant receptors (humans, life support functions such as drinking water systems, fishing grounds, crops and nature) and dispersion pathways (slopes, rivers, humans or groundwater systems) related to the objects of interest present (obtained from maps or local knowledge). Match the actual location of the objects of interest (derived from step 2a) with the location of relevant receptors and pathways (derived from step 2b). Assess the possibilities and potential extent of exposure.

The expected magnitude of the different types of impact is indicated in Table FT2 by the impact distance or severity index (for carcinogenic and persistent substances).
For the direct impacts on humans, the predefined impact distance as provided in Table M2 is used to estimate whether relevant receptors are located within the predicted impact distances. For instance, if a factory for textile production (dyes) is present in the area, the main hazard is noted to be a very toxic gas (chlorine, hazard type GT3). From table LST it is clear that direct impact on human health is the main concern. In that case the predicted impact distance as provided in table FT2, listed in the column 'direct impact to humans' is used to provide an indication on the impact distance that must be taken

into account. If humans are expected to be present within this impact distance (in this case 500 m to 5 km) downwind from the facility, possibilities of exposure are to be expected.
Note that the impact distances are rough indications to work with. The figures are based on the release of assumed typical quantities as listed in the 'quantity' column of Table FT2. Furthermore, the general assumptions in the explanation of the 'user guidance' apply to these impact distances.
The magnitude of the long-term impacts is indicated by severity indexes ranging from 0 to 5 (not relevant to severe impact expected). For these types impact, the expected impact distance is assumed to be equal to the actual distance of dispersion; for each concentration level, the possibility of exposure is thereby prevented. The possible extent of dispersion must be roughly estimated from the type pathway and the local situation.

8.2.3 FM2, Step 2c: what quantity is involved?

To calculate impact distances (as indications of the radius around the object of interest where you need to scan for the presence of relevant receptors and assume serious effects), typical quantities from the listed processes are provided in the 'quantity' column. Modify the impact distance if you have indications that the quantities involved are actually different than the typical quantities assumed in Table FT2. If you have all the relevant information available, you can use the look-up table of the Facilities and Objects Assessment table to modify the estimation of the actual impact distance. In this way you can prioritize the objects of interest based on more detailed estimations of the impact distances.

8.2.4 FM2, Step 2d: processing the information

The previous steps provide an indication on the severity of the hazard, the possibilities of exposure and the expected type of impact for each of the objects of interest present. To process this information, you prioritize the listed objects of interest based on common sense and taking into account the local situation and the proportional contribution of the hazard, possibilities of exposure and predefined impacts provided by the previous steps. The general description about setting priorities (priority paragraph within section 6.2) provides general guidance about which cases should be assigned a high priority.

8.2.5 FM2, Step 2e: check for other impacts

Apply the general procedure of this step as described in chapter 5.

8.3 FM2, Step 3: output

The format of the LST is useful for listing, evaluating and reporting on the various assessments if supplemented with a description of the actual objects of interest and remarks on findings. Especially in the Priorities Scan Module, it is important to report all cases and sub-assessments so you can correctly compare and prioritize the entire list.

8.4 FM2, Step 4: consider follow-up actions

A likely follow up action is to field visit the listed facilities, to check the actual status and perform an actual impact assessment using Module 3.

8.5 FM2, Step 5: exit or assess next case

Apply the general procedure of this step as described in chapter 5.

9 Facilities and Objects Assessment Module and look-up

9.1 FM3, Step 1: select the appropriate module

The actual 'Facilities and Objects Assessment Module' (FM3) of FEAT is obviously the module that delivers the impact assessment by providing predefined calculations of the magnitude of the impact. An impact assessment is performed primarily to assess the impact of a specific situation that is encountered in the field. The 'Facilities and Objects Assessment Module' provides predefined impact distances and severity indexes for the different receptors given certain quantities of a substance of a certain hazard class.

First of all, make sure that you understand and apply the basic safety practices and precautionary measures for field assessments, especially when conducting surveillance of situations with hazardous chemicals. If you are unsure about the safety of the situation, do not perform the field assessment: **safety first!**

9.2 FM3, Step 2: perform the impact assessment

9.2.1 FM3, Step 2a: what is the hazard?

An indication of the main type of hazard resulting from the substance concerned must be available. If information on the main type of hazard is missing, indications of the type of hazard can be obtained from field observation, the 'Substance look up table', the label look up table or consulting local experts where possible. Table FT3 contains the most fully explained list of hazard types (abbreviations of the hazard types are explained in the abbreviation section of PART I). The first letters of the abbreviation of the hazard type indicate the main hazard type. In addition, the number reflects a subdivision and indicates the severity of this hazard. As an example, the hazardous gasses range from GT5 (an acutely toxic gas such as chlorine) to GT1 (a very low-toxicity gas).

The nature of the hazard can be observed in the field by e.g. coloured plumes in air or water, smell or obvious leakage of containments that are labelled or expected to contain hazardous materials. Be aware that not all releases are obvious and there are possibilities for 'silent releases' without odour or colour. In some cases these can be discovered from signs of actual effects such as death of poultry or fish, discoloration of vegetation and reports of adverse health effects on humans. These signs can help indicate the nature of the hazard.

The Substance look-up table includes most of the commercially used hazardous substances and provides an indication of the primary type of hazard (as defined within FEAT) of this substance. The Substance look-up table is divided into four sections: (a) toxic gas, flammables, and small containers; (b)toxic liquids; (c) persistent, bio-accumulative or carcinogenic substances; and (d) substances that are not rated. This categorization is the same as in the corresponding Table FT3 and the Most Likely Scenario table. Within these categories, the substances are listed alphabetically by name. When searching for specific aspects, for example the main hazard of a liquid substance, use the corresponding part of the substance look-up table. If there is no indication of the type of substance, you can then search in all parts of the substance look-up table (by substance name in alphabetical order). The Substance look-up table hazards are noted in order of priority, starting with the main type of hazard.

For transport hazard labels, the Label look-up table also provides an indication of the type of hazard that must be taken into account. International transport labels indicate the hazard corresponding to a substance. Within FEAT, comparable hazard types are used. This look-up table provides a link between these two hazard indications. However, there is no perfect match between them, and you should interpret this information cautiously. To match the hazards more accurately, include the physical property of the substance from your field observations.

9.2.2 FM3, Step 2b and 2c: exposures and quantities involved

The Likely Scenarios Table supports field observations and helps estimate actual exposure. For the hazard in question, first estimate the exposure for the relevant receptors and dispersion pathways (as listed in the Likely Scenarios Table). Of course, you should think beyond these general indications and look for possible other factors that influence your case. Estimate the actual exposure based on the quantity of substance to which people or the environment are exposed.

It is often difficult to quantify the extent of exposure. For gaseous substances, for instance, it may be obvious that people have been exposed due to the detection of its typical odour, but this does not mean that the exposure has been harmful. If exposure takes place and you doubt the extent of exposure, call the main office to discuss the need for additional expertise or analytic measurements. However, there are also substances that are only detectable by their odour at exposure levels which are harmful or even deadly. And many hazardous substances have no odour at all.

9.2.3 FM3, Step 2d: processing the information

In Table FT3, read the predefined impact distance or severity index that corresponds with the hazard and the quantities to which people or the environment are exposed. Use the estimated impact distances as an indication of the magnitude of the impact, keeping in mind the limitations of this estimate. For substances that have a long-term impact (i.e. persistent, bio-accumulating, carcinogenic, mutagenic and reprotoxic substances) the impact area is equal to the dispersion area. For such substances, the lowest detectible concentrations are indicated as undesirable. The primary concern is to prevent dispersion to the greatest extent possible. A severity index for the relevant substances (specified in the Substance look-up table) indicates to what extent the substances are actually persistent, accumulating or carcinogenic, and provides a measure for the severity of the dispersal and the degree to which long-term effects can be expected.

9.2.4 FM3, Step 2e: check for other impacts

Apply the general procedure of this step as described in chapter 5.

9.3 FM3, Step 3: output

The output of evaluating the risks of actual amounts of compounds should be incorporated in the priority setting for management action.

9.4 FM3, Step 4: consider follow-up actions

The follow-up action is impact mitigation by the field team, and/or calling in further specialists.

9.5 FM3, Step 5: exit or assess next case

Apply the general procedure of this step as described in chapter 5.

Appendix 1 General risk assessment paradigm

The general formula of FEAT is based in the international risk assessment paradigm, which defines a general process for risk assessment (see Figure 2).

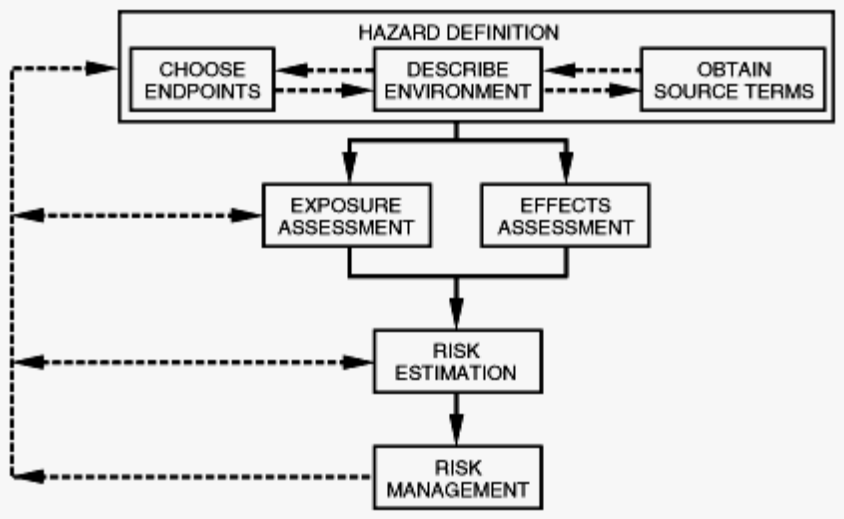

Figure 2. General risk assessment paradigm (modified from Suter (1993))

Each risk assessment can be seen as a four-step procedure:

1. problem or hazard definition, in this case: a Flash Environmental Assessment needs to be made;
2. exposure assessment, in this case: determining the concentrations of toxic compounds in the environment after a disaster, following both primary and secondary releases, and considering both ‘here and now’ and ‘there and in the future’ exposure scenarios; the exposure assessment yields Q (a stored Quantity), and / or C (a local concentration of the compound, after release of the full Quantity, or a part of it), and considers whether there is an exposure route (Exposure).
3. effect assessment, in this case: considering the dose-effect relationships that are known for the different endpoints (human, life support functions and environment);

and finally (by combining 2 and 3):

4. risk estimation or Risk Characterization, in this case: the impact distance is used to characterize the spatial spread of impacts of a certain degree or intensity.

The risk assessment is followed by risk management, which can have a feedback loop to the monitoring of the hazard as it changes following risk management actions.

The data for the formulas in FEAT have been developed by assuming disaster scenarios (desktop) with different compounds and environmental conditions, starting from the identification of potential sources of chemical releases in the First Alert Module. Thereafter, the formulas have been used to analyze the scenarios quantitatively or qualitatively. Based on these results, the look-up tables have been filled in. The most detailed look-up table presents the possible resulting classes of Impact Distances (in the Facilities and Objects Assessment), calculated under realistic worst case disaster scenarios.

The look-up tables are applied for the situation that the disaster has taken place (for example the disruption of a storage tank) and for the situation that the probability of impact is greatly increased as a result of the natural disaster (for example a foundation weakened by inundation, as secondary impact).

The type of priority measures that must be taken (prevention, mitigation) are dependent on the assumption that the impact probability is 1 (has taken place) or is <1 (has not taken place, but the probability is greatly increased by the natural disaster). Visual or desktop inspection should reveal the probability of secondary impacts, and the higher the probability of secondary impacts, the more local field workers need to focus on reducing that probability. It is possible that the time-window for actions to prevent (secondary) impacts is very narrow (toxic gas emission directly after earthquake) and that nothing can be done to mitigate the impact. In other cases (for example pipeline rupture with release of liquids), the time-window can be long enough to take mitigating actions against primary impacts or secondary impacts.

Appendix 2 Human impact assessment overview

The determination of priority and the calculation of effect distances for humans is based on specific scenarios. A scenario is essentially a description of the loss of containment of a hazardous material, taking the circumstances into account, as well as an assessment of the effect on humans ('FEAT-Human Health').

To determine the type of effect on humans (e.g. inhalation of a toxic gas or heat radiation), the following aspects are taken into account in FEAT:

1. the type of facility and the type of hazardous material that is released (e.g. toxicity);
2. the quantity of the hazardous material (e.g. kilograms or cubic metres);
3. the method of release (e.g. liquid, gas, aerosol);
4. the meteorological circumstances;
5. the effects on humans (time of exposure, exposure method – inhalation or physical contact).

Note to 1, *The type of facility and the type of hazardous material that is released (e.g. toxicity).*
There are many types of facilities with even more types of chemicals or hazardous substances. In the Netherlands every type of facility (enterprise) has a specific code – the SBI code list. This code list has been used as the basis for selecting types of facilities in FEAT.

At every facility a variety of hazardous materials can be present. For humans, the hazard norms basically concern toxic, explosive and combustible materials. The toxicity depends on the LC or LD concentration (Lethal Concentration or Lethal Dose) and the 'gas-generating capacity'. In Europe several national databases are available from which this information can be derived. For FEAT, the 'S3B'database of the Netherlands has been used. This database is a nationally accepted database for determining the type and effect of release of hazardous materials with respect to 'external safety', i.e. the effect on human populations. For effects on humans the Substance look-up table is based on the 'S3B' list.

The full 'SBI code list' has been assessed and combined with the 'S3B code list' to make it operative for FEAT, resulting in a list of approximately 225 types of facilities (FEAT facility listing of the 'Priorities Scan Module'). In order to prioritize in the 'First Alert Module' (FM1), the result has been assessed with the effect distances listed in 'The Green Book'. Dutch municipalities use this methodology for spatial planning purposes and for providing environmental permits. The Green Book is a general and indicative assessment tool to determine the effect distances (safety distances) around specific types of facilities, without having detailed information on a specific facility.

Note to 2: *the quantity of the hazardous material (e.g. kilograms or cubic metres).*
The effect of a release of a hazardous material depends on the quantity released. In Europe, a Council Directive (96/82/EC) was issued in 1996 to identify the most hazardous enterprises and locations of hazardous materials (the so-called Seveso Directive). The Directive is based on the quantity and type of specific hazardous materials. In the FEAT methodology, the type and 'lower tier' quantities of the Seveso Directive have been used as basis criteria for determining the potential impact (low, medium or high).

Note to 3: *the method of release*
FEAT assumes a 'full rupture' of the installation, where the total quantity (e.g. of a storage tank) is released into the environment. Basically, the following release scenarios are used in FEAT:

- toxic gas (GT) leads to a toxic cloud:

- toxic liquid (L-GT) leads to a liquid pool; and
    - the pool partly evaporates, generating a toxic cloud (into the air);
    - the pool partly releases to the environment (into soil, a river or a lake).
- flammable liquids (LF) lead to a pool:
    - the pool partly evaporates, generating a flammable cloud (into the air), and the cloud ignites (fire/explosion);
    - the pool partly releases to the environment (into soil, a river or a lake).
- flammable gas (GF) leads to a flammable cloud, the cloud ignites (fire/explosion);
- liquid persistent substances (Lp) release to the environment (into soil, a river or a lake);
- carcinogenic, mutagenic and reprotoxic (CMR) materials release to the environment (into air, soil, a river or a lake);
- explosive materials (E) explode, leading to overpressure (shock wave);
- combustible materials (C) lead to fire (heat radiation).

Note to 4: *the meteorological circumstances*
The calculation of the dispersion of gasses is based on the Dutch 'Yellow Book' (formerly CPR 14). Basically, the meteorological circumstances are assumed to be a wind speed of 5 m/s and stability class D, according to the most commonly used atmospheric turbulence classification developed by Pasquill in 1961. Six stability classes named A, B, C, D, E and F were designed, where class A being the most unstable or most turbulent class, and class F the most stable or least turbulent class.

Note to 5: *the effects on humans (time of exposure, exposure method - inhalation or physical contact)*
The effects on humans depend on various factors, such as time of exposure and exposure method (inhalation or physical contact). Beginning in 2003, several studies have been conducted in the Netherlands to determine the effect of quantity and the effect of hazardous material on humans. In 2005, this led to the National Register of Dangerous Substances (the 'Risc Register'). This methodology is used in FEAT. This implies that the effect of release of hazardous substances on humans is based on the following.

- direct lethal effect (toxic): 1% human mortality (irreversible effects): Lethal.
- direct health effect (toxic): less serious harm to humans (50% reversible effects): Health.
- direct lethal effect (direct contact with flames): 100% human mortality; outside flames: no effect.
- direct lethal effect (inside heat radiation area): 100% human mortality inside area where heat radiation is above 20 kW per m^2; outside this area of heat radiation: no effect.
- direct lethal effect (within overpressure area): 1% human mortality inside 0.1 Pa overpressure area; others are wounded.

Appendix 3 Ecosystem impact assessment overview

Introduction
The environmental assessment of FEAT focuses on so-called 'life-support functions' and on protection of valued ecosystems, with the eventual target of minimizing indirect impacts on man, or undesired impacts of any kind. This brief summary presents the scientific background of the FEAT approach with special focus on environmental impacts ('FEAT-Environment').

Key method characteristics of FEAT *Environment*
The key method characteristics of FEAT *Environment* are the following:

- the method follows the outlines of the other FEAT assessment;
- it uses the three-part concept of source, pathway and receptor to address whether real impacts can be expected (if one component is missing – for example, if there is no pathway, then real damage will be nil);
- it expresses potential damage in units that are easy to use and interpret: metres of potentially affected area (in diameter for lakes and land areas and in metres for rivers lengths);
- it determines the damage diameter or river length based on scientific information (ecotoxicology);
- it considers not only direct impacts, but also the potential damage that may occur secondarily;
- it is aims for impact prevention and management, for example by evacuating the hazardous area (human population) or by preventing hazardous compounds from reaching valued environments.

The method begins with typical chemical facilities, where each type of facility is considered to have a typical array of chemicals stored or in transport, in typical quantities (Q).

FEAT Environment method

Follow the risk assessment paradigm
The FEAT Environment method takes account of the typical methods of risk assessment that have been adopted worldwide (see Appendix 1) this means that:

1. the problem definition is that which is used above;
2. an exposure assessment is made;
3. an effect assessment is made.

Furthermore, because it combines exposure and effects assessment in the requirements for the problem definition:

4. it provides a risk characterization expressed as the area of damage.

From Quantity to environmental Concentration
The exposure assessment step starts with the quantity (Q) of stored and potentially released chemical(s), where the Q values have been derived as part of the main FEAT approach, for typical, major factory types around the globe. The units of Q are kilograms or litres, and usually expressed in summary amounts like tonnes. Since risks are determined by ambient concentrations, FEAT considers a disaster to cause Q to be spread over a volume of environment (E). The unit of this parameter is cubic metre. When the quantity Q spreads over the environment (E), the environment will contain a concentration (C), expressed in kg/m^3, or any other equivalent concentration unit. The larger the environment in which Q disperses, the lower the concentration, and the lower the impact.

Based on lists of Q determined for the FEAT method in general, and based on assumptions of the shape and volume of potentially affected environment, it is easy to describe the decrease of concentration in the environment as a function of distance. For FEAT, we have provided the following scenarios for some typical environmental situations:

- a lake (with a circular shape), so that the concentration is influenced by the lake volume (V) as follows: $V = \pi R^2 *$ Depth, where (for the tabulated values of the FEAT Environment method) the lake depth is assumed to be 1 metre and R (Radius) is the impact measurement of interest;
- a river, where the concentration is influenced by the river volume (V) as follows: V = Length * Width * Depth. FEAT assumes that Width=50 metres and Depth = 1 metre, and the affected river length is the impact measurement of interest;
- a soil area, with a circular shape, so that the concentration is influenced by the soil volume (V), as follows: $V = \pi R^2 *$ Depth, where (for the tabulated values of the FEAT Environment method) the affected soil depth is assumed to be 2 centimetres, and R (Radius) is the impact measurement of interest.

Conceptually, all exposure calculations are therefore mathematically straightforward and are determined by typical Q values and by the FEAT assumptions of the lake, river or soil volume that is potentially affected.

Concentration data related to impact magnitude

The effects assessment of FEAT Environment are based on vast amounts of ecotoxicity data, according to the principles of the Species Sensitivity Distribution (SSD) approach (Posthuma et al., 2002). Figure 3 provides an example of an SSD derived from acute toxicity data. An SSD is the statistical description of the variability in sensitivity (S) across tested species. SSDs can be made for each of the relevant compounds for which Q values are compiled in the general FEAT methodology, provided that there are ecotoxicity data.

An SSD relates the environmental concentration (C) (linkage to the exposure assessment, on the X axis) to the fraction of species that is likely to be affected on the Y axis. The latter fraction is quantified as the potentially affected fraction, PAF. The value of PAF varies between 0 and 1 (or between 0 and 100%). SSDs can be made on the basis of NOECs (No-Observed Effect Concentrations), which is common practice for deriving environmental quality standards for toxic compounds in various jurisdictions (including the EU and the US), but also on the basis of acute ecotoxicity data (EC50 values, those concentrations that imply serious adverse effects in 50% of the tested individuals). The latter approach was used for the FEAT Environment assessment.

Ecotoxicity data were obtained from databases on chemical compound ecotoxicity that are used worldwide: the EPA database in the USA and the RIVM database in the Netherlands (USEPA, 2002; Wintersen et al., 2004), as summarized by De Zwart (De Zwart, 2002).

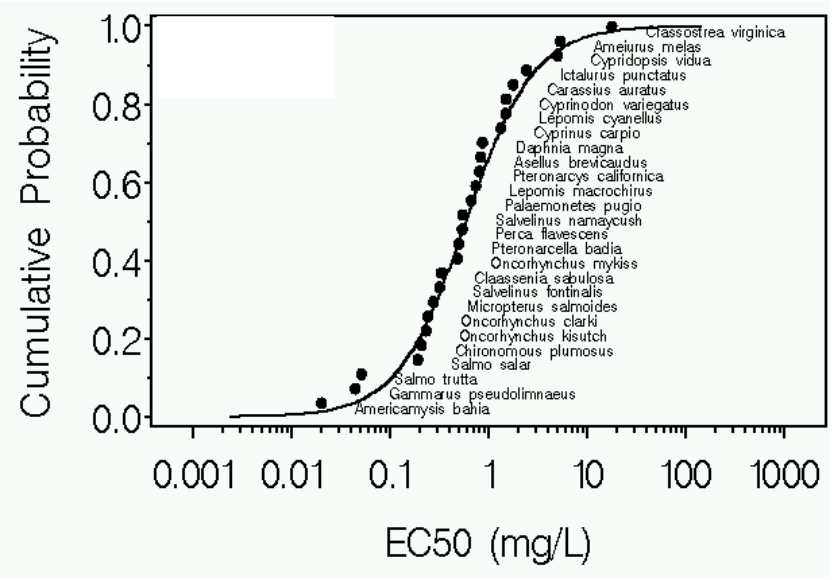

Figure 3. An example of a Species Sensitivity Distribution for a compound based on EC50 data from ecotoxicity tests with the aquatic species as identified. Each compound has a typical SSD, which is shifted left or right as compared to this example compound (for compounds with higher and lower toxicity, respectively). By selecting the PAF_{acute} = 50% as the FEAT impact criterion to address serious environmental damage (on the Y axis), the associated ambient concentration of a compound (on the X axis) can be determined from the SSD_{acute},. Simple exposure assessment calculations can then be used to determine the acute risk perimeter for soil areas or lakes, or the acute risk river length.

Risk characterization in metres

Based on the exposure assessment formulas (derived from Q) and the effects assessment data (derived from ecotoxicity databases and SSDs), the risk characterization can now determine the unknown variables that are relevant to underpin risk management action, i.e. the lake or soil diameter and the river length that would be seriously affected. In the FEAT methodology, the risk characterization is then tabulated as a look-up table (in metres) to enable quick application in difficult and realistic assessment conditions as experienced in the first hours and days after a major disaster.

Summary

As summary, tabulated typical Q quantities are assumed to be emitted (directly or indirectly) following a disaster in an environmental volume (V), yielding a distance-concentration function (larger distance implies larger volume, which implies lower concentration). With this function, the perimeter of a lake or a soil area is sought where the concentration would immediately cause 50% mortality of the species in the environment. This so-called PAF_{acute} = 50% depends on the ecotoxicity of the compounds. By means of simple calculations (combining Q with the characteristics of typical lakes, soil systems or rivers) the affected area or river length is expressed in metres and is tabulated. In other words, when either the toxicity of the compound or the value of Q increases, the diameter and river length also increase.

Discussion

The strength of the method is that it compiles all available scientifically complex knowledge on the ecotoxicity of compounds into easy-to-use units: metres of potential damage. This is enough to take immediate action when needed. Actions can be anything that helps to reduce damage dispersion of Q in the environment, such as keeping Q localized as much as possible.

A weakness of the method is that various assumptions are made to obtain look-up tables for expected impacted areas, e.g. the shape and depth of lakes, soil areas or rivers. Only when such assumptions are made, can values be tabulated, which was the requisite for FEAT Environment. Scientifically, there is an easy solution: FEAT Environment provides formulas to calculate the impact area based on local river width and depth, lake shape and depth, and intrusion of compounds into soil. This would, however, seriously affect the usefulness of the method in the first hours after the disaster, since it would require calculations. By including the assumptions in FEAT, the system was designed so that the information as presented in the look-up tables is representative for typical situations that may occur in the field, and so that the field teams can interpret the outcomes to take immediate measures, depending on the potentially affected areas. In that sense, when they see compound A and B having vastly different impact areas, this should and does imply that they would focus primarily on the compound with the largest impact area.

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SECTION II Case study

10 A case study with FEAT

10.1 Introduction

This section presents a simple case study performed with FEAT. The case study sketches how FEAT-emergency management activities can unfold when information about an affected industrial site becomes available over time.

To perform the impact assessment and to go through the different steps of the assessment the user guidance and tables of section III of this report are used. Only the main features and the most-likely use of the modules are highlighted.

The case study represents the steps by (and for) an advanced user, omitting a detailed description, but providing insight into the generality of FEAT and its result as disaster management support tool in a post-disaster management situation.

10.2 First hours after the disaster

10.2.1 Information present in first hours after disaster:

One hurricane and severe rains struck one of the most important provinces of a developing country. Within the disaster area there is an industrial site which is located on the embankment of the (imaginary) river Wool near the (imaginary) city of Woolmouth.

There is a production facility of industrial gasses such as hydrogen chlorine and a wood-treating industry which is believed to use (concentrated) arsenic.

10.2.2 Stepwise assessment results

Step 1.
By matching the situation with the characteristics of the modules described in the user guidance, the First Alert module is selected to be used at this stage because it serves as first screening for big and obvious major potential impacts in cases where very limited information is available.

Step 2 through 3
It is checked whether the facilities are listed in the look-up table of the First Alert Module, FT1, and what the major potential implications would consist of.

Both facilities are listed in FT1, and there is thus a high priority alert for possible major effects.

The table entry for the production of industrial gasses suggests potential for serious direct impact on humans. From the same table it is derived that this facility also may have medium effects on life support and nature and lower effects on the long-term.

The table entry for the wood treating facility suggests primarily long-term impacts. It can be determined that wood treating industries using arsenic potentially affect the receptors human and nature in the long term and can also directly affect the functions life support and nature as major impacts.

Step 4
As a follow up action the Likely Scenario Table (LST) table is used to indicate the relevant receptors and pathways (based on the information about the location) in relation to the potential hazards that are present.
The LST indicates that the main pathway of dispersion connected to the hazard of toxic gasses is air. Humans are identified as the main receptors. Based on this information it follows that for this facility the presence of humans downwind of the facility are of prior concern if the toxic gasses have lost or might lose containment.

Arsenic is known to be toxic and to have accumulating properties. If the wood treating facility uses arsenic it may have a serious direct and long term impact (derived from FT1). From the available information it is thus concluded that one has to deal with a toxic liquid with persistent and accumulating properties. Considering the gross information that is available on the location the Likely Scenario Table indicates that besides humans also fishing areas and surface waters, ground water wells, rivers and lakes are potentially relevant receptors. The main pathway of dispersion is water (groundwater, river, lake). Checking the possibilities of dispersion and thus exposure of the relevant receptors trough water is one of the priorities for follow-up management investigations and action.

The wood-treating facility is listed within the table under the heading long-term impacts. It can be determined that wood-treating industries using arsenic potentially affect the receptors human and nature in long term and can also directly affect the functions life support and nature as major impact.

Another follow up action is a first desktop impact assessment using Module FM3 for both facilities if there is an estimation of the quantities involved. As long as there is no information on quantities the Priorities module (FM2) can be used to determine priority between the facilities.

Step 5
The first assessment was focused on the information of the facilities readily available. Within the context of the disaster other facilities or hazards as listed in the First Alert Module (FT1) or the Likely Scenario Table (LST) might be present. For instance:

- are one or more of the natural impacts as listed in the LST to be expected?
  - direct impact on life support from the wind by the damage to agricultural products (banana trees *et cetera*)?
  - possibility of landslides from the rain if the area has steep hills?
  - erosion of fertile soil or mudflows?

It is advised to check whether other receptors, damage types or facilities are present or likely present.

10.3 Priority setting after obtaining basic local information

10.3.1 Information present after arriving at the location:

Usually the disaster management team (or members) has arrived in the area or location of interest, and as the disaster has evolved, more information becomes available. The situation in this phase is now characterized by the following additional information (as compared to the initial phase described above):

- the industrial zone is the most important hazard source in the disaster area (any natural impact on nature and infrastructure such as landslides or erosion is not expected any more upon local inspection and expertise).

- the facility producing industrial gasses is severely damaged by the disaster but no emissions have been reported so far;
- it is assumed but not confirmed that there is little damage to the wood-treating facility;
- there is also a paint production facility within the same industrial zone near the city of Woolmouth. There is no information about the damage to this facility.
- the surface near the industrial site is flat, with a generally low slope towards the riverbanks. The soil consists of semipermeable mixture of gravel and sand. The location is seismically stable. The groundwater flow from under the industrial site is direct towards the river. The groundwater level is approximately 1 m below surface.
- Figure 4 provides a rough map of the region. The river Wool (at 100 m from the industrial site) discharges in Lake Woolly at 15 km downstream of the river Wool. The lake is an important fishing and food source area for the local community. The industrial site is surrounded by city areas (being the city Woolmouth at 3 km) and agricultural land. Close to the site at approximately 10 km a nature reserve is present.

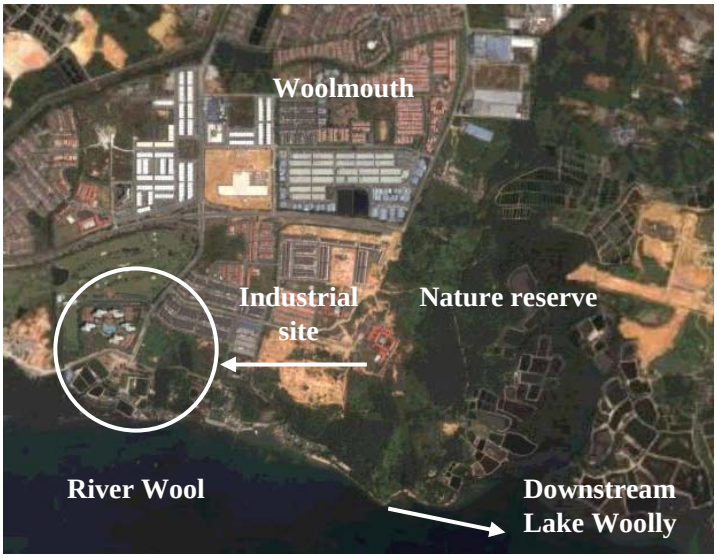

Figure 4. Location of the storage site – main and local watercourses

10.3.2 Stepwise assessment results

Step 1

The industrial zone itself has now been identified to be the most important environmental hazard in the disaster area, therefore focus lies on this site. It is now time to determine which of the facilities has a priority for field visits. This can be determined with help of module 2, the Priorities Module.

Step 2a through 2d

The advanced user will perform step 2a till 2e for all facilities simultaneously to yield actual information on the main potential hazard and actual estimates of possibilities of exposure. This assessment is based on the spatial situation of the facilities and the relevant receptors and pathways present in the area as well as estimates of the magnitude of the impact based on typical quantities as derived from table FT2 ‘Facilities and Objects of interest’. When the assessor is not familiar with FEAT, the assessment proceeds by following the steps as presented in the user guidance.

By consulting FT2 the assessor can conclude that paint production facilities use solvents for the production of color and paint. Solvents are considered liquids with medium toxicity (based on hazard type LTe2). From FT2 it is concluded that the main effects of this type of compounds can be expected on life support and nature. Medium effects are expected on humans and small effects on the long term. If a typical quantity of 25,000 kg of solvents is present at the facility, effects on humans can be expected from 500 m to 5 km away (in case there is a pathway present). By using the Likely Scenario Table it can be determined that fishing areas, surface water and other water bodies like rivers and lakes are the most relevant receptors. Water bodies are also the main pathway through which exposure of the receptors takes place. Considering the available information about the situation of the industrial site near the river Wool, direct impact on aquatic life support and nature functions is concluded to be of prior concern. Impacts on humans are less likely to be expected due to the absence of a relevant exposure pathway (soil or air).
To conclude, there are mainly possibilities of exposure of and impacts on aquatic life support functions when the stored substances have lost containment and reach the nearby river Wool, as the river is connected to fishing grounds and a nature reserve. Possibilities of exposure after the loss of containment depend on the connection between the exact location of the substances and the river system via drainage or direct discharge.

When consulting FT2 for the facility producing industrial gasses it is known that the most important hazard is the toxic gas hydrogen chlorine. If the gas looses containment humans and (land) animals are at immediate risk downwind of the plant. The expected impact contour is between 5 and 50 km (at typical quantities of 5,000 kg) because the gas is transported by air (determined earlier with help of the Likely Scenario Table). Life-support functions and long-term effects have a medium and low priority respectively. From the map it is clear that the city of Woolmouth is located within the potential effected area if the gas looses containment (not yet reported). Meaning that further research on the state of the containment has a very high priority.

When consulting FT2 and combining the results with results of the first assessment, the wood-treating facility potentially has a serious long-term impact on humans, (aquatic) life-support systems and nature. Also potentially direct effects are present on (aquatic) nature. Direct effects on humans are of medium priority and only if the typical quantities of 10000 kg are present. A possible impact contour of 500 m to 5 km can be drawn for direct effects on humans. Water courses or groundwater are the most important pathways that might lead to exposure. Considering the location of the facility near the river Wool relevant watercourses are present and the fishing grounds in Lake Woolly and the nature reserve are vulnerable receptors that are seriously threatened if the solvents loose containment. Exposure is not sure but possible. Possibilities of exposure after the loss of containment depend on the connection between the exact location of the substances and the river system via drainage or direct discharge. If the substances reaches Lake Wooly the fishing area might be damaged without the possibility of recovery.

Step 2e

In the above approach the main hazards of the facility and chemicals have been identified. However chemicals can have multiple hazards. At this stage these additional hazards have not yet been assessed. If deemed relevant, assessing these hazards in addition tot the main hazard can now be done. To do this the same steps as before have to be taken per chemical and hazard (not worked out in this example). The additional hazard types are considered relevant if they have a different or increasing type of impact or reveal different possibilities of exposure.

Step 3

Table 3 summarizes the results from step 2a to 2d for the main hazards of the facilities.

Table 3. Summary of steps 2a till 2d for the main hazards of the facilities.

Facility	Hazard (and Compound Class)	Exposure		Impact of prior concern	Q (Quantity of compound(s))	Remarks and considerations
		Pathway present	Receptor present at location			
Paint	Liquid medium toxic to environment (LT2e)	Water bodies like river and lake, possibly also drainage systems (?)Aquatic organisms/fishes	Aquatic organisms/fish	Life support and nature direct	Actual amounts not known but assumed to be present.	Large waterbody possibility for dilution? Direct impact, recovery is possible. Medium toxicity.
Industrial gasses	Acute toxic gas to humans// (land) animals (GT5)	Air	Humans	Human direct	Actual amounts not known but assumed to be present Possibility of instantaneous release or more continuous release from a pipeline?	No release noted yet. Facility is severely damaged. Short window of opportunity to mitigate if gas loses containment (plume of gas passing by, directly impacting humans). Possibility for continuous source (pipeline)?
Wood treating	Highly persistent and bio-accumulating toxic substance (PB2)	Water bodies, groundwater, possibly also drainage systems (?)	(Aquatic) life support functions, (aquatic) nature and humans	Long-term	Actual amounts not known but assumed to be present	Large waterbody, possibility for dilution? If damage has occurred the prevention of any dispersion is of prior concern at this stage (to prevent long lasting impacts). Check irrigation of agricultural land with water from river Wool. Check source for drinking water?

Step 4

Prioritization for field visits (which further support management action after inspection) is based on common sense and is thus subject to discussion.

In this case study the facility producing industrial gasses gets priority for a field visit because severe damage to the facility is reported and the potential direct impact to humans is large. If the gas is about to loose containment in the near future due to damage of the facility, preventive measures are highly effective and may save many lives.
On the other hand one could argue that no effect is noted and thus the chance that the gasses have lost containment is small. If the gasses are already released and the source is not continuous (for example a pipeline) the damage has already occurred and possibilities of mitigation measure will have a limiting effect.

Also the wood-treating facility needs to be visited with priority. If the substances have already lost containment, any measure to prevent further dispersion of the substances would be highly effective and would reduces the impact downstream of the facility (the river and the lake) significantly. Preventive management (causing the hazardous compound not to reach the sensitive receptors) prevents long-lasting or even irreversible impacts on e.g. life support by fisheries.

The facility producing paint has the lowest priority for a site visit due to the medium toxicity and the possibility of recovery after an impact has occurred. Evidently, low priority does not mean that the field team shouldn't visit the field site of low priority at all; it just indicates the sequence of site visits that would be optimal to reduce secondary damage to the most.

Another follow up action is an impact assessment using Module FM3 for all facilities if there is an estimation of the quantities involved.

Step 5
A next step is to consider ‘less likely’ scenaria that are not highlighted in the Likely Scenario Table. Within this case, additional pathways of exposure could be considered, like a drainage system that connects the paint producing and wood-treating facilities to the nearby river Wool which would seriously increase the risk of spreading of the contaminants. Also the use of irrigation water originating from the river Wool for the agricultural use can be considered a realistic pathway. In the latter case, the water might be contaminated by the substances from the wood-treating industry (persistent and bio-accumulating), and this poses an additional potential impact. Avoiding this potential exposure is easy, since it implies a management action ‘to stop the pumps’ temporarily.

10.4 Risk assessment of the facility

For the explanation of this module only one of the facilities is described in this example. For the other facilities a similar approach can be used.
In the pervious module it was determined that the facility producing industrial gasses would need to get management priority due to potential direct effects on humans. This facility is taken as an example to perform an impact assessment using Table FT3 of the Facilities and Objects Assessment module.

10.4.1 Information present after field visiting the location

In the present phase, it is known that the facility is severely damaged and that it contains hydrogen chlorine as an acutely toxic gas.

10.4.2 Stepwise assessment results

Results from earlier assessments and Step 1
The detailed hazard type (in this case GT5) can be found in the Substance look-up Table or if you have done an assessment with the priorities module FT2 you have already determined the hazard type during this assessment. Because of the direct impact on humans by air it is crucial to consider the personal health and safety of the risk assessors and managers, next to the hazards for the local receptors. The look-up tables suggest to approach the facility from a safe upwind distance if really needed. A local authority confirms that approximately 4000 kg of hydrogen chlorine is currently stored at the plant. Visual inspection from a safe distance, using binoculars, suggests that the plant is in real bad shape and the foundations of some of the installations are partly washed away. There are however, no clear visual signs proofing effects or releases at this point, although there is neither information demonstrating that the situation is safe for the coming hours and days.

Step 2 through 3
From the earlier assessments and novel information, a lot of information has become available about the facility. Now that the quantity of the stored compound is relatively well known and precise, the risk assessor can use the Facilities and Objects Assessment module to give a precise estimation for one or more maximum effect contours.
Table FT3 shows relevant information under the heading Toxic gas, explosive, flammable and small containers, where it suggest the hazard type GT5; this stands for acutely toxic. Due to the absence of 4000 kg in the table you can use the most related quantity above the actual quantity (in this case 5000 kg). At a quantity of 5000 kg hydrogen chlorine the potential lethal impact zone for humans is up to 350 m. Severe health impacts on humans are possible up to about 6.2 km. The same impact distance applies to large (terrestrial) animals (e.g. cows). There is no indication for impact on life support and nature.

Step 4
The city limits of Woolmouth are located at 3 km downwind. This suggests that the number of human casualties may be limited (as compared to a facility within a city area), but that human health effects can be expected well within the city of Woolmouth. Effects have not yet been reported, which indicates that a release of hydrogen chlorine has most likely not yet taken place. However due to the bad condition of the plant and the potential impact distance the follow-up actions to be considered are to (1) notify all the competent local authorities (usually the fire brigade of civil defense) about the facility and the potential impact and (2) calling the emergency back-office to discuss the situation or if necessary request for an expert opinion.

Step 5
If you have assessed all facilities with the FT3 table and there are no further facilities or chemicals that can pose risks you can finish your assessment with FEAT.

Further actions that can follow, but are not within the scope of FEAT, are:
- the evacuation of the inhabitants of Woolmouth;
- repair of the storage tank containing the hydrogen chlorine;
- the controlled removal of the hydrogen chlorine from the industrial site.

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SECTION III User version and executive summary

The Flash Environmental Assessment Tool (FEAT)

To identify acute environmental risks immediately following disasters
Version 1.0

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The Flash Environmental Assessment Tool (FEAT)

To identify acute environmental risks immediately following disasters
Version 1.0

Table of Contents

Acknowledgements
This document is a user version of FEAT based on the extensive description of the method in: van Dijk et al. (RIVM report no. 609000001).

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Disclaimer
FEAT combines large amounts of scientific insights and data into one simple tool for use in field-based situations. Assumptions are made in the FEAT, some of them approximate. FEAT outputs will help prioritize the activities of relief and risk management teams, but cannot provide definitive scientific assessments or analysis. For example, FEAT cannot provide exact impact perimeters. Exact results will depend on individual cases and conditions. Users will need to set priorities based on actual field situations, which may differ from those presented in this document.

Foreword and Scope

The Flash Environmental Assessment Tool (FEAT) helps to identify existing or potential acute environmental impacts that pose risks for humans, human life-support functions and ecosystems, following sudden-onset natural disasters. FEAT focuses primarily on immediate and acute impacts arising from released hazardous chemicals. It can also help to identify potential long-term issues, for example those involving releases of persistent compounds. FEAT also provides information on physical impacts to the natural environment, such as soil erosion and salt water intrusion.

Based on this information, users can decide on initial risk management actions under disaster conditions. In particular, it helps users make timely and accurate requests for additional, specialized equipment or expertise to address impacts.

1. Introduction

Natural disasters such as earthquakes, floods and hurricanes can damage infrastructure and result in secondary environmental impacts such as immediate or potential releases of hazardous materials. These can pose acute risks to human life and health, and adversely affect surrounding environments that are vital for livelihoods. Natural disasters may also trigger physical impacts such as salt water intrusion, mudslides, slope instability and flooding.

Disaster response teams are faced with the difficult task of not only dealing with the disaster at hand, but also identifying and responding appropriately to these potential environmental impacts. However, thousands of toxic chemicals could be involved in any given disaster, each with its own toxicity profile, and with a multitude of exposure pathways (e.g. air, water and soil) and receptors (e.g. humans, livestock, fishing grounds). In such complex situations, it can be easy to overlook or misjudge important risks. At the same time, given the often overwhelming demands of disaster situations, complex and full-fledged environmental assessments would be inappropriate. Therefore, a practical, accurate, yet simple tool is required to assist initial response teams such as United Nations Disaster Assessment and Coordination (UNDAC) teams.

With these challenges in mind, FEAT is a carefully balanced compromise between simplicity and scientific rigor, with emphasis on usefulness to response mechanisms such as UNDAC teams. It provides quick answers in complex disaster situations, even in the absence of specialized technical resources or expertise.

In summary, FEAT is a “first aid” tool to identify environmental impacts, and support initial response actions in disaster contexts. It does not take the place of in-depth environmental assessments, which may be appropriate at later stages of the disaster response. Findings from use of the FEAT should be communicated quickly to appropriate organizations so that appropriate actions can be taken, as described in this document.

2. Basics of the FEAT concept

Following is an overview of the key elements of the FEAT, a tool designed to balance scientific rigor with simplicity of use.

2.1 Modular approach

FEAT consists of three increasingly detailed assessment modules. This approach allows for maximum flexibility in differing and evolving disaster conditions. It also recognizes that users will have varying questions and needs, at different stages of the initial disaster response. The modules can be used independently, but taken together they represent the typical steps usually followed from the first notification of a disaster to the end of the initial response.

- The First Alert Module helps to scan for the presence of certain potentially high risk facilities in the affected area (FEAT Module 1/FM1)
- The Priorities Module helps users to determine objects of interest within an area and to, prioritize field visits (FEAT Module 2/FM2); and,
- The Facilities and Object Assessment Module helps users determine risks from individual facilities such as factories, or objects, such as storage tanks and trucks of chemicals (FEAT Module 3/FM3).

These modules provide pre-defined impact assessment information that help the user identify the potential magnitude of the impact of a given hazard and quantity. To determine whether the potential impact is actually relevant, it must also be determined whether exposure is likely. The FEAT Likely Scenarios Module (LSM) provides the most likely and important combinations of the type of hazard, the receptors, pathways and the type of impact to be expected, as described in more detail below.

Each FEAT module links to a table that provides the user with the information needed to use that particular module. The tables are numbered in accordance with the corresponding module. For example, the Module 1 (FM1) is the First Alert Module, and its corresponding table is Table FT1.

All modules follow the same basic steps.

2.2 Operational output: "metres of probable effect distance"

FEAT Module 2 and Module 3 combine all information on substance toxicity and chemical impacts into a single unit, called "metres of probable effect distance". This concept is easy to use anywhere. To express the severity of various long-term potential effects, such as carcinogenic hazards, a severity index is used.

2.3 One basic concept for the entire assessment tool

The core concept of FEAT can be expressed by the formula: Impact = F (hazard, exposure, quantity).

Stated differently, all FEAT assessments are based on three impact-determining factors:

1. Intrinsic hazard of the compound
2. Possibility of exposure (if there is no receptor and/or no pathway, there is no exposure and thus no impact)
3. Quantity (the larger the quantity, the more severe the impact).

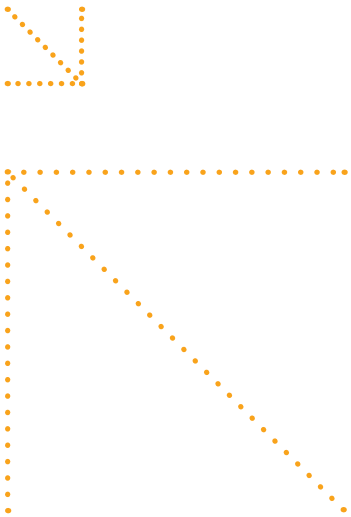
A situation only has a relevant impact if the hazard, exposure and the quantity are all significant. The magnitude of the impact depends on the combined contribution of all three impact determining factors together.

For example: a highly toxic material in large quantities has a small impact if minimal exposure takes place. By contrast, small amounts of a substance with only medium toxicity will have a high impact if people or the environment are highly exposed.

FEAT provides the user either with predefined information or requests estimates for all three impact-determining factors. It then provides a predefined estimate of the impact in terms of metres of expected impact distance or severity indexes.

2.4 Focus on the most likely scenarios

FEAT helps the user to determine the most likely and highest-impact combinations of hazards, receptors, and pathways. Less likely combinations of hazard, exposure and quantity are not prioritized in the FEAT.



For example, toxic gases normally pose risks primarily due to exposure through the air, and are of most immediate concern to human health. This would be prioritized in FEAT. Toxic gases may lead to other types of exposure – for example, it may become a solution in a river, or lead to crop damage. However, such impacts are generally less likely, and/or less relevant in the first phase of a disaster. Therefore, they are not prioritized in the FEAT. These distinctions allow users to focus assessment needs and concentrate on most probable risks.

2.5 Reliance on common sense

There are infinite possible combinations of hazards, pathways and receptors. More than 100,000 compounds can be emitted under a wide range of possible geographical conditions. All situations can therefore never be contained in a single tool. The information in FEAT can at best provide insight into situations that are similar to those that will be encountered in the field, and illustrate implications for action. Beyond this, FEAT assumes and relies on the common sense of its users to adapt the FEAT to actual situations using the above-noted formula and the Likely Scenarios Module.

BOX 1: A parable

Imagine a child sitting at a table in a dining room. A goldfish swims nearby in its bowl, and a cat lies under the table on a carpet. Soup is being served. Unfortunately, the soup is spilled and spreads across the table.

What do you do?

It is clear that you have to assess the situation quickly, make some assumptions and act accordingly. Your actions will depend on your interpretation of the most important potential impact scenarios, ranging from: a dead fish, an injured child, a ruined carpet, an injured cat, and the remaining soup being edible. This action will, in turn, be guided by your understanding of the hazards posed by the soup, such as its temperature, the possibility for stains, the pathways along which the soup can reach receptors, and the amount of soup spilled.

Many possible risks can be imagined, and assessment needs can be high. The soup may be hot, cold, a thin bouillon or thick pea soup. The child may be old enough to jump aside, or too young to move alone. The carpet may be a family wool heirloom and difficult to clean, or may be cheap and worn

Assumptions must be made in this situation if no further information is available: soup is generally served hot, the child is unlikely to be able to move quickly, and avoiding harm to children is normally considered more important than avoiding harm to a cat or carpet. Therefore, child safety would guide initial decisions, and first action taken would be to remove the child. This would prevent damage to what is considered the most valued and threatened entity.

After the child is safe, the situation can be re-assessed and the risks to other targets can be considered. By looking at the pathway of the hot soup, the second action is to stop the soup flow, and by taking a single action, save both the cat and the carpet. No action is needed for the fish; exposure is unlikely due to the protective bowl and water around the fish.

Finally, after the emergency situation is declared to be “under control”, cleanup activities are started. If necessary, this can be done with some delay.

The parable helps to understand the basic concept of FEAT, namely to identify and act upon the most important likely scenario.

FEAT takes the same steps as in the parable: The logical and most adverse combinations of hazard, possibilities of exposure and type of impact are determined in the Likely Scenarios Module and the situation is assessed using one or more of the three assessment modules. In the parable, the most hazardous situation is a hot, thin soup moving towards a young, vulnerable child. Damage to carpets is secondary, or can be addressed later. Damage to fish could happen, but is unlikely. In FEAT, hazardous compounds are classified as gases, liquids or solids. These are linked to typical pathways of exposure (air, bodies of water, soil) and to typical impact types (human mortality, effects on life support systems including effects on drinking water, fisheries and agriculture). By pre-selecting the most likely cases – such as injury to a child, in the above example - FEAT limits assessment efforts and helps users focus on the most relevant scenarios.

3. Use of FEAT

Introduction

FEAT consists of three independent assessment modules, the Likely Scenarios Module and the User Guidance. Following the User Guidance, FEAT users will select the module that best suits their needs and circumstances, follow the instructions to perform the assessment, and proceed to the next module as needed. The user will go through the same basic steps in each module. The modules can be used independently, but taken together represent the steps normally taken from the first notification of a disaster, to the end of the initial response.

Use of the FEAT is guided by:

- the background information contained in this chapter, which explain the use of each module. This is divided into Part 1, which provides general information, and Part 2, which provides module-specific information; and,
- the FEAT User Guidance, which provide detailed, step-by-step instructions in a visual format and show the link between modules.

One of the most important outputs of the process is a clear understanding of whether additional international expertise and/or resources are needed to address any of the impacts identified. This information, as well as any other information resulting from a FEAT assessment, should be communicated at the earliest possible time to the appropriate body.

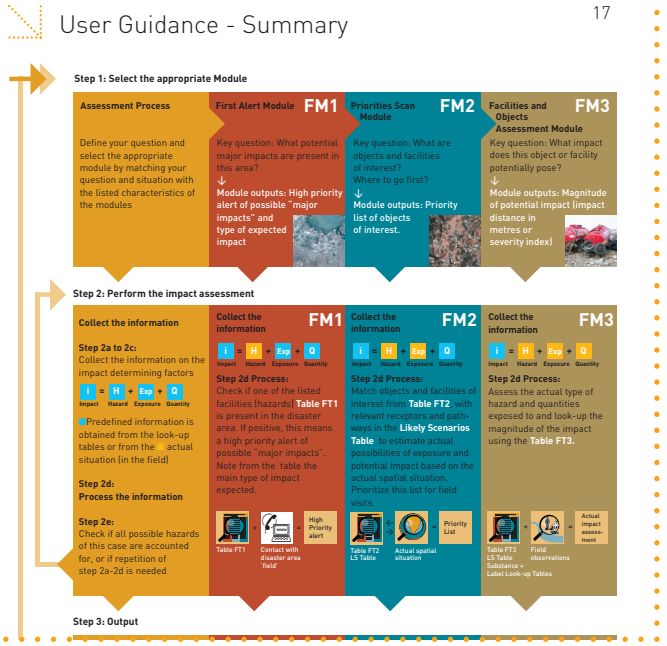
Part 1: General information on use of FEAT

Step 1: Select the appropriate module

Select the appropriate module by matching your situation and questions with the characteristics of the modules described below and summarized in the Summary of the User Guidance (Figure 1). Users should choose one of the following three assessment modules:

- The First Alert Module (FM1) to scan for the presence of certain potentially high risk facilities in the affected area;
- The Priorities Module (FM2) to identify facilities and objects of interest in the affected area, rank according to potential **impact** and prioritize field visits; and,
- The Facilities and Objects Assessment Module (FM3) to determine impacts from individual facilities such as factories, or objects, such as storage tanks of chemicals.

Figure 1, snapshot of the User Guidance - Summary



As described in more detail below, the Likely Scenarios Module is the core of the FEAT. It will be referred back to following the use of any of Modules 1-3, to focus efforts on the most likely and highest impact scenarios of a certain hazard.

After selecting the appropriate module, follow the remaining steps as shown in the column in the User Guidance for the selected module.

Step 2: Performing the impact assessment – general information

The following steps are common to all modules. Additional, module-specific guidance is provided below in part 2.

Steps 2a through 2c: Collect information on the impact-determining factors.

Using these steps, collect information about the factors

Figure 2: snapshot of the User Guidance

that determine the impact: (a) main hazard, (b) possibilities of exposure (i.e. pathways and receptors as selected from the Likely Scenario Module), and (c) substance quantity. Part of the required information can be found in the tables within the modules. In Modules 1-3, you collect information in a similar fashion. Instructions are included below which will help you in collecting and interpreting the required information.

- Every table within a module contains information about the hazard, the quantity of the substance and the potential (type or magnitude) of impact. For all modules, the information about the possibilities of exposure is obtained by referring back to the Likely Scenarios Module, which combines details on receptors, pathways and the expected main type of impact relevant to specific hazards.
- The tables that belong to the various modules have the same general structure. The general structure of the headers shows the main divisions of the tables in which the impact-determining factors can be found (H, Exp, Q = i). Varying amounts of detail are provided in the columns of the respective table, according to the aim of the module.
- When collecting information about the impact-determining factors, users will have varying amounts of the predefined information from the FEAT table that corresponds with the module. In some cases, estimates must be made with the information from the field. The FEAT User Guidance Tables describe the sources of the information used for the module and the extent to which actual field observations are required for each module.
- The table FT1 that corresponds to the First Alert Module is divided into three impact types: those involving direct impact on humans, those involving long-term impacts on life support and nature and objects that mainly pose an immediate threat to life support and nature. Users may want to focus on facilities, processes or hazards for one of these types of impact, based on the type of region in which the disaster took place (e.g. densely populated, agricultural, or aquatic environments).
- All tables provide an estimate of the type, magnitude and/or severity of impact.

The following types are distinguished:

- Direct impact on human health
  - Immediate death and immediate adverse health effects (e.g. explosion, immediate toxic effects)
- Direct impact on life-support functions and nature
  - humans are impacted through effects on their life-support functions e.g. direct impact on crops, fish resources, agricultural land, water supply
  - the same direct impacts that affect life support functions can also threaten biodiversity and specific species or ecosystems
- Long-term impact on life-support functions, nature and humans (toxic persistent substances entering the food chain and natural ecosystems and effects of carcinogenic substances).

Human direct

Long term

Life support and nature direct

- The tables corresponding with the First Alert Module and the Priorities Module provide recognizable objects/facilities and processes that use substances having a specific type of hazard. This makes it easier to determine the hazard. Depending on the information that is available in the field, one of the following columns is to be used: facility, process, substance or hazard type, to define the hazard in question.

Step 2d: Process the information,
Processing for each module is adapted to the aim and characteristics of the module.

Step 2e: Check if the first steps should be repeated to account for other hazards
Determine whether steps 2a to 2d of the assessment must be repeated for other hazard aspects of the same case or substance. If substances pose more than one type of hazard, such as toxic liquids with substantial volatility (e.g. with the potential hazard of the liquid itself, and the gas evaporating from the liquid), both types of hazard must be considered and both types of expected impacts must be taken into account. To do this, go through steps 2a to 2d as many times as necessary for each hazard.

Step 3: Generate or review your output
Compare the importance of the impact-determining factors and evaluate them based on your common sense understanding of the collected information. This is the definitive result of the assessment of this case.

Step 4: Follow-up actions to consider
Based on the results of the impact assessment of this case, consider suitable follow-up actions or collect supplementary data from the field to make a more detailed impact assessment with one of the other modules.

Step 5: Exit or go to next impact assessment
Determine if there are other cases that require evaluation (other objects or, for example, the leakage of a second substance from the same object) or if the assessment has been completed.

Follow up actions after completing the impact assessment
It is vital that relevant findings be communicated to the relevant organizations, so that action can be taken to mitigate impacts. In many cases the appropriate organization will be the Joint UNEP/OCHA Environment Unit Joint Environment Unit.

Part 2: Module-specific information

Likely Scenarios Module (LSM)

As noted, this module is the core of the FEAT. It focuses the assessment on the highest impact and most likely scenarios by allowing the user to combine the information on the hazard, with likely pathways and receptors and resulting impact to be expected. In this way, the user can determine whether an identified potential impact creates a high-risk scenario. In most cases, users will keep coming back to this module, to determine and focus assessment needs identified in other modules.

Using the table

The combinations of hazards, pathways, receptors, and resulting impacts are relevant to all FEAT modules and are provided in the LSM (Likely Scenario Module). This module lists the main types of hazards (first column).

Find the actual hazard of your situation/case (in most cases derived from step 2a of the single impact assessment you have conducted using modules 1-3) in the first column of the table. Follow the rows of this hazard type to determine the relevant receptors for this hazard, the relevant pathways of dispersion and the expected main type of impact. The main type of impact is indicated with colour codes and priority numbers that are explained below the table.

For example, if you are dealing with a toxic gas or smoke, the LSM indicates that humans are the main relevant receptors and air (wind) is the main dispersion pathway. The table indicates that direct impact on humans is the most likely type of impact and is a high priority concern. Estimate the possibilities of exposure from the proximity of the nearest humans (settlements) and the direction of the wind would be your follow up actions based on this scenario information. This knowledge provides focus to your assessment process and follow-up measures. If this Likely Scenarios Module is used as part of a single assessment using another module, the listed receptors and pathways are taken into account in the subsequent steps of the assessment.

Figure 3: snapshot of the Likely Senario Table.

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Likely Scenarios Table

H Hazard Type from facilities and substances	Exp Relevant Receptors						Relevant Pathways						Q	i Potential Impact		
	Human	Live support			Nature									Human direct	Long-term	Life support and nature direct
	Humans[1]	Fishing area surface water	Ground water (wells)	Agriculture	Nature reserves	Rivers, lake coast	Air	Soil, Ground-water	Lake	River, drains	Human	Animal				
Toxic gas, explosive, flammable, combustible, small containers																
Toxic gas and smoke (GT)	■						■						☐	1	3	2
Explosives (liquid, solid) (E)	■						■				■		☐	1	3	3
Flammable and explosive gas (GF)	■						■						☐	1	3	2
Flammable liquids (LF)	■								■	■			☐	2	3	2
Small containers of chemicals ***	■									■	■		☐	1	3	2
Toxic liquids (to humans and environment)																

Figure 4: snapshot of First Alert Module.

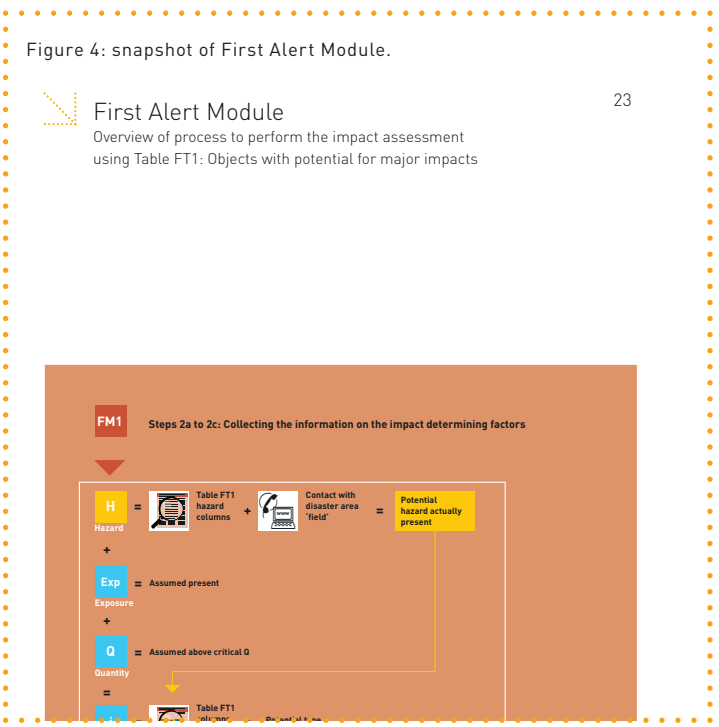

Figure 5: snapshot of table FT1 First Alert.

First Alert Module (FM1)

Immediately after the onset of an emergency, the First Alert Module (FM1) is used to screen for "big and obvious" potential impacts. Generally speaking, if one of the listed facilities is present in the affected area, there is cause for concern and reason to investigate further.

The First Alert Module has been kept as simple as possible, and all steps of the impact assessment are compressed into a single look-up action using its corresponding table, FT 1. The only action needed is to check whether one of the facilities listed in the first column of FT1 is present within the disaster area. If the facility is present you will have a high priority alert for possible major secondary effects, and immediate action is recommended to verify the actual status of this facility and act accordingly.

By following the row for the facility (table FT1) that is actually present in the disaster area (indicating a certain hazard), you can find the main type of impact to be expected. Use the type of impact as an indication of the threatened receptors, exposure routes, reaction time frame, opportune prevention or mitigation measures, and type of expertise required. In the First Alert Module, both the substance that causes the hazard and the exposure are assumed to be above the critical level (as shown in the table).

Priority Scan Module (FM2)

During the second phase of the response to an emergency, assessment teams must identify objects and facilities of interest, plan field activities and establish priorities for actual field visits with the Priorities Module.

When using the Priorities Module, facilities or objects that may be of concern within a specific region are identified and compared in order to determine priorities for field observations. In theory, the user follows the universal steps of the impact assessment for every object individually, after which the estimated impact of the various objects is compared to determine their relative priority. In practice, the experienced user may take all objects through the steps of the impact comparison simultaneously. In this case, conducting the impact assessment essentially amounts to taking the following actions:

Collect information on the impact-determining factors (Steps 2a through 2c)

Step 2a: Define the hazard
Determine which facilities or processes from Table 2, "Facilities and Objects of interest", are present in the area and then use the table to find the most urgent type of hazard for the corresponding process.

Step 2b: Assess possibilities of exposure
Using the Likely Scenarios Module, determine the relevant receptors and pathways given the type of hazard expected. Using geographical information from the area, determine whether the relevant receptors and pathways of dispersion (e.g. rivers) are actually present in the vicinity of various hazardous objects and estimate the actual possibilities of exposure.

Step 2c: Predefined quantities from table FM2 are used (referred to as Q-typical) to predefine the impact distances in table 2. These quantities are estimated quantities that are typically used in the facility and process under consideration.

Figure 6: snapshot of the Priorities Module.

Process the information (Step 2d and Step 3)

Step 2d: Process the information
The results include the objects or processes for which relevant receptors are present within the estimated impact area and for which relevant pathways are present. Prioritize them based on common sense. Evaluate the objects regarding the priority for making a field visit by considering the proportional contributions of the three impact-determining factors, together with the expected magnitude and type of impact. The estimated magnitude of impact (from Table 2) and the probability and estimated degree of exposure play an important role in evaluating the priority, as does the potential susceptibility of the region to a specific type of impact. For example, a long-term impact on the hydrological system or a coral reef weighs more heavily in an area where the local population depends on fishing than in an industrial area where the population does not depend on surface water, or where the water was heavily contaminated before the disaster (e.g. near an industrial site).

Figure 7: snapshot of Table FT2 Priorities Module, Objects of interest list.

Table FT2 Priorities Module, Objects of interest list

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H Hazard			Exp	Q Quantity	i Potential Impact		
			Exposure				
Facility or process	Substance	Hazard type		Typical (kg)	Human direct	Long term	Life support and nature direct
(Un) Loading and storage ships (containers, minerals, coal, grain, etc):		fire		10.000	500 m to 5 km	3	3
(Un) Loading and storage ships (oil and solvents, hazardous, etc)	oil and solvents	LTe1/LF2/PB1,5		100.000	5 km to 50 km	2	2
Aerospace manufacture/repair (land-side)	cyanide	LTW/LTe3		10.000	500 m to 5 km	3	2
Aerospace manufacture/repair (land-side)	hydrofluoric acid	LTe4/L-GT*		10.000	500 m to 5 km	3	1
Agricultural services (incl small storage)	mixed chemicals (fire)	GT4 (toxic smoke)		1.000	500 m to 5 km	3	2
Agriculture (animals, crop, forestry, fruit, etc.)	carbamate pesticide	LTe4/LT*		1.500	500 m to 5 km	3	2
Agriculture (animals, crop, forestry, fruit, etc.)	dithiocarbamate pesticide	LTe2/LT*/LF/CRM1		1.500	500 m to 5 km	2	2
Agriculture (animals, crop, forestry, fruit, etc.)	mercury based pesticide	LTe4/CMR1/L-GT*		1.500	500 m to 5 km	2	1
Agriculture (animals, crop, forestry, fruit, etc.)	organochlorine pesticide	PB2/CMR1/LTe4/L-GT*/LF		1.500	500 m to 5 km	1	1
Agriculture (animals, crop, forestry, fruit, etc.)	organophosphorus pesticide	LTe4/LF2/CMR1		10.000	500 m to 5 km	2	2
Agriculture (animals, crop, forestry, fruit, etc.)	organotin pesticide	PB2/CMR1/LTe4/L-GT*		1.500	500 m to 5 km	1	1
Agriculture (animals, crop, forestry, fruit, etc.)	phenoxyacetic acid derivative pesticide	L-GT*/LTe2/LF2/CMR0,5		1.500	500 m to 5 km	3	2
Agriculture (animals, crop, forestry, fruit, etc.)	pyrethroid pesticide	LTe4/LT*/LF		1.500	500 m to 5 km	2	2
Agriculture (animals, crop, forestry, fruit, etc.)	substituted nitrophenol pesticide	LTe3/LT*/PB1		1.500	500 m to 5 km	2	2
Agriculture (animals, crop, forestry, fruit, etc.)	triazine pesticide	LTe3/LT*/LF/PB1/CMR1		1.500	500 m to 5 km	2	2
Agriculture (horticulture, fruit, crop, etc)	mixed chemicals (fire)	GT4 (toxic smoke)		1.000	500 m to 5 km	3	2
Airports (air-side)	kerosine	LTe1/PB1,5		25.000.000	500 m to 5 km	2	1
Artificial ski run	ammonia	GT3/GTe3		1.000	500 m to 5 km	3	2
Auction agriculture and fishery		fire		5	Less than 50 m	3	3
Auction personal objects		fire		5	Less than 50 m	3	3
Breeding and keeping animals	mixed chemicals (fire)	GT4 (toxic smoke)		500	500 m to 5 km	3	2
Buildig industry		fire		5	Less than 50 m	3	3
Bus-, tram- and metro, taxi, touringcar stations	cleaning agents	LTe2/LF2/PB1		10.000	500 m to 5 km	2	2
Bus-, tram- and metro, taxi, touringcar stations	solvents	LTe2/PB1/CMR1		10.000	500 m to 5 km	2	2
Business trading (general, offices)		fire		5	Less than 50 m	3	3
Car- and truckparks (incl. cooling)		fire		5	Less than 50 m	3	3
Car racing tracks, skelter- and carting		fire		5	Less than 50 m	3	3
Car scrapyard	cleaning agents	LTe2/LF2/PB1		10.000	50 m to 500 m	2	2
Car scrapyard	solvents	LTe2/PB1/CMR1		10.000	50 m to 500 m	2	2
Cleaning companies (buildings)		fire		5	Less than 50 m	3	3
Computer services and information (technology)		fire		5	Less than 50 m	3	3
Culture and recreation (theatre, museum, library, dancing, zoo)		fire		5	Less than 50 m	3	3
Defence	explosives	E		10.000	500 m to 5 km	3	3

Step 3: Output

Your output is a list of actually present potential hazards (hazardous objects) that possibly expose relevant receptors, prioritized by the need for a field visit.

Figure 8: snapshot of Table FT3 Facilities and Objects Assessment Module.

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Table FT3 Facilities and Objects Assessment Module

H Hazard		Exp Exposure	Q Quantity		i Potential Impact					
					Human direct		Life support and nature direct			
Hazard type	Hazard sub-type		amount	(unit)	Lethal (m)	Health (m)	Soil (m)	Lake (m)	River (m)	Large animals (m)
Toxic gas, Explosive, flammable, small containers										
GT Gas Toxic to humans	GT5 Acute toxic (based on chlorine)	☐	20	kg	30	250				■
		☐	100	kg	60	600				■
		☐	1,000	kg	250	2,400				■
		☐	5,000	kg	350	6,250				■
	GT4 High toxic (based on sulphur dioxide)	☐	200	kg	20	950				■
		☐	1,000	kg	60	2,400				■
		☐	10,000	kg	250	9,500				■
		☐	50,000	kg	550	24,850				■
	GT3 Medium toxic (based on ammonia)	☐	200	kg	20	200				■
		☐	1,000	kg	60	550				■
		☐	10,000	kg	250	2,050				■
		☐	50,000	kg	600	5,350				■
	GT2 Low toxic (based on ethylchloride)	☐	1,000	kg	10	20				■
		☐	10,000	kg	30	60				■
		☐	50,000	kg	60	200				■
	GT1 Very low toxic	☐	50,000	kg	0	0				■
Explosive (E)	E (Class 1.1, 1.2 and 1.5)	☐	1,000	kg	350	NA				■
Gas toxic to the environment GTe (going into solution)	GTe-1 to GTe4 Gas toxic to the environment	☐	5,000	kg	450	NA				■
		☐	50,000	kg	500	NA				■
Flammable (F)	LF0 to LF4 Liquefied flammable gas	☐	1,000	kg	60	90				■
		☐	10,000	kg	200	300				■
		☐	50,000	kg	400	650				■

Figure 9: snapshot of the Substance Look-up Table.

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Substance Look-up Table

Part 1: Toxic gases, explosives, flammables, small containers

Substance name	Hazard type (in order of relevance)	UN-nr
1,1-Difluoroethane	GF3	1030
1,1-Difluoroethylene	GF3	1959
1,1-Dimethoxyethane	LF2	2377
1,2,3,6-Tetrahydrobenzaldehyde	LF1/LTe2	2498
1,2,3,6-Tetrahydropyridine	LF2	2410
1,2-Butylene oxide, stabilized	LF2	3022
1,2-Di-(dimethylamino)ethane	LF2	2372
1,2-Dimethoxyethane	LF2	2252
1-Bromo-3-methylbutane	LF1	2341
1-Chloro-1,1-difluoroethane	GF2	2517
1-Methoxy-2-propanol	LF1	3092
2,2'-Dichlorodiethyl ether	LF1	1916
2,2-Dimethylpropane	GF1	2044
2,3-Dihydropyran	LF2	2376
2,3-Dimethylbutane	LF2	2457
2-Diethylaminoethanol	LF1	2686
2-Dimethylaminoethanol	LF1	2051
2-Ethylbutanol	LF1	2275
2-Ethylbutyl acetate	LF1	1177
2-Ethylbutyraldehyde	LF2	1178
2-Ethylhexylamine	LF1	2276
2-Methyl-1-butene	LF2	2459
2-Methyl-2-butene	LF2	2460
2-Methylpentan-2-ol	LF1	2560
3,3-Diethoxypropene	LF2	2374
3-Methyl-1-butene	LF2	2561
3-Methylbutan-2-one	LF2	2397
4-Methoxy-4-methylpentan-2-one	LF1	2293
Acetal	LF2	1088
Acetic acid, glacial	LF1	2789
Acetic anhydride	LF1	1715
Acetyl methyl carbinol	LF1	2621
Acetylene	GF3	1001
Acetylene, Ethylene and Propylene in mixture, refrigerated liquid containing at least 71.5% Ethylene with not more than 22.5% Acetylene and not more than 6% Propylene.	GF0	3138
Adhesives (flammable)	LF2/LF1	1133

3.4 Facilities and Objects Assessment Module (FM3)

The Facilities and Objects Assessment Module of FEAT provides an estimate of specific impacts, by providing predefined calculations of the magnitude of the impact. The module provides impact distances and severity indexes for the various receptors that correspond with certain quantities of a substance having a certain type of hazard.

Before performing an impact assessment in the field, make sure that you understand and apply the basic safety practices and precautionary measures for field assessments, especially when conducting surveillance of situations involving hazardous chemicals. If you are unsure about the safety of the situation, do not perform the field assessment: safety first!

Collect information on the impact-determining factors (Steps 2a through 2c)

Step 2a: Define the hazard

By observation or using information available in the field, estimate the type of hazard resulting from the facility or object. In some situations, effects can be noted such as death of poultry or fish, discoloration of vegetation and reports of adverse health effects on humans. These signs can help indicate the nature of the hazard.

If information on the main hazard is missing, indications of the type of hazard can be obtained from the Substance Look-up Table or the Label Look-up Table. The Substance Look-up Table includes most of the commercially used hazardous substances and provides an indication of the primary type of hazard (as defined within FEAT) of this substance. The Substance Look-up Table is divided into four sections: (a) toxic gas, flammables, and small containers; (b)toxic liquids; (c) persistent, bio-accumulative or carcinogenic substances; and (d) substances that are not rated. This categorization is the same as in the corresponding Table 3 and the most likely scenario table. Within these categories, the substances are listed alphabetically by name. When searching for specific

aspects, for example the main hazard of a liquid substance, use the corresponding part of the Substance Look-up Table. If there is no indication of the type of substance, you can then search in all parts of the Substance Look-up Table (by substance name in alphabetical order). The Substance Look-up table hazards are noted in order of priority, starting with the main type of hazard.

For transport hazard labels, the Label Look-up Table also provides an indication of the type of hazard that must be taken into account. International transport labels indicate the hazard corresponding to a substance. Within FEAT, comparable hazard types are used. This look-up table provides a link between these two hazard indications. However, there is no perfect match between them, and you should interpret this information cautiously. To match the hazards more accurately, include the physical property of the substance from your field observations.

Steps 2b and 2c: assess possibilities of exposure and quantities involved

The Likely Scenarios Table supports field observations and helps estimate actual exposure. For the hazard in question, first estimate the exposure for the relevant receptors and dispersion pathways (as listed in the Likely Scenarios Table). Of course, you should think beyond these general indications and look for possible other factors that influence your case. Estimate the actual exposure based on the quantity of substance to which people or the environment are exposed.

Process the information (Step 2d and Step 3)

In Table FT3, read the predefined impact distance or severity index that corresponds with the hazard and the quantities to which people or the environment are exposed. Use the estimated impact distances as an indication of the magnitude of the impact, keeping in mind the limitations of this estimate. For substances that have a long-term impact (i.e. persistent, bio-accumulating, carcinogenic, mutagenic and reprotoxic substances) the impact area is equal to the dispersion area. For such substances, the lowest detectible concentrations are indicated as undesirable. The primary concern is to prevent dispersion to the greatest extent possible. A severity index for the relevant substances (specified in the Substance Look-up Table) indicates to what extent the substances are actually persistent, accumulating or carcinogenic, and provides a measure for the severity of the dispersal and the degree to which long-term effects can be expected.

Figure 10: snapshot of the Lable look-up table.

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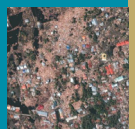
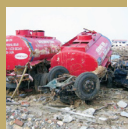
Label look-up table

Goal: International transportation labels indicate the hazard emerging from a substance. Within FEAT similar hazard types are used. This look-up table provides a link between both hazard indications although there is no perfecft match and caution with the interpretation is needed. Add the physical property of the substance from your field observations to match more acurately with the hazard types as listed in the Likely Scenarios Table.

Symbol	Addition to symbol	Indication of Feat hazard type	Abreviation of Feat hazard type	Expected impact
	E	E, Explosive	E	Human direct
	O	Oxidizing: Flammable, Explosive (in contact with flammable material)	F, E	Human direct
	F+	Extremely Flammable	F (FL*, FG*)	Human direct
	F	Flammable	F (FL*, FG*)	Human direct
no symbol	-	Flammable	F (FL*, FG*)	Human direct
	T+	Highly Toxic	T (GT*, LT*)	Human direct, Life support and nature direct
	T	Toxic	T (GT*, LT*)	Human direct, Life support and nature direct
	Xn	Toxic	T (GT*, LT*)	Human direct, Life support and nature direct
	C			Human direct
	Xi			Human direct
	N	Toxic, special attention to life support and nature and long-term impacts	T (GT*, LT*), PB	Life support and nature direct

User Guidance - Summary

Step 1: Select the appropriate Module

Assessment Process	First Alert Module FM1	Priorities Scan Module FM2	Facilities and Objects Assessment Module FM3
Define your question and select the appropriate module by matching your question and situation with the listed characteristics of the modules	Key question: What potential major impacts are present in this area? ↓ Module outputs: High priority alert of possible "major impacts" and type of expected impact 	Key question: What are objects and facilities of interest? Where to go first? ↓ Module outputs: Priority list of objects of interest. 	Key question: What impact does this object or facility potentially pose? ↓ Module outputs: Magnitude of potential impact (impact distance in metres or severity index) 

Step 2: Perform the impact assessment

Collect the information	Collect the information FM1	Collect the information FM2	Collect the information FM3
Step 2a to 2c: Collect the information on the impact determining factors i = H + Exp + Q Impact Hazard Exposure Quantity Predefined information is obtained from the look-up tables or from the actual situation (in the field) **Step 2d: Process the information** **Step 2e:** Check if all possible hazards of this case are accounted for, or if repetition of step 2a-2d is needed	i = H + Exp + Q Impact Hazard Exposure Quantity **Step 2d Process:** Check if one of the listed facilities (hazards) **Table FT1** is present in the disaster area. If positive, this means a high priority alert of possible "major impacts". Note from the table the main type of impact expected.  Table FT1 +  Contact with disaster area 'field' = High Priority alert	i = H + Exp + Q Impact Hazard Exposure Quantity **Step 2d Process:** Match objects and facilities of interest from **Table FT2**, with relevant receptors and path-ways in the **Likely Scenarios Table** to estimate actual possibilities of exposure and potential impact based on the actual spatial situation. Prioritize this list for field visits.  Table FT2 LS Table ← →  Actual spatial situation = Priority List	i = H + Exp + Q Impact Hazard Exposure Quantity **Step 2d Process:** Assess the actual type of hazard and quantities exposed to and look-up the magnitude of the impact using the **Table FT3.**  Table FT3 LS Table Substance + Label Look-up Tables +  Field observations = Actual impact assess-ment

Step 3: Output

Generate and/or review your output

Step 4: Follow-up actions to consider

Follow up and link to other modules

FM1 FM2 FM3

Step 5: Exit or next impact assessment

Determine what repetitions are needed, and whether another object of interest should be screened

Define your next question and repeat the cycle

Step 1: Select the appropriate Module (FM)

Assessment Process

Define your question and select the appropriate module by matching your question and situation with the listed characteristics of the modules

Key question answered

Key words of situation

Need for actual information

Predefined information is obtained from the look-up tables or from the actual situation (in the field)

i = H + Exp + Q
Impact Hazard Exposure Quantity

First Alert Module — FM1

Key questions answered by this module
- What serious potential impacts are present in the affected area?

Key words of situation
- Area covered: spatial scale of entire disaster area
- Main use of module: as first screening, very limited information available, only including "big and obvious" major potential impacts.
- Main users: desk officers directly after notification of the disaster.

i = H + Exp + Q
Impact Hazard Exposure Quantity

Requires check of presence of major potential hazards (facilities)

Output
- High priority alert of possible "potential major impacts"
- Type of impact to be expected. Indicating the receptors and pathways, reaction time frame, opportune mitigation or preventive measures and type of expertise required.

Priorities Module — FM2

Key questions answered by this module
- What are the main objects of interest?
  What is the first priority for field visits?

Key words of situation
- More localized regions within affected area local spatial scale,
- Screening for priority situations within the affected area that require a field visit
- Main users: Typically used by response teams after arrival on site in preparation for actual field visits.

i = H + Exp + Q
Impact Hazard Exposure Quantity

Requires estimate of the actual exposure based on the spatial situation of the facilities (hazards), relevant receptors and possibilities of dispersion.

Output
- List of facilities and objects that are priortised for the field visit.
- The priority is a relative ranking of the identified objects of interest and does not imply the priority towards other response activities.

Facilities and Objects Assessment Module — FM3

Key question answered by this module
- What impact does this particular facility or object potentially pose?

Key words of situation
- Assessment of specific facility or object.
- Typically used on site by field assessors

i = H + Exp + Q
Impact Hazard Exposure Quantity

Most detailed level of impact assessment of FEAT, using actual information on all three impact-determining factors: type of hazard, exposure and quantity exposed to.

Output
Impact assessment of a facility or object. Provides an impact distance for the relevant receptors (types of impact) the actual type of hazard and quantities involved.

Step 2: Perform the impact assessment

		First Alert Module — FM1	Priorities Module — FM2	Facilities and Objects Assessment Module — FM3
Collecting the information on the impact determining factors	**Step 2a**: What is the **hazard**?	All predefined **Table FT1**	• Check the actual presence and location of the facilities listed in **Table FT2** within the region of interest. Note the corresponding main type of **hazard** defined in the table. • Use the **Likely Scenarios Table** to define the main type of impact, the opportune receptors and pathways from the hazard posed by the facilities present in the area. • Assess the possibilities and potential extent of **exposure** based on local spatial situation of the facilities, receptors and pathways • Prioritize the list of objects (facilities) of interest using common sense and taking into account the proportional contribution of the hazard, possibilities of exposure and magnitude of the predefined impacts (based on assumed quantities and listed in Table FT2 as impact distance and severity indexes). Focus on the main hazard first.	• Assess the main type of **hazard** through field observations, using the Substance Look-up Table, the Label look-up Table or by consulting local experts where possible. • Use the **Likely Scenarios Table** to define the main type of impact, the opportune receptors and pathways based on the hazard • Determine actual presence of receptors and pathways of dispersion in the field and assess the possibilities and extend of **exposure** • Assess the **quantity** involved (exposed to). • **Table FT3** provides predefined impact distances for the different types of impact based on the actual hazard type and the quantities involved (exposed to). • Use common sense to adapt the predefined impact figures to the actual situation. The predefined figures are realistic worst-case estimates and presume instantaneous and maximum dispersion and exposure.
	Step 2b: What are opportune receptors and pathways of dispersion to consider, that determine possibilities of **exposure**?			
	Step 2c: What **quantity** is involved?			
Processing the information	**Step 2d: processing the information**	• Check if one of the listed facilities **(Table FT1)** is present in the disaster area. Note the corresponding main type of impact defined in the table  Table FT1 + Contact with disaster area 'field' =	 Table FT2 LS Table ←→ Actual spatial situation = Priority List	 Table FT3 LS Table Substance + Label Look-up Tables + Field observations = Actual impact assessment
	Step 2e: using common sense, check if all possible impacts of this case are accounted for or if repetition of steps 2a-2d is needed	• Does the substance pose multiple types of hazard? If yes, perform the impact assessment cycle again. For many substances the different types of hazards are indicated within the "Substance Look-up Tables" • Check whether the main type of impact is the only impact to be expected Determine if there are any other possibilities of dispersion or exposure than those taken into account.		

User Guidance, continued

Step 3: Output

Assessment Process	First Alert Module FM1	Priorities Module FM2	Facilities and Objects Assessment Module FM3
Generate or review your output	Evaluate/review your output if more iterations of the actual impact assessment are performed		

Step 4: Follow-up actions to consider

Follow up and link to other modules	• Check the actual situation prior to all other (humanitarian) activities. **The Likely Scenarios Table** provides an indication of the opportune receptors and pathways (given the presumed hazard of the indicated substances) to check for their presence with priority. • Consider performing a first desktop impact assessment using **Module FM3** (information on type of hazard, quantities involved and possible exposure are needed). • Follow-up actions suitable to the expected type of impact (described in **Module FM3**).	Field visits to check the actual status and perform an actual impact assessment using **Module FM3**.	Depending on the severity of actual or potential impacts, FEAT users should consider requesting additional, specialized expertise.

Step 5: Exit or next impact assessment

- Determine which steps, if any, should be repeated. For example, is it necessary to go to the next module or use the same module again to assess the impact from another object of interest?
- Define your next question and repeat the cycle (starting with step 1).

Likely Scenarios Table

H Hazard Type from facilities and substances	Exp Relevant Receptors						Relevant Pathways						Q	i Potential Impact		
	Human	Live support			Nature									Human direct	Long-term	Life support and nature direct
	Humans[1]	Fishing area surface water	Ground water (wells)	Agriculture	Nature reserves	Rivers, lake coast	Air	Soil, Ground-water	Lake	River, drains	Human	Animal				
Toxic gas, explosive, flammable, combustible, small containers																
Toxic gas and smoke (GT)	■						■						□	1	3	2
Explosives (liquid, solid) (E)	■						■				■		□	1	3	3
Flammable and explosive gas (GF)	■						■						□	1	3	2
Flammable liquids (LF)	■								■	■			□	2	3	2
Small containers of chemicals ***	■									■	■		□	1	3	2
Toxic liquids (to humans and environment)																
Toxic liquid (LTW, LTe)	■	■	■		■	■		■	■	■			□	2	3	1
Volatile Toxic liquid (L-GT)	■						■						□	1	3	2
Persistent and accumulating substances																
Persistent and/or bio accumulating, carcino-genic liquid (PB-L, CMR-L)	■	■	■		■	■		■	■	■			□	2	1	2
Persistent and /or bio accumulating, carcino-genic dust and particles (PB-D, CMR-D)	■	■			■		■		■	■	■	■	□	2	1	2
Natural impact on nature and infrastructure**																
Landslide	■												□	1	3	1
Wave / flash floods	■			■	■				■	■			□	1	3	1
Fire (forest)	■				■								□	1	3	2
Erosion (fertile soil)				■	■								□	3	1*	2*
Salt		■	■	■	■	■		■	■	■			□	3	1*	2*
Mudflow / particles in water	■	■		■		■			■	■			□	2	3**	1
Wind	■			■	■		■						□	2	3	1

■ Occasional □ Assumed present

1 High Priority 2 Medium Priority 3 Low Priority

[1] Humans and large (breathing) animals

* Long-term impact on life support functions

** Except damage of mud on coral reefs

*** For example: jerry cans of pesticides. These are listed as an extra category because they are commonly used by small business and easily transported. The substances may be (re-)used or displaced by inexperienced persons which may cause uncommon scenarios of exposure.

**** If relevant and possible, potential natural impacts on nature and infrastructure should be identified in order to assess whether specialised assistance is needed.

Determine the hazard

The tables corresponding with the First Alert Module and the Priorities Module provide recognizable objects/ facilities and processes that use substances with a specific type of hazard. This makes it easier to determine the hazard. Depending on the information available in the field, use one of the following columns: facility, process, substance or hazard type. The Substance Look-up Table provides hazard types of specific substances.

FEAT Abbreviations

Main-code	Sub-code	Explanation
Any	*	Star as subcategory indicates that no further specification within main group is available. If no additional information can be obtained from the field, use the most severe sub-hazard type as a worst case estimation.
CMR		Carcinogenic, mutagenic and reprotoxic
	CMR0.5 to CMR2	CMR with severity index ranging from 0.5 to 2
	CMR-L	Carcinogenic, mutagenic and reprotoxic liquid
	CMR-D	Carcinogenic, mutagenic and reprotoxic dust
E		Explosive
F		Flammable
GF		Gas, flammable
	GF3	Gas, very highly flammable
	GF2	Gas, highly flammable
	GF1	Gas, flammable
GNR		Gas, not rated
GT		Gas, toxic by inhalation (to humans and large animals)
	GT5	Gas, toxic – acute toxic
	GT4	Gas, toxic – high toxic
	GT3	Gas, toxic – medium toxic
	GT2	Gas, toxic – low toxic
	GT1	Gas, toxic – very low toxic
GTe		Gas, toxic to the aquatic environment (heavy and soluble)
	GTe4	Gas, toxic – acute toxic
	GTe3	Gas, toxic – high toxic
	GTe2	Gas, toxic – medium toxic
	GTe1	Gas, toxic – low toxic
LF		Liquefied flammable
	LF2	Liquid, highly flammable
	LF1	Liquid, flammable
LFW		Liquid, flammable after contact with water
LNR		Liquid, not rated
LP		Liquid, persistent
LTW		Liquid, toxic (to humans and large animals) when in contact with water
L-GT		Liquid, evaporating into gas that is toxic (to humans and large animals) by inhalation
	L-GT4	Liquid, evaporating – acute toxic gas
	L-GT3	Liquid, evaporating – high toxic gas
	L-GT2	Liquid, evaporating – medium toxic gas
	L-GT1	Liquid, evaporating – low toxic gas
LTe		Liquid, toxic (to the environment) by direct contact or toxic liquid emerging from solution of toxic substances
	LTe4	Liquid, toxic – acute toxic
	LTe3	Liquid, toxic – high toxic
	LTe2	Liquid, toxic – medium toxic
	LTe1	Liquid, toxic – low toxic
NR		Not rated
PB		Persistent and bioaccumulating substance
	PB0.5 to PB2	PB with severity index ranging from 0.5 to 2
	PB-L	Persistent and bioaccumulating liquid
	PB-D	Persistent and bioaccumulating dust
SNR		Solid, not rated
SF		Solid, flammable
SFW		Solid, flammable after contact with water
STW,ST and STe		Solid, toxic by direct contact (to humans, animals and the environment). Consider processing as LTe when dissolved in water
	STe4	Solid, acute toxic
	STe3	Solid, high toxic
	STe2	Solid, medium toxic
	STe1	Solid, low toxic

First Alert Module

Overview of process to perform the impact assessment
using Table FT1: Objects with potential for major impacts

FM1 **Steps 2a to 2c: Collecting the information on the impact determining factors**

H Hazard =  Table FT1 hazard columns +  Contact with disaster area 'field' = **Potential hazard actually present**

+

Exp Exposure = **Assumed present**

+

Q Quantity = **Assumed above critical Q**

=

i Impact =  Table FT1 columns potential impact = **Potential type of impact**

Step 2d: Processing the information

FM1 + **Check if one of the listed facilities (hazards) is present** = **High priority alert**

Table FT1 First Alert Module

Objects with potential for major impact

H Hazard			Exp	Q Quantity	i Potential Impact		
Type of industry	Type of facility	Substance most hazardous			Human direct	Long-term	Life support and nature direct
Direct impact on humans							
Production of chemicals	Production industrial gasses	ethene, propane, hydrogen chlorine, oxigen	☐	☐	1	3	2
	Production anorganic chemical base materials	ammoniumnitrate	☐	☐	1	3	2
	Production agricultural chemicals	chlorine	☐	☐	1	2	1
		carbon disulfide	☐	☐	1	2	2
	Production pharmaceutical base materials	methanol	☐	☐	1	2	2
	Production organic chemical base materials	ammonia, isopropanol, pentane acrylonitrile, bromine, chlorine, monovinylchloride	☐	☐	1	3	2
		fluorosulfonic acid, vinyl bromide, fluorine, acrolein	☐	☐	1	2	1
		dimethylsulfate	☐	☐	1	2	2
		butane	☐	☐	1	3	1
	Tanker cleaning	cleaning agents	☐	☐	1	3	2
Production of (natural) products	Tanning industry	cyanide, sulfuric acid	☐	☐	1	2	2
		ammonium sulfate	☐	☐	1	3	2
	Textile industry (dyes)	bromine, chlorine, naphtalene, alkali, sodium sulfide	☐	☐	1	3	3
	Textile industry (dyes)	sodium nitrate	☐	☐	1	2	2
Mining and exploration	Oil and gas mining (onshore, offshore)	natural gas	☐	☐	1	3	3
Fireworks and explosive products	Production fertilizers, fireworks	ammonia, ammoniumnitrate, fireworks	☐	☐	1	3	3
	Trading, wholesale professional fireworks (large enterprises)	ammoniumnitrate, fireworks	☐	☐	1	3	2
	Production organic chemical base materials	organic peroxide	☐	☐	1	3	2
	Wholesale fertilizers	ammoniumnitrate	☐	☐	1	2	1
	Winning, preparing and distribution drinking water (with chemicals)	chlorine	☐	☐	1	2	2
Storage, steel and (marshalling) yards	(Un-) Loading and storage ships (oil and solvents, hazardous, etc)	oil and solvents	☐	☐	1	3	3
	Marshalling yards	liquified petroleum gas (lpg)	☐	☐	1	3	3
	Refinery oil and solvents and gas (incl. storage)	natural gas					
Airports, military, civil	Energy production and distribution (steam, propane/butane, oil and solvents, etc)	propane, butane, ammonia, natural gas	☐	☐	1	3	2
	Hospital /sterilizing industry	ethylene oxide	☐	☐	1	2	2

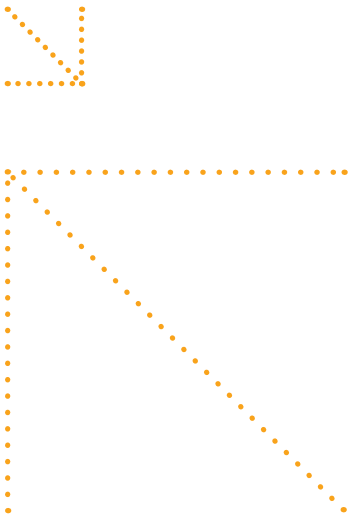
☐ Assumed present

Table FT1 First Alert Module, continued

Objects with potential for major impact

H Hazard			Exp	Q Quantity	i Potential Impact		
Type of industry	Type of facility	Substance most hazardous			Human direct	Long-term	Life support and nature direct
Long-term impacts (persistent and bioaccumulating and carcinogenic, mutagenic and reprotoxic = 'pbt-cmr')							
Production of chemicals	Production organic chemical base materials	arsenic chlorine	☐	☐	1	1	1
		arsenic compound, chromic fluoride, organotin	☐	☐	1	1	2
		dibromomethane, hexachlorobenzene	☐	☐	1	1	2
		pentachloroethane, tetrabromoethane	☐	☐	1	1	2
	Agriculture (animals, crop, forestry, fruit, etc)	(dithiocarbamate, pyrethroid, triazine) pesticide	☐	☐	2	2	2
Production of (natural) products	Agriculture (animals, crop, forestry, fruit, etc)	organochlorine pesticide	☐	☐	2	1	1
	Agriculture (animals, crop, forestry, fruit, etc)	organotin pesticide	☐	☐	2	1	1
	Tanning industry	arsenic	☐	☐	2	1	1
	Tanning industry	chromium (III)	☐	☐	1	1	2
	Wood treating industry	arsenic	☐	☐	2	1	1
	Wood treating industry	chromium (III)	☐	☐	1	1	2
Mining and exploration	Mining other (gold, copper, nickel)	arsenic	☐	☐	2	1	1
	Mining other (gold, copper, nickel)	mercury	☐	☐	2	1	1
Storage, steel and (marshalling) yards	Galvano industry	chromium (III)	☐	☐	1	1	2
Airports, military, civil	Hospitals	ethylene oxide	☐	☐	2	2	2
	Airports (air-side)	kerosine	☐	☐	2	2	1
Life support and nature							
Production of chemicals	Manufacturing synthetic fibres	acrylic acid	☐	☐	2	3	1
	Production industrial gasses	monovinylchloride	☐	☐	1	2	1
	Production lubricants	oil and solvents	☐	☐	2	2	1
	Production of pharmaceutical products	medicine	☐	☐	1	3	1
	Production of lacker and varnish	toluene diisocyanate	☐	☐	1	3	1
	Production of synthetic resin	acrylic acid, toluene diisocyanate	☐	☐	2	3	1
	Production oil and solvents products (base materials)	oil and solvents	☐	☐	2	2	1
	Production organic chemical base materials	mercury compound, pentachlorophenol, (chloro) benzenes	☐	☐	1	2	1
	Tanker cleaning	oil and solvents	☐	☐	1	2	1
Production of (natural) products	Agriculture (animals, crop, forestry, fruit, etc)	mercury based pesticide	☐	☐	2	2	1
	Glass production	hydrogen fluoride	☐	☐	1	3	1
	Production cardboard and paper	chlorine bleaching	☐	☐	2	2	1
	Production cokes electrodes	liquid acid	☐	☐	2	3	1
	Production of colour and paint	solvents	☐	☐	2	2	1
	Production (recycling) of rubber	chloroprene, (trichloro) benzenes	☐	☐	2	2	1
	Synthetic manufacturing	acrylic acid, phenolic resin	☐	☐	2	3	1
	Textile, tanning industry (dyes)	benzene, aniline	☐	☐	1	2	1
	Wood treating industry	copper salts, pentachlorophenol, creosote	☐	☐	1	2	1
Mining and exploration	Oil and gas mining (onshore, offshore)	oil and solvents	☐	☐	1	2	1
Storage, steel and (marshalling) yards	Marshalling yards	chlorine	☐	☐	1	2	1
	Refinery oil and solvents and gas (incl. storage)	oil and solvents	☐	☐	1	2	1
Airports, military, civil	Aerospace manufacture/repair (land-side)	hydrofluoric acid	☐	☐	2	3	1
	Swimming facilities	chlorine bleaching	☐	☐	2	2	1
	Winning, preparing and distribution drinking water (with chemicals)	chlorine	☐	☐	1	2	1

☐ Assumed present

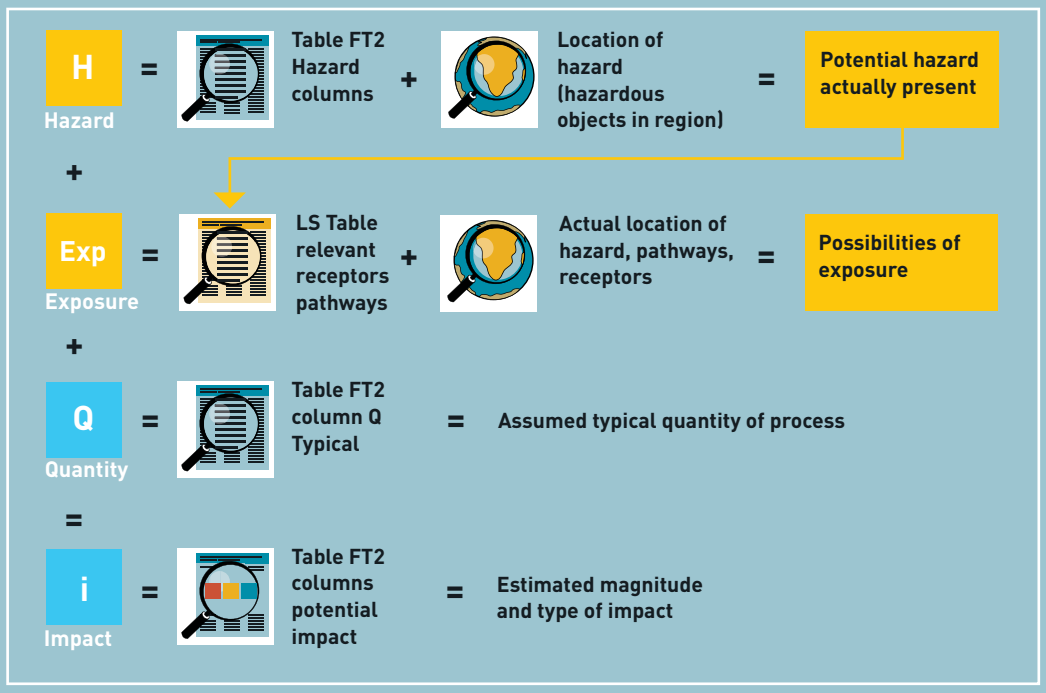


Priorities Module

Overview of process to perform the impact assessment using Table FT2: Objects of interest list

FM2

Steps 2a to 2c: Collect the information on the impact-determining factors



Step 2d: Process the information

Prioritize the list of objects (facilities) of interest using common sense and taking into account the proportional contribution of the hazard, possibilities of exposure and magnitude of predefined impacts

Table FT2 Priorities Module, Objects of Interest List

H Hazard			Exp Exposure	Q Quantity	i Potential Impact		
Facility or process	Substance	Hazard type		Typical (kg)	Human direct	Long term	Life support and nature direct
(Un) Loading and storage ships (containers, minerals, coal, grain, etc):		fire		10.000	500 m to 5 km	3	3
(Un) Loading and storage ships (oil and solvents, hazardous, etc)	oil and solvents	LTe1/LF2/PB1,5	☐	100.000	5 km to 50 km	2	2
Aerospace manufacture/repair (land-side)	cyanide	LTW/LTe3	☐	10.000	500 m to 5 km	3	2
Aerospace manufacture/repair (land-side)	hydrofluoric acid	LTe4/L-GT*	☐	10.000	500 m to 5 km	3	1
Agricultural services (incl small storage)	mixed chemicals (fire)	GT4 (toxic smoke)	☐	1.000	500 m to 5 km	3	2
Agriculture (animals, crop, forestry, fruit, etc.)	carbamate pesticide	LTe4/LT*	☐	1.500	500 m to 5 km	3	2
Agriculture (animals, crop, forestry, fruit, etc.)	dithiocarbamate pesticide	LTe2/LT*/LF/CRM1	☐	1.500	500 m to 5 km	2	2
Agriculture (animals, crop, forestry, fruit, etc.)	mercury based pesticide	LTe4/CMR1/L-GT*	☐	1.500	500 m to 5 km	2	1
Agriculture (animals, crop, forestry, fruit, etc.)	organochlorine pesticide	PB2/CMR1/LTe4/L-GT*/LF	☐	1.500	500 m to 5 km	1	1
Agriculture (animals, crop, forestry, fruit, etc.)	organophosphorus pesticide	LTe4/LF2/CMR1	☐	10.000	500 m to 5 km	2	2
Agriculture (animals, crop, forestry, fruit, etc.)	organotin pesticide	PB2/CMR1/LTe4/L-GT*	☐	1.500	500 m to 5 km	1	1
Agriculture (animals, crop, forestry, fruit, etc.)	phenoxyacetic acid derivative pesticide	L-GT*/LTe2/LF2/CMR0,5	☐	1.500	500 m to 5 km	3	2
Agriculture (animals, crop, forestry, fruit, etc.)	pyrethroid pesticide	LTe4/LT*/LF	☐	1.500	500 m to 5 km	2	2
Agriculture (animals, crop, forestry, fruit, etc.)	substituted nitrophenol pesticide	LTe3/LT*/PB1	☐	1.500	500 m to 5 km	2	2
Agriculture (animals, crop, forestry, fruit, etc.)	triazine pesticide	LTe3/LT*/LF/PB1/CMR1	☐	1.500	500 m to 5 km	2	2
Agriculture (horticulture, fruit, crop, etc)	mixed chemicals (fire)	GT4 (toxic smoke)	☐	1.000	500 m to 5 km	3	2
Airports (air-side)	kerosine	LTe1/PB1,5	☐	25.000.000	500 m to 5 km	2	1
Artificial ski run	ammonia	GT3/GTe3	☐	1.000	500 m to 5 km	3	2
Auction agriculture and fishery		fire	☐	5	Less than 50 m	3	3
Auction personal objects		fire	☐	5	Less than 50 m	3	3
Breeding and keeping animals	mixed chemicals (fire)	GT4 (toxic smoke)	☐	500	500 m to 5 km	3	2
Buildig industry		fire	☐	5	Less than 50 m	3	3
Bus-, tram- and metro, taxi, touringcar stations	cleaning agents	LTe2/LF2/PB1	☐	10.000	500 m to 5 km	2	2
Bus-, tram- and metro, taxi, touringcar stations	solvents	LTe2/PB1/CMR1	☐	10.000	500 m to 5 km	2	2
Business trading (general, offices)		fire	☐	5	Less than 50 m	3	3
Car- and truckparks (incl. cooling)		fire	☐	5	Less than 50 m	3	3
Car racing tracks, skelter- and carting		fire	☐	5	Less than 50 m	3	3
Car scrapyard	cleaning agents	LTe2/LF2/PB1	☐	10.000	50 m to 500 m	2	2
Car scrapyard	solvents	LTe2/PB1/CMR1	☐	10.000	50 m to 500 m	2	2
Cleaning companies (buildings)		fire	☐	5	Less than 50 m	3	3
Computer services and information (technology)		fire	☐	5	Less than 50 m	3	3
Culture and recreation (theatre, museum, library, dancing, zoo)		fire	☐	5	Less than 50 m	3	3
Defence	explosives	E	☐	10.000	500 m to 5 km	3	3
Defence	fuel	LTe1/LF1/PB1,5	☐	10.000	500 m to 5 km	2	2
Defence	hydrazine	LTe3/L-GT3	☐	25.000	500 m to 5 km	3	2
Education		fire	☐	5	Less than 50 m	3	3
Electricity distribution	ammonia	GT3/GTe3	☐	100.000	500 m to 5 km	3	2
Electrotechnical industrie other		fire	☐	5	Less than 50 m	3	3
Energy production and distribution (steam, propane/butane, oil and solvents, etc.)	ammonia	GT3/GTe3	☐	50.000	5 km to 50 km	3	2
Energy production and distribution (steam, propane/butane, oil and solvents, etc.)	natural gas	GF0/GTe3	☐	50.000	5 km to 50 km	3	3
Energy production and distribution (steam, propane/butane, oil and solvents, etc.)	propane, butane	GF3/GTe3	☐	50.000	5 km to 50 km	3	2
Environmental services	mixed chemicals (fire)	GT4 (toxic smoke)	☐	10.000	500 m to 5 km	3	2
Financial institutions		fire	☐	5	Less than 50 m	3	3
Fire brigade		fire	☐	5	Less than 50 m	3	3
Fishfarming	mixed chemicals (fire)	GT4 (toxic smoke)	☐	10.000	50 m to 500 m	3	2
Forestry and -services (incl. small storage)	mixed chemicals (fire)	GT4 (toxic smoke)	☐	1.000	500 m to 5 km	3	2
Galvano industry	chromium (III)	PB1/CMR1/STe3	☐	5.000	5 km to 50 km	1	2
Gas distribution	natural gas	GF0/GTe3	☐	10.000	500 m to 5 km	3	3
Gas servicestations (with LPG)	liquified petroleum gas	GF3/GTe3	☐	50.000	500 m to 5 km	3	3
Gas servisestations (no LPG)		fire	☐	5	Less than 50 m	3	3
Glass production	hydrogen fluoride	L-GT3/L-GTe4	☐	5.000	5 km to 50 km	3	1
Government, province, municipalities (offices)		fire	☐	5	Less than 50 m	3	3
Health care		fire	☐	5	Less than 50 m	3	3
Heating facilities (e.g. gasboil and solvents)		fire	☐	5	Less than 50 m	3	3
Hospital	ethylene oxide	GT3/GF1/CMR1	☐	10.000	500 m to 5 km	2	2
Hospital /sterilising industry	ethylene oxide	GT3/GF1/CMR1	☐	10.000	5 km to 50 km	2	2

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Table FT2 Priorities Module, Objects of Interest List

H Hazard			Exp Exposure	Q Quantity	i Potential Impact		
Facility or process	**Substance**	**Hazard type**		**Typical (kg)**	**Human direct**	**Long term**	**Life support and nature direct**
Hotels, conferencecentres, disco's, cafes, bar, cafeterias, catering		fire	☐	5	Less than 50 m	3	3
Ice skating rinks	ammonia	GT3/GTe3	☐	10.000	500 m to 5 km	3	2
Iron and steel foundries	cleaning agents	LTe2/LF2/PB1	☐	25.000	500 m to 5 km	2	2
Iron and steel foundries	solvents	LTe2/PB1/CMR1	☐	25.000	500 m to 5 km	2	2
Large storage and terminalling structures		fire	☐	5	Less than 50 m	3	3
Laundry, carpet clean, hairdresser, undertaker, fitness, etc.	chlorosilane	L-GT2/LTe2	☐	10.000	500 m to 5 km	3	2
Laundry, carpet clean, hairdresser, undertaker, fitness, etc.	dibenzoylperoxide	PB1/L-GT2/LTe3	☐	10.000	500 m to 5 km	2	1
Laundry, carpet clean, hairdresser, undertaker, fitness, etc.	hydrogen peroxide	L-GT2/LTe2	☐	10.000	500 m to 5 km	3	2
Manufacturing rubber products		fire	☐	5	Less than 50 m	3	3
Manufacturing synthetic fibres	acrylic acid	LTe1/LF1	☐	5.000.000	500 m to 5 km	3	1
Marshalling yards	chlorine	GT5/GTe4	☐	25.000.000	5 km to 50 km	2	1
Marshalling yards	LPG	GF3/GTe3	☐	50.000	5 km to 50 km	3	3
Metal and threat rollinging, profiling, walshing and milling		fire	☐	5	Less than 50 m	3	3
Minerals mining		fire	☐	5	Less than 50 m	3	3
Mining other (gold, copper, nickel)	arsenic compound, liquid, n.o.s.	PB2/CMR2/LTe2/L-GT*	☐	10.000	500 m to 5 km	1	1
Mining other (gold, copper, nickel)	cyanide	LTW/LTe3	☐	10.000	500 m to 5 km	3	2
Mining other (gold, copper, nickel)	mercury	PB2/CMR1/LTe4/L-GT*	☐	10.000	500 m to 5 km	1	1
Nuclear plants and cooling towers		radiation	☐				
Nursery		fire	☐	5	Less than 50 m	3	3
Offices, church, clubhouse, animal training		fire	☐	5	Less than 50 m	3	3
Oil and gas mining (onshore, offshore)	natural gas	GF0/GTe3	☐	50.000	5 km to 50 km	3	3
Oil and gas mining (onshore, offshore)	oil and solvents	LTe1/LF2/PB1,5	☐	25.000.000	5 km to 50 km	2	1
Peat mining		fire	☐	5	Less than 50 m	3	3
Photo and film development	solvents	LTe2/PB1/CMR1	☐	10.000	50 m to 500 m	2	2
Post and telecom		fire	☐	5	Less than 50 m	3	3
Preparation recyling/shredder metal, cars, building materials, etc		fire	☐	5	Less than 50 m	3	3
Printing and publishers		fire	☐	5	Less than 50 m	3	3
Production accumulators and batteries	mixed chemicals (fire)	GT4 (toxic smoke)	☐	10.000	50 m to 500 m	3	2
Production anorganic chemical base materials	ammoniumnitrate	E	☐	2.500	5 km to 50 km	3	2
Production audio viauls products, telecom		fire	☐	5	Less than 50 m	3	3
Production bicycle and motors		fire	☐	5	Less than 50 m	3	3
Production cardboard and paper	chlorine bleaching	GT3/GTe4	☐	10.000	500 m to 5 km	2	1
Production cars, trucks and lorries		fire	☐	5	Less than 50 m	3	3
Production chemicals - other	chloride salts	L-GT2/LTe1	☐	10.000	500 m to 5 km	3	3
Production chemicals - other	dimethylsulfate	LTe2/L-GT1	☐	10.000	500 m to 5 km	3	2
Production clothing (incl. painting and printing)	solvents	LTe2/PB1/CMR1	☐	10.000	50 m to 500 m	2	2
Production cokes	oxigas	GTe3/GF0	☐	10.000	500 m to 5 km	3	2
Production cokes electrodes	hydrogen	GTe2/GF0	☐	50.000	500 m to 5 km	3	3
Production cokes electrodes	liquid acid	LTe2/NR	☐	2.000.000	500 m to 5 km	3	1
Production cokes electrodes	methanol	LTe1/L-GT2/LF2/CMR1	☐	5.000.000	500 m to 5 km	3	2
Production electromotors- and generators	cleaning agents	LTe2/LF2/PB1	☐	10.000	50 m to 500 m	2	2
Production electromotors- and generators	solvents	LTe2/PB1/CMR1	☐	10.000	50 m to 500 m	2	2
Production electrotechnical components		fire	☐	5	Less than 50 m	3	3
Production eletrotechnical machinery		fire	☐	5	Less than 50 m	3	3
Production fertilizer	ammonia	GT3/GTe3	☐	50.000	5 km to 50 km	3	2
Production fertilizer	ammoniumnitrate	E	☐	2.500.000	5 km to 50 km	3	2
Production fireworks	ammonia	GT3/GTe3	☐	50.000	5 km to 50 km	3	2
Production fireworks	ammoniumnitrate	E	☐	2.500.000	5 km to 50 km	3	2
Production flour		fire	☐	5	Less than 50 m	3	3
Production furniture		fire	☐	5	Less than 50 m	3	3
Production glas, earthware, pottery, etc		fire	☐	5	Less than 50 m	3	3
Production glue and adhesives		fire	☐	5	Less than 50 m	3	3
Production industrial gasses	ethene	GTe3/GF0/CMR0,5	☐	5.000	5 km to 50 km	3	2
Production industrial gasses	hydrogen chloride	GT5/GTe2	☐	5.000	5 km to 50 km	3	2
Production industrial gasses	monovinylchloride	GT2/CMR	☐	50.000	5 km to 50 km	2	1
Production industrial gasses	oxigen	CMR/GTe1	☐	2.000.000	5 km to 50 km	3	2
Production industrial gasses	propane	GF3/GTe3	☐	2.000.000	5 km to 50 km	3	2

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Table FT2 Priorities Module, Objects of Interest List

H Hazard			Exp Exposure	Q Quantity	i Potential Impact		
Facility or process	Substance	Hazard type		Typical (kg)	Human direct	Long term	Life support and nature direct
Production industrial machinery		fire	☐	5	Less than 50 m	3	3
Production industrial wiring		fire	☐	5	Less than 50 m	3	3
Production iron and steel base materials	oxigas	GTe3/GF0	☐	50.000	500 m to 5 km	3	2
Production lamps	hydrogen	GTe2/GF0	☐	50.000	500 m to 5 km	3	3
Production leather	galvano/zinc bath	L-GT3/LTe3/PB1	☐	1.000	500 m to 5 km	2	2
Production lubricants	oil and solvents	LTe1/LF2/PB1,5	☐	2.500.000	500 m to 5 km	2	1
Production medical and optical products and instruments		fire	☐	5	Less than 50 m	3	3
Production metal products		fire	☐	5	Less than 50 m	3	3
Production metals (base products)		fire	☐	5	Less than 50 m	3	3
Production non ferro		fire	☐	5	Less than 50 m	3	3
Production of agricultural chemicals	carbon disulfide	LTe2/LF2	☐	50.000	5 km to 50 km	2	2
Production of agricultural chemicals	chlorine	GT5/GTe4	☐	25.000	5 km to 50 km	2	1
Production of color and paint	solvents	LTe2/PB1/CMR1	☐	25.000.000	500 m to 5 km	2	1
Production of pharmaceutical base materials	ammonia	GT3/GTe3	☐	50.000	5 km to 50 km	3	2
Production of pharmaceutical base materials	isopropanol	LTe1/LF2	☐	500.000	5 km to 50 km	3	2
Production of pharmaceutical base materials	methanol	LTe1/L-GT2/LF2/CMR1	☐	500.000	5 km to 50 km	2	2
Production of pharmaceutical base materials	pentane	L-GT2/LTe2/LF2	☐	500.000	5 km to 50 km	3	2
Production of pharmaceutical products	medicine	ST	☐	50.000	5 km to 50 km	3	1
Production of food and drink, incl. slaughterhouse	ammonia	GT3/GTe3	☐	50.000	500 m to 5 km	3	2
Production of lacker and varnish	toluene diisocyanate	LTe2/L-GT1/PB0,5	☐	25.000	5 km to 50 km	3	1
Production of rubber	chloroprene	CMR2/LTe1	☐	10.000	500 m to 5 km	2	1
Production of synthetic resin	acrylic acid	LTe1/LF1	☐	5.000.000	500 m to 5 km	3	1
Production of synthetic resin	toluene diisocyanate	LTe2/L-GT1/PB0,5	☐	5.000.000	500 m to 5 km	3	1
Production office machinery		fire	☐	5	Less than 50 m	3	3
Production oil and solvents products (base materials)	oil and solvents	LTe1/LF2/PB1,5	☐	2.500.000	500 m to 5 km	2	1
Production organic chemical base materials	acrolein, inhibited	LTe3/LF2/L-GT3/PB1	☐	10.000	5 km to 50 km	2	2
Production organic chemical base materials	acrylonitrile	L-GT3/CMR2/LF2/LTe2	☐	50.000	5 km to 50 km	2	1
Production organic chemical base materials	acrylonitrile	L-GT3/CMR2/LF2/LTe2	☐	100.000	5 km to 50 km	2	1
Production organic chemical base materials	arsenic chloride	PB2/CMR2/LTe2/L-GT*	☐	10.000	500 m to 5 km	1	1
Production organic chemical base materials	arsenic compound, liquid, n.o.s.	PB2/CMR2/LTe2/L-GT*	☐	10.000	500 m to 5 km	1	1
Production organic chemical base materials	bromine, chlorine	GT3/GTe4	☐	10.000	5 km to 50 km	2	1
Production organic chemical base materials	bromomethylpropanes	LTe4/LF2	☐	50.000	500 m to 5 km	3	2
Production organic chemical base materials	butadienes, inhibited	GF2/GTe2/CMR2	☐	50.000	500 m to 5 km	2	2
Production organic chemical base materials	butane	GT2/GTe3/GF3	☐	25.000	5 km to 50 km	3	2
Production organic chemical base materials	chlorobenzene	LTe2/LF1	☐	50.000	500 m to 5 km	3	1
Production organic chemical base materials	chromic fluoride, solution	LTe3/PB1/CMR1/L-GT*	☐	10.000	5 km to 50 km	1	2
Production organic chemical base materials	dibromomethane	PB2/CMR1/LTe3/L-GT*	☐	10.000	5 km to 50 km	1	2
Production organic chemical base materials	dimethylsulfate	LTe2/L-GT1	☐	100.000	5 km to 50 km	3	1
Production organic chemical base materials	fluorine	GT0/GTe3/PB1	☐	10.000	5 km to 50 km	2	2
Production organic chemical base materials	fluorosulfonic acid	LTe3/PB1/L-GT*	☐	10.000	5 km to 50 km	2	2
Production organic chemical base materials	formaldehyde, solution	LTe1/LF1/CMR1	☐	50.000	500 m to 5 km	2	2
Production organic chemical base materials	hexachlorobenzene	PB2/CMR2/L-GT*/LTe2	☐	10.000	5 km to 50 km	1	2
Production organic chemical base materials	hexachlorocyclopentadiene	LTe3/L-GT2	☐	10.000	500 m to 5 km	3	2
Production organic chemical base materials	hydrazine, anhydrous	LTe3/LF1/L-GT2	☐	25.000	500 m to 5 km	3	2
Production organic chemical base materials	mercury compound, liquid, n.o.s.	LTe4/CMR1/L-GT*	☐	10.000	5 km to 50 km	2	1
Production organic chemical base materials	monovinylchloride	GT2/CMR	☐	50.000	5 km to 50 km	2	1
Production organic chemical base materials	organic peroxide	LTe3/E/L-GT2/CMR1	☐	50.000	5 km to 50 km	2	1
Production organic chemical base materials	organotin compound, liquid, n.o.s.	PB2/CMR1/LTe4/L-GT*	☐	10.000	5 km to 50 km	1	2
Production organic chemical base materials	pentachloroethane	CMR2/PB0,5/LTe2/L-GT2	☐	10.000	5 km to 50 km	1	2
Production organic chemical base materials	pentachlorophenol	CMR2/PB0,5/STe3/L-GT*	☐	10.000	5 km to 50 km	2	1
Production organic chemical base materials	tetrabromoethane	PB2/CMR1/LTe4/L-GT*	☐	10.000	5 km to 50 km	1	2
Production organic chemical base materials	trichlorobenzenes, liquid	LTe2/LT*/CMR0,5/PB0,5	☐	10.000	5 km to 50 km	3	1
Production organic chemical base materials	vinyl bromide, inhibited	GT3/GTe2/GF1	☐	25.000	5 km to 50 km	2	2
Production organic chemical base materials	vinyl chloride, inhibited	GF2/GTe2	☐	10.000	500 m to 5 km	2	2
Production perfumes and cosmetics	solvents	LTe2/PB1/CMR1	☐	10.000	50 m to 500 m	2	2
Production photochemical products	solvents	LTe2/PB1/CMR1	☐	1.000	500 m to 5 km	2	2

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H Hazard			Exp Exposure	Q Quantity	i Potential Impact		
Facility or process	Substance	Hazard type		Typical (kg)	Human direct	Long term	Life support and nature direct
Production rubber tyres	chloroprene	CMR2/LTe1	☐	10.000	500 m to 5 km	2	1
Production soap and detergents	chloride salts	L-GT2/LTe1	☐	10.000	500 m to 5 km	3	3
Production steel pipes	cleaning agents	LTe2/LF2/PB1	☐	10.000	50 m to 500 m	2	2
Production steel pipes	solvents	LTe2/PB1/CMR1	☐	10.000	50 m to 500 m	2	2
Production sugar	sulfur dioxide	GT4/GTe4	☐	50.000	500 m to 5 km	3	2
Production textile	solvents	LTe2/PB1/CMR1	☐	10.000	50 m to 500 m	2	2
Production tobacco		fire	☐	5	Less than 50 m	3	3
Production transport - other		fire	☐	5	Less than 50 m	3	3
Production wood	solvents	LTe2/PB1/CMR1	☐	10.000	50 m to 500 m	2	2
Production wood plating and laminating		fire	☐	5	Less than 50 m	3	3
Pump- and compressorstations pipelines		fire	☐	5	Less than 50 m	3	3
Radio controlled aeroplane facilities		fire	☐	5	Less than 50 m	3	3
Radioactive and nuceal industry		radiation	☐				
Railwaystations (no marshalling)	cleaning agents	LTe2/LF2/PB1	☐	10.000	500 m to 5 km	2	2
Railwaystations (no marshalling)	solvents	LTe2/PB1/CMR1	☐	10.000	500 m to 5 km	2	2
Recycling		fire	☐	5	Less than 50 m	3	3
Recycling liquids and rubber	trichloride ethanes	L-GT3/LTe2	☐	10.000	50 m to 500 m	3	2
Recycling liquids and rubber	trichlorobenzenes	LTe2/LT*/CMR0,5/PB0,5	☐	10.000	50 m to 500 m	2	1
Recycling oil and solvents and lubricants	oil and solvents	LTe1/LF2/PB1,5	☐	10.000	50 m to 500 m	2	2
Refinery of vegetable oil and solvents and grease	ammonia	GT3/GTe3	☐	25.000	500 m to 5 km	3	2
Refinery oil and solvents and gas (incl. storage)	natural gas	GF0/GTe3	☐	50.000	5 km to 50 km	3	3
Refinery oil and solvents and gas (incl. storage)	oil and solvents	LTe1/LF2/PB1,5	☐	2.500.000	5 km to 50 km	2	1
Renewal rubber tyres		fire	☐	5	Less than 50 m	3	3
Research and development (incl laboratories)		fire	☐	5	Less than 50 m	3	3
Scrap yards (collection)	cleaning agents	LTe2/LF2/PB1	☐	10.000	50 m to 500 m	2	2
Scrap yards (collection)	solvents	LTe2/PB1/CMR1	☐	10.000	50 m to 500 m	2	2
Services and consultancy - other (offices)		fire	☐	5	Less than 50 m	3	3
Ship dismantling	cleaning agents	LTe2/LF2/PB1	☐	10.000	500 m to 5 km	2	2
Ship dismantling	solvents	LTe2/PB1/CMR1	☐	10.000	500 m to 5 km	2	2
Shipyards and repair		fire	☐	5	Less than 50 m	3	3
Shooting faciliteis		fire	☐	5	Less than 50 m	3	3
Small and medium enterprises trading and repair for private individuals		fire	☐	5	Less than 50 m	3	3
Sportsfacilities		fire	☐	5	Less than 50 m	3	3
Stadions (sport)		fire	☐	5	Less than 50 m	3	3
Swimming faciliteis	chlorine bleaching	GT3/GTe4	☐	10.000	500 m to 5 km	2	1
Synthetic manufacturing	acrylic acid	LTe1/LF1	☐	5.000.000	500 m to 5 km	3	1
Synthetic manufacturing	phenolic resin	LTe3/L-GT2/CMR0,5	☐	5.000.000	500 m to 5 km	3	1
Tanker cleaning	cleaning agents	LTe2/LF2/PB1	☐	50.000	5 km to 50 km	2	2
Tanker cleaning	oil and solvents	LTe1/LF2/PB1,5	☐	25.000.000	5 km to 50 km	2	1
Tanker cleaning	solvents	LTe2/PB1/CMR1	☐	50.000	5 km to 50 km	2	1
Tanning industry	ammonium sulfate	L-GT*/LTe2	☐	5.000	5 km to 50 km	3	3
Tanning industry	aniline	CMR2/LTe2/LNR	☐	10.000	5 km to 50 km	2	1
Tanning industry	arsenic compound, liquid, n.o.s.	PB2/CMR2/LTe2/L-GT*	☐	10.000	500 m to 5 km	1	1
Tanning industry	chromium (III)	PB1/CMR1/STe3	☐	5.000	5 km to 50 km	1	2
Tanning industry	cyanide	LTW/LTe3	☐	5.000	5 km to 50 km	3	2
Tanning industry	sulfuric acid	LTe2/LNR	☐	5.000	5 km to 50 km	3	2
Textile industry (dyes)	alkali	L-GT*/LTe2	☐	5.000	5 km to 50 km	3	2
Textile industry (dyes)	benzene	CMR2/LTe2/LF2	☐	10.000	5 km to 50 km	2	1
Textile industry (dyes)	bromine	GT3/GTe4	☐	5.000	5 km to 50 km	2	2
Textile industry (dyes)	chlorine	GT5/GTe4	☐	5.000	5 km to 50 km	2	2
Textile industry (dyes)	naphtalene	L-TG3/PB1,5*/STe2	☐	10.000	5 km to 50 km	2	2
Textile industry (dyes)	sodium nitrate	LTe1/NR	☐	5.000	5 km to 50 km	3	3
Textile industry (dyes)	sodium sulfide	L-GT*/LTe3	☐	5.000	5 km to 50 km	3	2
Trading and merchandising - general		fire	☐	5	Less than 50 m	3	3
Trading and repair cars, motorcycles, service stations	cleaning agents	LTe2/LF2/PB1	☐	10.000	50 m to 500 m	2	2
Trading and repair cars, motorcycles, service stations	solvents	LTe2/PB1/CMR1	☐	10.000	50 m to 500 m	2	2

☐ For possibility of exposure, see LS Table

Table FT2 Priorities Module, Objects of Interest List

H Hazard			Exp	Q Quantity	i Potential Impact		
			Exposure				
Facility or process	**Substance**	**Hazard type**		**Typical (kg)**	**Human direct**	**Long term**	**Life support and nature direct**
Trading personal estate		fire	☐	5	Less than 50 m	3	3
Trading professional fireworks (large enterprises)	fireworks	E	☐	50.000	5 km to 50 km	3	3
Trading professional fireworks (SME)	fireworks	E	☐	50.000	500 m to 5 km	3	3
Trading real estate		fire	☐	5	Less than 50 m	3	3
Transport - other		fire	☐	5	Less than 50 m	3	3
Transport companies (no (tank) cleaning)		fire	☐	5	Less than 50 m	3	3
Transport offices and services		fire	☐	5	Less than 50 m	3	3
Truck and (rail) lorry repair shops	cleaning agents	LTe2/LF2/PB1	☐	10.000	50 m to 500 m	2	2
Truck and (rail) lorry repair shops	solvents	LTe2/PB1/CMR1	☐	10.000	50 m to 500 m	2	2
Water cleaning		fire	☐	5	Less than 50 m	3	3
Wholesale chemical products	mixed chemicals (fire)	GT4 (toxic smoke)	☐	10.000	500 m to 5 km	3	2
Wholesale fertilizers	ammoniumnitrate	E	☐	2.500.000	5 km to 50 km	3	2
Wholesale fire products (SME)		fire	☐	10.000	500 m to 5 km	3	3
Wholesale intermediate products		fire	☐	5	Less than 50 m	3	3
Wholesale iron and metal and heating equipment		fire	☐	5	Less than 50 m	3	3
Wholesale liquid and gas fuels	natural gas	GF0/GTe3	☐	10.000	500 m to 5 km	3	3
Wholesale liquid and gas fuels	oil and solvents	LTe1/LF2/PB1,5	☐	2.500.000	500 m to 5 km	2	1
Wholesale machines		fire	☐	5	Less than 50 m	3	3
Wholesale metal / minerals		fire	☐	5	Less than 50 m	3	3
Wholesale metals and half products		fire	☐	5	Less than 50 m	3	3
Wholesale mineral oil and solvent product (excl. fuels)	oil and solvents	LTe1/LF2/PB1,5	☐	50.000	500 m to 5 km	2	2
Wholesale other		fire	☐	5	Less than 50 m	3	3
Wholesale scrap and metals		fire	☐	5	Less than 50 m	3	3
Wholesale wood and building materials		fire	☐	5	Less than 50 m	3	3
Wiindmills		fire	☐	5	Less than 50 m	3	3
Winning, preparing and distribution drinking water (no chemicals)		fire	☐	5	Less than 50 m	3	3
Winning, preparing and distribution drinking water (with chemicals)	chlorine	GT5/GTe4	☐	25.000	500 m to 5 km	2	1
Wood treating industry	arsenic compound, liquid, n.o.s.	PB2/CMR2/LTe2/L-GT*	☐	10.000	500 m to 5 km	1	1
Wood treating industry	chromium (III)	PB1/CMR1/STe3	☐	5.000	500 m to 5 km	1	2
Wood treating industry	copper salts	PB1/LTe4	☐	10.000	500 m to 5 km	2	1
Wood treating industry	creosote	LTe4/L-GT1/CMR1	☐	5.000	500 m to 5 km	3	1
Wood treating industry	pentachlorophenol	CMR2/PB0,5/STe3/L-GT*	☐	10.000	500 m to 5 km	2	1

☐ For possibility of exposure, see LS Table

Facilities and Objects Assessment Module

Overview of process to perform the impact assessment using table FT3: Facilities and Objects Assessment Module

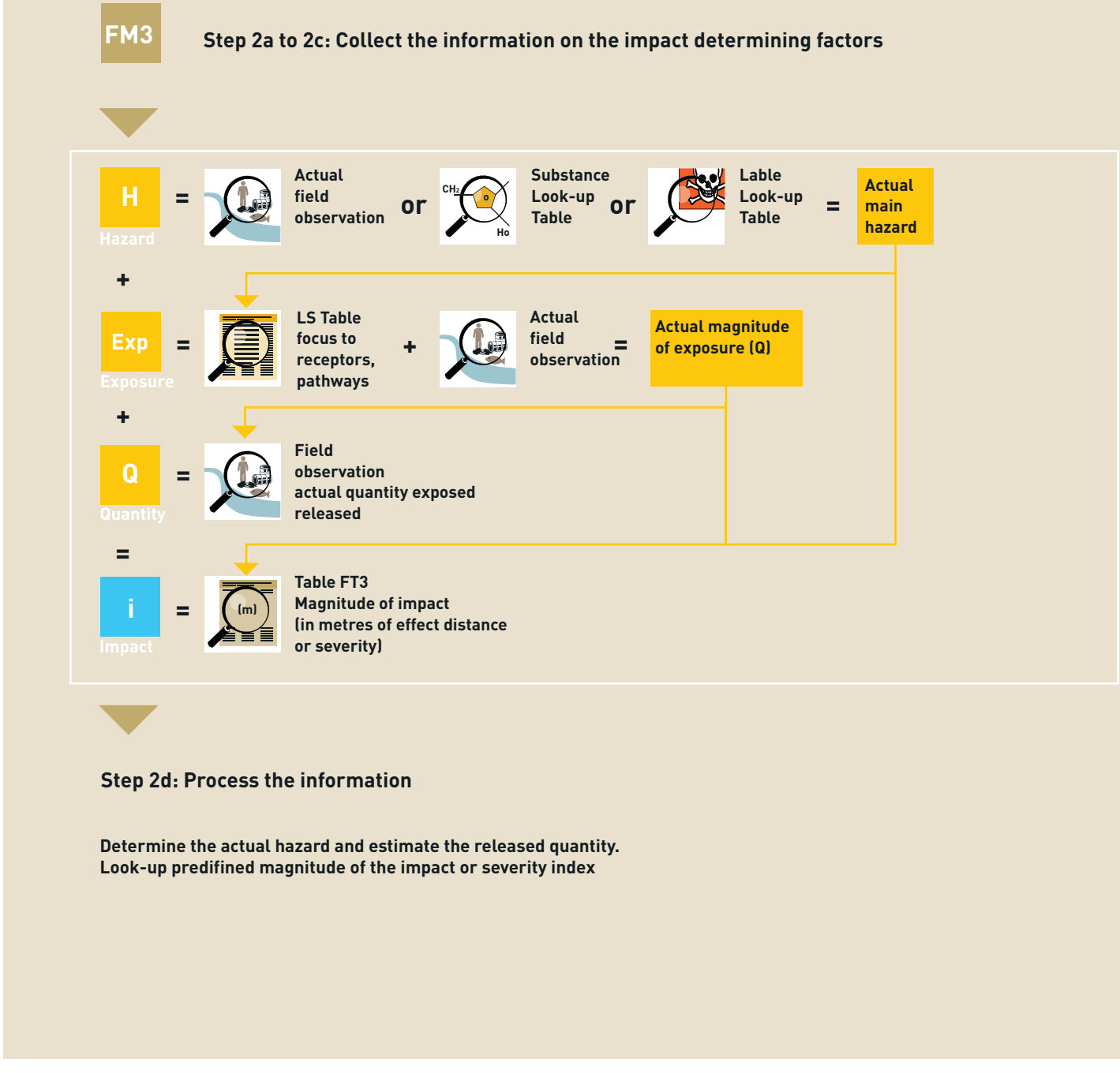


Table FT3 Facilities and Objects Assessment Module

H Hazard		Exp Exposure	Q Quantity		i Potential Impact					
					Human direct		Life support and nature direct			
Hazard type	**Hazard sub-type**		**amount**	**(unit)**	**Lethal (m)**	**Health (m)**	**Soil (m)**	**Lake (m)**	**River (m)**	**Large animals (m)**
Toxic gas, explosive, flammable, small containers										
GT Gas Toxic to humans	GT5 Acute toxic (based on chlorine)	☐	20	kg	30	250				■
		☐	100	kg	60	600				■
		☐	1,000	kg	250	2,400				■
		☐	5,000	kg	350	6,250				■
	GT4 High toxic (based on sulphur dioxide)	☐	200	kg	20	950				■
		☐	1,000	kg	60	2,400				■
		☐	10,000	kg	250	9,500				■
		☐	50,000	kg	550	24,850				■
	GT3 Medium toxic (based on ammonia)	☐	200	kg	20	200				■
		☐	1,000	kg	60	550				■
		☐	10,000	kg	250	2,050				■
		☐	50,000	kg	600	5,350				■
	GT2 Low toxic (based on ethylchloride)	☐	1,000	kg	10	20				■
		☐	10,000	kg	30	60				■
		☐	50,000	kg	60	200				■
	GT1 Very low toxic	☐	50,000	kg	0	0				■
Explosive (E)	E (Class 1.1, 1.2 and 1.5)	☐	1,000	kg	350	NA				■
Gas toxic to the environment GTe (going into solution)	GTe-1 to GTe4 Gas toxic to the environment	☐	5,000	kg	450	NA				■
		☐	50,000	kg	500	NA				■
Flammable (F)	LF0 to LF4 Liquefied flammable gas	☐	1,000	kg	60	90				■
		☐	10,000	kg	200	300				■
		☐	50,000	kg	400	650				■
Small containers with chemicals	not specified	Serious but mainly local/individual impacts. Dispersion and exposure due to curiousity, playing of children or intended reuse of substances								
Toxic liquids (to humans and environment)										
L-GT Liquid evaporating into toxic gas (exposure to humans trough air)	L-GT4 Liquid toxic - acutely toxic (based on methylisocyanate)	☐	20	kg	80	250				■
		☐	100	kg	250	700				■
		☐	1,000	kg	850	2,750				■
		☐	5,000	kg	2,150	7,250				■
	L-GT3 Liquid toxic - highly toxic (based on Acroleine)	☐	100	kg	40	700				■
		☐	1,000	kg	150	2,750				■
		☐	5,000	kg	400	7,250				■
	L-GT2 Liquid toxic - medium toxic (based on nitric acid)	☐	1,000	kg	20	350				■
		☐	10,000	kg	70	150				■
		☐	50,000	kg	200	3,250				■
	L-GT1 Liquid toxic - low toxic (based on acrylonitrile)	☐	1,000	kg	20	150				■
		☐	10,000	kg	70	500				■
		☐	50,000	kg	200	1,250				■

☐ For possibility of exposure, see LS Table

■ = equal human health

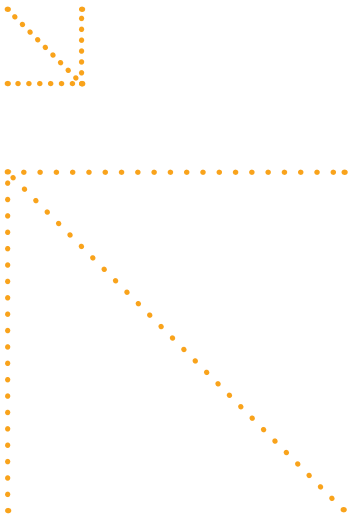
Table FT3 Facilities and Objects Assessment Module

H Hazard		Exp	Q Quantity		i Potential Impact					
		Exposure			 Human direct		 Life support and nature direct			
Hazard type	**Hazard sub-type**		**amount**	**(unit)**	**Lethal (m)**	**Health (m)**	**Soil (m)**	**Lake (m)**	**River (m)**	**Large animals (m)**
Toxic liquids (to humans and environment)										
LTe Liquid toxic to the environment (exposure through dispersion of the liquid)	LTe4 Liquid toxic - acutely toxic to the environment (based on creosote)	☐	100	kg			2,800	400	10,000	
		☐	1,000	kg			8,900	1,300	100,000	
		☐	5,000	kg			19,900	2,800	500,000	
	LTe3 Liquid toxic - highly toxic to the environment (based on hydrazine)	☐	1,000	kg			5,000	700	31,700	
		☐	10,000	kg			15,900	2,200	317,000	
		☐	50,000	kg			35,500	5,000	1,584,900	
Liquid toxic to the environment (LTe)	LTe2 Liquid toxic - medium toxic to the environment (based on methylisocyanate)	☐	20	kg			200	30	40	
		☐	100	kg			400	100	200	
		☐	1,000	kg			1,300	200	2,000	
		☐	5,000	kg			2,800	400	10,000	
	LTe1 Liquid toxic - low toxic to the environment (based on methanol)	☐	1,000	kg			100	0	0	
		☐	10,000	kg			200	0	0	
		☐	50,000	kg			400	100	200	
PB or CMR properties, long term impact										
	PB (-L, -D) Persistent/Bioaccumulating (-Liquid, dust). Substances listed in the 'Substance Look-up Table' including PB severity index	☐	any		■	■	■	■	■	■
	CMR (-L, -D) Carcinogenic, Mutugenic and Reprotoxic (-Liquid, -Dust). Substances listed in the 'Substance Look-up Table' including CMR severity index.	☐	any	kg	■	■	■	■	■	■

☐ For possibility of exposure, see LS Table

■ impact area = dispersion area: prevent all dispersion possible

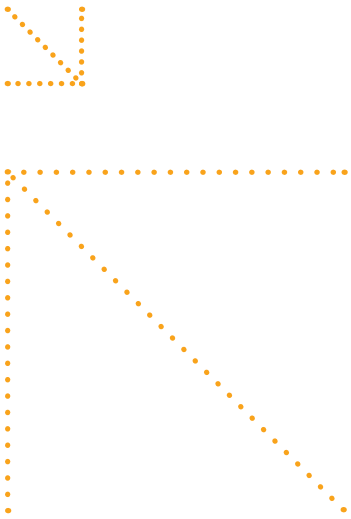
■ = equal human health



Label Look-up Table

Goal: International transportation labels indicate the hazard emerging from a substance. Within FEAT similar hazard types are used. This look-up table provides a link between both hazard indications although there is no perfecft match and caution with the interpretation is needed. Add the physical property of the substance from your field observations to match more acurately with the hazard types as listed in the Likely Scenarios Table.

Symbol	Addition to symbol	Indication of Feat hazard type	Abreviation of Feat hazard type	Expected impact
	E	E, Explosive	E	Human direct
	O	Oxidizing: Flammable, explosive (in contact with flammable material)	F, E	Human direct
	F+	Extremely flammable	F (FL*, FG*)	Human direct
	F	Flammable	F (FL*, FG*)	Human direct
no symbol	-	Flammable	F (FL*, FG*)	Human direct
	T+	Highly toxic	T (GT*, LT*)	Human direct, Life support and nature direct
	T	Toxic	T (GT*, LT*)	Human direct, Life support and nature direct
	Xn	Toxic	T (GT*, LT*)	Human direct, Life support and nature direct
	C			Human direct
	Xi			Human direct
	N	Toxic, special attention to life support and nature and long-term impacts	T (GT*, LT*), PB	Life support and nature direct, Long-term (PB)
	T	Carcinogenic	CMR	Long-term (CRM)
	Xn	Possibly carcinogenic	CMR	Possibly Long-term (CRM)
	T	Carcinogenic	CMR	Long-term (CRM)
	Xn	Possibly carcinogenic	CMR	Long-term (CRM)
	T	Possibly carcinogenic	CMR	Long-term (CRM)
	Xn	Possibly carcinogenic	CMR	Possibly Long-term (CRM)



Substance Look-up Table

Part 1: Toxic gases, explosives, flammables, small containers

Substance name	Hazard type (in order of relevance)	UN-nr
1,1-Difluoroethane	GF3	1030
1,1-Difluoroethylene	GF3	1959
1,1-Dimethoxyethane	LF2	2377
1,2,3,6-Tetrahydrobenzaldehyde	LF1/LTe2	2498
1,2,3,6-Tetrahydropyridine	LF2	2410
1,2-Butylene oxide, stabilized	LF2	3022
1,2-Di-(dimethylamino)ethane	LF2	2372
1,2-Dimethoxyethane	LF2	2252
1-Bromo-3-methylbutane	LF1	2341
1-Chloro-1,1-difluoroethane	GF2	2517
1-Methoxy-2-propanol	LF1	3092
2,2'-Dichlorodiethyl ether	LF1	1916
2,2-Dimethylpropane	GF1	2044
2,3-Dihydropyran	LF2	2376
2,3-Dimethylbutane	LF2	2457
2-Diethylaminoethanol	LF1	2686
2-Dimethylaminoethanol	LF1	2051
2-Ethylbutanol	LF1	2275
2-Ethylbutyl acetate	LF1	1177
2-Ethylbutyraldehyde	LF2	1178
2-Ethylhexylamine	LF1	2276
2-Methyl-1-butene	LF2	2459
2-Methyl-2-butene	LF2	2460
2-Methylpentan-2-ol	LF1	2560
3,3-Diethoxypropene	LF2	2374
3-Methyl-1-butene	LF2	2561
3-Methylbutan-2-one	LF2	2397
4-Methoxy-4-methylpentan-2-one	LF1	2293
Acetal	LF2	1088
Acetic acid, glacial	LF1	2789
Acetic anhydride	LF1	1715
Acetyl methyl carbinol	LF1	2621
Acetylene	GF3	1001
Acetylene, Ethylene and Propylene in mixture, refrigerated liquid containing at least 71.5% Ethylene with not more than 22.5% Acetylene and not more than 6% Propylene.	GF0	3138
Adhesives (flammable)	LF2/LF1	1133
Alcoholates solution, n.o.s., in alcohol	LF2	3274
Alcoholic beverages	LF2/LF1	3065
Alcohols, flammable, poisonous, n.o.s.	LF2/LF1	1986
Alcohols, n.o.s.	LF2/LF1	1987
Allyl formate	LF2	2336
Allyl glycidyl ether	LF1	2219
alpha-Methylvaleraldehyde	LF2	2367
alpha-Pinene	LF1	2368
Ammonia solution, with more than 50% Ammonia	GT3/GTe3	3318
Ammonia, anhydrous	GT3/GTe3	1005
Ammonia, solution, with more than 10% but not more than 35% Ammonia	GTe3/LNR	2672
Ammonia, solution, with more than 35% but not more than 50% Ammonia	GT3	2073
Amyl acetates	LF1	1104
Amyl alcohols	LF2/LF1	1105
Amyl butyrates	LF1	2620
Amyl chloride	LF2	1107
Amyl formates	LF1	1109
Amyl nitrite	LF2/LF1	1113
Anisole	LF1	2222
Arsine	GT5/LTe4	2188
Asphalt	LF2/LF1	1999

Substance Look-up Table

Part 1: Toxic gases, explosives, flammables, small containers

Substance name	Hazard type (in order of relevance)	UN-nr
Bicyclo[2.2.1]hepta-2,5-diene	LF2	2251
Boron trichloride	GT3	1741
Boron trifluoride	GT0	1008
Bromine chloride	GT*	2901
Bromotrifluoroethylene	GF2	2419
Butadienes, inhibited	GF2/GTe2/CMR2	1010
Butane	GT2/GTe3/GF3	1075
Butanols	LF2/LF1	1120
Butyl acetates	LF2/LF1	1123
Butyl chloride	LF2	1127
Butyl ethers	LF1	1149
Butyl mercaptan	LF2	2347
Butyl methyl ether	LF2	2350
Butyl vinyl ether, inhibited	LF2	2352
Butylene	GF2	1012
Butyraldehyde	LF2	1129
Butyraldoxime	LF1	2840
Butyric anhydride	LF1	2739
Carbon dioxide and Ethylene oxide mixture, with more than 87% Ethylene oxide	GT*/GF*	3300
Carbon dioxide and Ethylene oxide mixture, with more than 9% but not more than 87% Ethylene oxide	GT*/GF*	1041
Carbon monoxide	GT0/GF0	1016
Carbon monoxide and Hydrogen mixture	GT0/GF0	2600
Carbonyl fluoride	GT0	2417
Carbonyl sulfide	GT5/GT3	2204
Chlorine	GT5/GTe4	1017
Chlorine pentafluoride	GT*	2548
Chlorine trifluoride	GT*	1749
Chloropicrin and Methyl bromide mixture	GT*	1581
Chloropicrin and Methyl chloride mixture	GT*	1582
Chlorosilanes, n.o.s.	L-GT*/LTe3/LF2	2988
Coal gas	GT0/GF0	1023
Coating solution	LF1	1139
Coating solution	LF2	1139
Combustible liquid, n.o.s.	LF2/LF1	1993
Compressed gas, flammable, n.o.s.	GF0	1954
Compressed gas, flammable, poisonous, n.o.s. (Inhalation Hazard Zone A)	GT0/GF0	1953
Compressed gas, poisonous, corrosive, n.o.s.	GT0	3304
Compressed gas, poisonous, flammable, corrosive, n.o.s.	GT0/GF0	3305
Compressed gas, poisonous, n.o.s.	GT0	1955
Compressed gas, poisonous, oxidizing, corrosive, n.o.s.	GT0	3306
Compressed gas, poisonous, oxidizing, n.o.s.	GT0	3303
Corrosive liquid, water-reactive, n.o.s.	LFW	3094
Corrosive solid, flammable, n.o.s.	SF	2921
Crotonylene	LF2	1144
Cyanogen	GT5/GT3	1026
Cyanogen chloride (CK)	GT4	1589
Cyclobutane	GF1	2601
Cyclopropane	GF3	1027
Cymenes	LF1	2046
Deuterium	GF0	1957
Diacetone alcohol	LF2/LF1	1148
Diborane	GT0/GF0	1911
Dichloropentanes	LF1	1152
Dichlorosilane	GT4/LTe2/GF1	2189
Diethoxymethane	LF2	2373

Substance Look-up Table

Part 1: Toxic gases, explosives, flammables, small containers

Substance name	Hazard type (in order of relevance)	UN-nr
Diethyl carbonate	LF1	2366
Diethyl ether	LF2	1155
Diethyl ketone	LF2	1156
Diethylamine	LF2	1154
Difluoromethane	GF*	3252
Diisobutylene, isomeric compounds	LF2	2050
Diisopropyl ether	LF2	1159
Diketene, inhibited	LF1	2521
Dimethyl carbonate	LF2	1161
Dimethyl disulfide	LF2	2381
Dimethyl ether	GF2	1033
Dimethyl sulfide	LF2	1164
Dimethylamine	GT4	
Dimethylamine, anhydrous	GT4/GF2	1032
Dimethylamine, aqueous solution	LF2	1160
Dinitrogen tetroxide	GT5	1067
Dinitrogen tetroxide and Nitric oxide mixture	GT*	1975
Di-n-propyl ether	LF2	2384
Dioxolane	LF2	1166
Dipentene	LF1	2052
Dipropyl ketone	LF1	2710
Dipropylamine	LF2	2383
Divinyl ether, inhibited	LF2	1167
Elevated temperature liquid, flammable, n.o.s., with flash point above 37.8°C (100°F), at or above its flash point	LF1	3256
Ethane	GF3	1035
Ethane, refrigerated liquid	GF0	1961
Ethanol	LF2/LF1	1170
Ethers, n.o.s.	LF2/LF1	3271
Ethyl 2-chloropropionate	LF1	2935
Ethyl acetate	LF2	1173
Ethyl acrylate, inhibited	LF2	1917
Ethyl borate	LF2	1176
Ethyl butyl ether	LF2	1179
Ethyl butyrate	LF1	1180
Ethyl chloride	GT3/GT2/GF1	1037
Ethyl crotonate	LF2	1862
Ethyl fluoride	GF3	2453
Ethyl formate	LF2	1190
Ethyl isobutyrate	LF2	2385
Ethyl lactate	LF1	1192
Ethyl mercaptan	LF2	2363
Ethyl methacrylate	LF2	2277
Ethyl methyl ether	GF2	1039
Ethyl methyl ketone	LF2	1193
Ethyl orthoformate	LF1	2524
Ethyl propionate	LF2	1195
Ethyl propyl ether	LF2	2615
Ethyl silicate	LF1	1292
Ethylacetylene, inhibited	GF1	2452
Ethylbenzene	LF2	1175
Ethylene	GF0	1962
Ethylene chlorohydrin	LF1	1135
Ethylene dichloride	LF2	1184
Ethylene glycol diethyl ether	LF1	1153
Ethylene glycol monoethyl ether	LF1	1171
Ethylene glycol monoethyl ether acetate	LF1	1172
Ethylene glycol monomethyl ether	LF1	1188
Ethylene glycol monomethyl ether acetate	LF1	1189
Ethylene oxide	GT3/GF1/CMR1/GTe1	1040

Substance Look-up Table

Part 1: Toxic gases, explosives, flammables, small containers

Substance name	Hazard type (in order of relevance)	UN-nr
Ethylene, refrigerated liquid (cryogenic liquid)	GF0	1038
Ethylenediamine	LF1	1604
Ethylhexaldehydes	LF1	1191
Extracts, aromatic, liquid	LF2/LF1	1169
Flammable liquid, corrosive, n.o.s	LF2/LF1	2924
Fluorine	GT0/GTe3/PB1	1045
Formic acid	LF1	1779
Furaldehydes	LF1	1199
Fusel oil	LF2/LF1	1201
Gas, refrigerated liquid, flammable, n.o.s.	GF0	3312
Gasohol	LF2	1203
Germane	GT5/GT3	2192
Hexaethyl tetraphosphate and compressed gas mixture	GT0	1612
Hexafluoroacetone	GT*	2420
Hydrocarbon gas, compressed, n.o.s.	GF0	1964
Hydrocarbon gas, liquefied, n.o.s.	GF3	1965
Hydrogen	GTe2/GF0	1049
Hydrogen and Methane mixture, compressed	GF0	2034
Hydrogen bromide	GT5	
Hydrogen bromide, anhydrous	GT5	1048
Hydrogen chloride	GT5/GTe2	
Hydrogen chloride, anhydrous	GT5	1050
Hydrogen iodide	GT4	
Hydrogen iodide, anhydrous	GT4	2197
Hydrogen selenide	GT5	
Hydrogen selenide, anhydrous	GT5/GT3	2202
Hydrogen sulfide	GT5/GT3	1053
Hydrogen, refrigerated liquid (cryogenic liquid)	GF0	1966
Ink, printer's, flammable	LF1	1210
Ink, printer's, flammable	LF2	1210
Insecticide gas, flammable, n.o.s.	GF*	3354
Insecticide gas, poisonous, flammable, n.o.s.	GT*/GF*	3355
Insecticide gas, poisonous, n.o.s.	GT*	1967
Iodopropanes	LF1	2392
Isobutane	GF2	1969
Isobutyl acetate	LF2	1213
Isobutyl acrylate	LF1	2527
Isobutyl aldehyde	LF2	2045
Isobutyl formate	LF2	2393
Isobutyl isobutyrate	LF1	2528
Isobutyl propionate	LF2	2394
Isobutylene	GF2	1055
Isobutyric acid	LF1	2529
Isobutyronitrile	LF2	2284
Isooctenes	LF2	1216
Isoprene, inhibited	LF2	1218
Isopropenyl acetate	LF2	2403
Isopropyl acetate	LF2	1220
Isopropyl butyrate	LF1	2405
Isopropyl chloroformate	LF2	2407
Isopropyl isobutyrate	LF2	2406
Isopropyl nitrate	LF2	1222
Isopropyl propionate	LF2	2409
Ketones, liquid, n.o.s.	LF2	1224
Liquefied gas, flammable, n.o.s.	GF*	3161
Liquefied gas, poisonous, corrosive, n.o.s.	GT*	3308
Liquefied gas, poisonous, flammable, corrosive, n.o.s.	GT*/GF*	3309
Liquefied gas, poisonous, flammable, n.o.s.	GT*/GF*	3160
Liquefied gas, poisonous, n.o.s.	GT*	3162
Liquefied gas, poisonous, oxidizing, corrosive, n.o.s.	GT*	3310

Substance Look-up Table

Part 1: Toxic gases, explosives, flammables, small containers

Substance name	Hazard type (in order of relevance)	UN-nr
Liquefied gas, poisonous, oxidizing, n.o.s.	GT*	3307
Liquefied natural gas (cryogenic liquid)	GF0	1972
Mercaptan mixture, liquid, flammable, n.o.s.	LF2/LF1	3336
Mercaptan mixture, liquid, flammable, poisonous, n.o.s.	LF1	1228
Mesityl oxide	LF1	1229
Methallyl alcohol	LF1	2614
Methane	GF0	1971
Methyl 2-chloropropionate	LF1	2933
Methyl acetate	LF2	1231
Methyl acrylate, inhibited	LF2	1919
Methyl bromide	GT3	1062
Methyl butyrate	LF2	1237
Methyl chloride	GT3/GF2	1063
Methyl chloride and Methylene chloride mixture	GT*/GF*	1912
Methyl fluoride	GF3	2454
Methyl formate	LF2	1243
Methyl isobutyl ketone	LF2	1245
Methyl isopropenyl ketone, inhibited	LF2	1246
Methyl isovalerate	LF2	2400
Methyl magnesium bromide in Ethyl ether	LF*	1928
Methyl mercaptan	GT3/GF1	1064
Methyl methacrylate monomer, inhibited	LF2	1247
Methyl propionate	LF2	1248
Methyl propyl ether	LF2	2612
Methyl propyl ketone	LF2	1249
Methyl tert-butyl ether	LF2	2398
Methyl vinyl ketone	LF2	1251
Methylacetylene and Propadiene mixture, stabilized	GF3	1060
Methylal	LF2	1234
Methylamine	GT4	
Methylamine, anhydrous	GT4/GF2	1061
Methylamine, aqueous solution	LF2	1235
Methylamyl acetate	LF1	1233
Methylamyl alcohol	LF1	2053
Methylchlorosilane	GT4/GF1	2534
Methylcyclohexanols	LF1	2617
Methylcyclohexanone	LF1	2297
Monovinylchloride	GT2/CMR	
Morpholine	LF1	2054
N,N-Diethylethylenediamine	LF1	2685
N,N-Dimethylcyclohexylamine	LF1	2264
N,N-Dimethylformamide	LF1	2265
n-Amyl methyl ketone	LF1	1110
n-Amylene	LF2	1108
n-Butyl formate	LF2	1128
n-Butyl methacrylate	LF1	2227
n-Heptene	LF2	2278
Nitric oxide	GT0	1660
Nitric oxide	GT1	
Nitrocellulose, solution, flammable	LF1	2059
Nitrocellulose, solution, flammable	LF2	2059
Nitroethane	LF1	2842
Nitrogen trifluoride	GT0	2451
Nitrogen trifluoride	GT1	
Nitrogen trioxide	GT*	2421
Nitroglycerin, solution in alcohol, with more than 1% but not more than 5% Nitroglycerin	LF2	3064
Nitroglycerin, solution in alcohol, with not more than 1% Nitroglycerin	LF2	1204
Nitromethane	LF2	1261

Substance Look-up Table

Part 1: Toxic gases, explosives, flammables, small containers

Substance name	Hazard type (in order of relevance)	UN-nr
Nitropropanes	LF1	2608
Nitrosyl chloride	GT5	1069
n-Propanol	LF2/LF1	1274
n-Propyl acetate	LF2	1276
n-Propyl benzene	LF1	2364
n-Propyl nitrate	LF2	1865
Octadiene	LF2	2309
Oil gas	GT0/GF0	1071
Organometallic compound, water-reactive, flammable, n.o.s.	LF*	3207
Oxygen difluoride	GT1/GT0	2190
Paraldehyde	LF1	1264
Perchloryl fluoride	GT*	3083
Perfluoroethyl vinyl ether	GF1	3154
Perfluoromethyl vinyl ether	GF3	3153
Perfumery products, with flammable solvents	LF2/LF1	1266
Phosgene (CG)	GT5	1076
Phosphine	GT5/GT3	2199
Phosphorus pentafluoride	GT0	2198
Phosphorus pentafluoride	GT1	
Picolines	LF1	2313
Pine oil	LF1	1272
Piperidine	LF1	2401
Polyester resin kit	LF2/LF1	3269
Propadiene, inhibited	GF3	2200
Propane	GF3/GTe3	1978
Propanethiols	LF2	2402
Propionaldehyde	LF2	1275
Propionic acid	LF1	1848
Propyl formates	LF2	1281
Propylene	GF3	1077
Propylene oxide	LF2	1280
Propylene tetramer	LF1	2850
Pyrrolidine	LF2	1922
Refrigerant gas R-143a	GF3	2035
Resin solution	LF2/LF1	1866
Rosin oil	LF2/LF1	1286
Rubber solution	LF2/LF1	1287
Selenium hexafluoride	GT*	2194
Silane	GT0/GF0	2203
Silicon tetrafluoride	GT0	1859
Silicon tetrafluoride	GT1	
Sodium methylate, solution in alcohol	LF2/LF1	1289
Stibine	GT5/GT3	2676
Sulfur dioxide	GT4/GTe4	1079
Sulfur tetrafluoride	GT5	2418
Sulfuryl fluoride	GT3	2191
Tellurium hexafluoride	GT*	2195
Terpinolene	LF1	2541
Tetrafluoroethylene, inhibited	GF3	1081
Tetrahydrofuran	LF2	2056
Tetrahydrothiophene	LF2	2412
Tetrapropyl orthotitanate	LF1	2413
Thioacetic acid	LF2	2436
Thiophene	LF2	2414
Tinctures, medicinal	LF2/LF1	1293
Triethyl phosphite	LF1	2323
Triethylamine	LF2	1296
Trifluoroacetyl chloride	GT*	3057
Trifluorochloroethylene	GT5/GT3	1082
Triisobutylene	LF1	2324

Substance Look-up Table

Part 1: Toxic gases, explosives, flammables, small containers

Substance name	Hazard type (in order of relevance)	UN-nr
Trimethyl borate	LF2	2416
Trimethyl phosphite	LF1	2329
Trimethylamine, anhydrous	GT4/GF2	1083
Trimethylamine, aqueous solution	LF2	1297
Tripropylene	LF2/LF1	2057
Tungsten hexafluoride	GT4	2196
Undecane	LF1	2330
Valeraldehyde	LF2	2058
Vinyl acetate	LF2	1301
Vinyl bromide	GT3	
Vinyl bromide, inhibited	GT3/GTe2/GF1	1085
Vinyl butyrate, inhibited	LF2	2838
Vinyl chloride, inhibited	GF2/GTe2	1086
Vinyl ethyl ether	LF2	1302
Vinyl fluoride, inhibited	GF3	1860
Vinyl isobutyl ether	LF2	1304
Vinyl methyl ether	GT3/GF1	1087
Zirconium metal, liquid suspension	LF2/LF1	1308

Substance Look-up Table

Part 2: Toxic liquids

Substance name	Hazard type (in order of relevance)	UN-nr
(Bio)Medical waste, n.o.s.	LTe2	3291
1,1,1-Trichloroethane	LTe2/LNR	2831
1,1-Dichloro-1-nitroethane	LTe2/SNR	2650
1,1-Dichloroethane	LTe2/LF2	2362
1,1-Dimethylhydrazine	L-GT2/LTe2/LF2	1163
1,2-Dibromobutan-3-one	L-GT*/LTe2	2648
1,2-Dichloroethylene	LTe2/LF2	1150
1,2-Dichloropropane	LTe2/LF2	1279
1,2-Dimethylhydrazine	L-GT*/LF2	2382
1,2-Epoxy-3-ethoxypropane	LTe5/LF1	2752
1,2-Propylenediamine	LTe5/LF1	2258
1,3,5-Trimethylbenzene	LTe3/LF1	2325
1,3-Dichloroacetone	LTe2/SNR	2649
1,3-Dichloropropanol-2	L-GT*/LTe2	2750
1,3-Dimethylbutylamine	L-GT*/LF2	2379
1,4-Butynediol	LTe2/SNR	2716
1,5,9-Cyclododecatriene	L-GT*	2518
1-Aziridinyl phosphine oxide (Tris)	L-GT*	2501
1-Bromo-3-chloropropane	L-GT*/LTe2	2688
1-Bromobutane	LTe2/LF2	1126
1-Chloro-2,3-epoxypropane	L-GT1/LF1	2023
1-Chloropropane	LTe2/LF2	1278
1-Ethylpiperidine	L-GT*/LF2	2386
1-Hexene	LTe2/LF2	2370
1-Methylpiperidine	L-GT*/LF2	2399
1-Pentol	L-GT*	2705
2,4-Toluenediamine	LTe2/SNR	1709
2-Amino-4-chlorophenol	LTe2/SNR	2673
2-Bromobutane	LTe2/LF2	2339
2-Bromoethyl ethyl ether	LTe2/LF2	2340
2-Bromopentane	LTe2/LF2	2343
2-Bromopropane	LTe2/LF2	2344
2-Chloropropane	LTe2/LF2	2356
2-Chloropropene	LTe2/LF2	2456
2-Chloropropionic acid	LTe2/LNR	2511
2-Chloropyridine	LTe2/LNR	2822
2-Dimethylaminoacetonitrile	L-GT*/LF2	2378
2-Ethylaniline	LTe2/LNR	2273
2-Ethylhexyl chloroformate	L-GT*/LTe2	2748
2-Iodobutane	LTe2/LF2	2390
2-Methyl-2-hepthanethiol	L-GT*/LTe2/LF*	3023
2-Methylfuran	LTe2/LF2	2301
3,3'-Iminodipropylamine	L-GT*	2269
3-Bromopropyne	LTe2/LF2	2345
3-Chloro-4-methylphenyl isocyanate	LTe2/SNR	2236
3-Chloropropanol-1	L-GT*/LTe2	2849
3-Diethylaminopropylamine	L-GT*/LTe2/LF*	2684
3-Nitro-4-chlorobenzotrifluoride	LTe2/LNR	2307
3-Trifluoromethylaniline	L-GT*/LTe2	2948
4,4'-Diaminodiphenylmethane	LTe2/SNR	2651
4-Chloro-o-toluidine hydrochloride	LTe2/SNR	1579
4-Methylmorpholine	L-GT*/LF2	2535
4-Thiapentanal	L-GT*/LTe2	2785
5-Methylhexan-2-one	LTe2/LF1	2302
Acetaldehyde	LTe2/LF2	1089
Acetaldehyde oxime	LTe3/LF1	2332
Acetone	LTe1/LF2	1090
Acetone oils	LTe1/LF2	1091
Acetonitrile	LTe2/LF2	1648

Substance Look-up Table

Part 2: Toxic liquids

Substance name	Hazard type (in order of relevance)	UN-nr
Acetyl bromide	L-GT*/LTe2	1716
Acetyl chloride	L-GT2/LTe2/LF2	1717
Acetyl iodide	L-GT*/LTe2	1898
Acridine	LTe2/SNR	2713
Acrolein	L-GT4/LTe2	
Acrolein dimer, stabilized	LTe2/LF1	2607
Acrolein, inhibited	LTe3/LF2/L-GT3/PB1	1092
Acrylamide	LTe2/SNR	2074
Acrylic acid, inhibited	LTe1/LF1	2218
Acrylonitrile, inhibited	L-GT1/ LF2 /LTe2	1093
Aircraft hydraulic power unit fuel tank	LTe2/NR	3165
Alcohols, flammable, poisonous, n.o.s.	L-GT*/LF2	1986
Aldehydes, flammable, poisonous, n.o.s.	L-GT*/LTe2/LF2	1988
Aldehydes, flammable, poisonous, n.o.s.	LTe2/LF2	1988
Aldehydes, n.o.s.	LTe2/LF2	1989
Alkyl phenols, liquid, n.o.s. (including C2-C12 homologues)	LTe2/LNR	3145
Alkyl phenols, solid, n.o.s. (including C2-C12 homologues)	LTe2/SNR	2430
Alkylamines, n.o.s.	L-GT*/LTe3	2735
Alkylamines, n.o.s.	L-GT*/LTe3/LF2	2733
Alkylamines, n.o.s.	LTe3/LF2	2734
Allyl alcohol	L-GT1/LF1	1098
Allyl bromide	L-GT1/LF2	1099
Allyl chloride	L-GT2/LTe2/LF2	1100
Allyl chlorocarbonate	L-GT*/LTe2/LF*	1722
Allyl ethyl ether	L-GT*/LF2	2335
Allyl iodide	L-GT*/LF2	1723
Allyl isothiocyanate, inhibited	L-GT2/LTe2/LF1	1545
Allylamine	L-GT3/LTe2/LF2	2334
Allyltrichlorosilane, stabilized	L-GT*/LTe3/LF*	1724
alpha-Naphthylamine	LTe2/SNR	2077
Aluminum phosphide pesticide	LTW/LTe2	3048
Amines, solid, corrosive, n.o.s.	LTe2/SNR	3259
Aminopyridines	LTe2/SNR	2671
Ammonium arsenate	LTe3/SNR	1546
Ammonium bifluoride, solution	L-GT*	2817
Ammonium dichromate	LTe2/NR	1439
Ammonium dinitro-o-cresolate	LTe3/SNR	1843
Ammonium metavanadate	LTe3/SNR	2859
Ammonium nitrate fertilizers	LTe2/NR	2067
Ammonium nitrate fertilizers, with Ammonium sulfate	LTe2/E/NR	2069
Ammonium perchlorate	LTe2/NR	1442
Ammonium persulfate	LTe2/NR	1444
Ammonium picrate, wetted with not less than 10% water	LTe2/NR	1310
Ammonium polysulfide, solution	L-GT*	2818
Ammonium polyvanadate	LTe3/SNR	2861
Ammonium sulfide, solution	L-GT*/LF*	2683
Amyl mercaptan	LTe2/LF2	1111
Amylamines	L-GT*/LTe3/LF2	1106
Amyltrichlorosilane	L-GT*/LTe2	1728
Aniline hydrochloride	LTe3/SNR	1548
Anisoyl chloride	L-GT*/LTe2	1729
Antimony compound, inorganic, liquid, n.o.s.	L-GT*/LTe2	3141
Antimony compound, inorganic, n.o.s.	LTe2/SNR	1549
Antimony lactate	LTe2/SNR	1550
Antimony pentachloride, liquid	L-GT*/LTe2	1730
Antimony pentachloride, solution	L-GT*/LTe2	1731
Antimony pentafluoride	L-GT1	1732
Antimony potassium tartrate	LTe2/SNR	1551
Aqua regia	L-GT1	1798
Arsenic acid, liquid	PB2/CMR2/LTe2/L-GT*	1553

Substance Look-up Table

Part 2: Toxic liquids

Substance name	Hazard type (in order of relevance)	UN-nr
Arsenic bromide	PB2/CMR2/LTe3/L-GT*	1555
Arsenic pentoxide	PB2/CMR2/LTe3/L-GT*	1559
Arsenic trioxide	PB2/CMR2/LTe3/L-GT*	1561
Arsenical pesticide, liquid, flammable, poisonous	PB2/CMR2/LTe4/L-GT*/LF2	2760
Arsenical pesticide, liquid, poisonous	PB2/CMR2/LTe4/L-GT*	2994
Arsenical pesticide, liquid, poisonous, flammable	PB2/CMR2/LTe4/L-GT*/LF*	2993
Azodicarbonamide	LTe2/NR	3242
Barium cyanide	STW/LTe2	1565
Benzene phosphorus dichloride	L-GT*/LTe3	2798
Benzene phosphorus thiodichloride	L-GT*/LTe3	2799
Benzonitrile	LTe2/LNR	2224
Benzoquinone	LTe2/SNR	2587
Benzotrichloride	L-GT1/LTe2	2226
Benzotrifluoride	LTe2/LF2	2338
Benzoyl chloride	L-GT*/LTe3	1736
Benzyl bromide	L-GT*/LTe3	1737
Benzyl chloride	LTe2/LNR	1738
Benzyl chloroformate	L-GT*/LTe2	1739
Benzyl iodide	L-GT*/LTe2	2653
Benzyldimethylamine	LTe3/LF1	2619
Benzylidene chloride	L-GT*/LTe2	1886
Beryllium compound, n.o.s.	LTe3/SNR	1566
Beryllium nitrate	LTe2/NR	2464
Beryllium powder	LTe3/SNR	1567
Bipyridilium pesticide, liquid, flammable, poisonous	L-GT*/LTe4/LF2	2782
Bipyridilium pesticide, liquid, poisonous	LTe4/L-GT*	3016
Bipyridilium pesticide, liquid, poisonous, flammable	L-GT*/LTe2/LF*	3015
Bipyridilium pesticide, solid, poisonous	LTe4/SNR	2781
Bisulfates, aqueous solution	L-GT*	2837
Bleaching powder	LTe2/NR	2208
Boron tribromide	L-GT2	2692
Boron trifluoride acetic acid complex	L-GT*	1742
Boron trifluoride diethyl etherate	L-GT*	2604
Boron trifluoride dimethyl etherate	L-GT*/LF2	2965
Boron trifluoride propionic acid complex	L-GT*	1743
Boron trifluoride, dihydrate	L-GT*	2851
Bromates, inorganic, aqueous solution, n.o.s.	LTe2/NR	3213
Bromates, inorganic, n.o.s.	LTe2/NR	1450
Bromine	L-GT3/GTe4	1744
Bromine pentafluoride	L-GT*	1745
Bromine trifluoride	L-GT1	1746
Bromoacetic acid	LTe2/SNR	1938
Bromoacetone	L-GT1/LTe2/LF1	1569
Bromoacetyl bromide	L-GT*	2513
Bromobenzene	LTe3/LF1	2514
Bromobenzyl cyanides	LTe3/SNR	1694
Bromochloromethane	LTe2/LNR	1887
Bromoform	LTe2/LNR	2515
Bromomethylpropanes	LTe4/LF2	2342
Butanedione	LTe2/LF2	2346
Butyl acrylate	LTe2/LF1	2348
Butyl nitrites	LTe1/LF2	2351
Butyl propionates	LTe2/LF1	1914
Butylbenzenes	LTe1/LF1	2709
Butyltoluenes	L-GT*/LTe2	2667
Butyltrichlorosilane	L-GT*/LTe2/LF*	1747
Butyronitrile	L-GT*/LF2	2411
Butyryl chloride	L-GT*/LF2	2353
Buzz	L-GT*	2810
Cacodylic acid	L-GT*	1572

Substance Look-up Table

Part 2: Toxic liquids

Substance name	Hazard type (in order of relevance)	UN-nr
Cadmium compound	LTe4/SNR	2570
Calcium cyanide	STW/LTe2	1575
Camphor	LTe3/NR	2717
Camphor oil	LTe2/LF1	1130
Carbamate pesticide, liquid, flammable, poisonous	L-GT*/LTe4/LF2	2758
Carbamate pesticide, liquid, poisonous	LTe4/L-GT*	2992
Carbamate pesticide, liquid, poisonous, flammable	L-GT*/LTe4/LF*	2991
Carbamate pesticide, solid, poisonous	LTe4/SNR	2757
Carbon bisulfide	LTe2/LF2	1131
Carbon tetrabromide	LTe2/SNR	2516
Caustic alkali liquid, n.o.s.	LTe2/LNR	1719
Chemical kit	L-GT*	1760
Chloral, anhydrous, inhibited	L-GT*/LTe2	2075
Chlorite solution	LTe2/LNR	1908
Chloroacetaldehyde	L-GT2/LTe2	2232
Chloroacetic acid, liquid	LTe2/LNR	1750
Chloroacetic acid, molten	LTe3/SNR	3250
Chloroacetic acid, solid	LTe3/SNR	1751
Chloroacetone, stabilized	L-GT1/LTe2/LF2	1695
Chloroacetonitrile	L-GT*/LTe3/LF*	2668
Chloroacetophenone	LTe3/SNR	1697
Chloroacetyl chloride	L-GT2	1752
Chloroanilines, liquid	LTe2/LNR	2019
Chloroanilines, solid	LTe3/SNR	2018
Chloroanisidines	LTe3/SNR	2233
Chlorobenzene	LTe2/LF1	1134
Chlorobenzotrifluorides	LTe3/LF1	2234
Chlorobenzyl chlorides	LTe3/SNR	2235
Chlorocresols	LTe3/SNR	2669
Chlorodinitrobenzenes	LTe3/SNR	1577
Chloroform	LTe2/LNR	1888
Chloromethyl chloroformate	L-GT*	2745
Chloromethyl ethyl ether	L-GT*/LF2	2354
Chloronitroanilines	LTe3/SNR	2237
Chloronitrobenzenes	LTe3/SNR	1578
Chloronitrotoluenes	L-GT*/LTe3	2433
Chlorophenols, liquid	LTe2/LNR	2021
Chlorophenols, solid	LTe3/SNR	2020
Chlorophenyltrichlorosilane	L-GT*/LTe2	1753
Chloropicrin	L-GT2/LTe2	1580
Chloropicrin mixture, n.o.s.	L-GT*	1583
Chloroprene, inhibited	L-GT2/LF2	1991
Chlorosilanes, corrosive, flammable, n.o.s.	L-GT*/LTe3/LF*	2986
Chlorosilanes, corrosive, n.o.s.	L-GT*/LTe2	2987
Chlorosilanes, flammable, corrosive, n.o.s.	L-GT*/LTe3/LF*	2985
Chlorosulfonic acid	L-GT*	1754
Chlorotoluenes	LTe3/LF1	2238
Chlorotoluidines	LTe3/SNR	2239
Chromic acid, solid	LTe2/NR	1463
Chromic acid, solution	LTe3/LNR	1755
Chromic fluoride, solid	LTe3/SNR	1756
Chromic fluoride, solution	LTe3/PB1/CMR1/L-GT*	1757
Chromium nitrate	LTe3/NR	2720
Chromium oxychloride	L-GT*	1758
Chromosulfuric acid	LTe3/LNR	2240
Coal tar distillates, flammable	LTe2/LF2	1136
Copper acetoarsenite	LTe3/SNR	1585
Copper arsenite	LTe3/SNR	1586
Copper based pesticide, liquid, flammable, poisonous	L-GT*/LTe4/LF2	2776
Copper based pesticide, liquid, poisonous	L-GT*/LTe3	3010

Substance Look-up Table

Part 2: Toxic liquids

Substance name	Hazard type (in order of relevance)	UN-nr
Copper based pesticide, liquid, poisonous, flammable	L-GT*/LTe4/LF*	3009
Copper based pesticide, solid, poisonous	LTe4/SNR	2775
Copper chlorate	LTe2/NR	2721
Copper chloride	STe4/SNR	2802
Copper cyanide	LTe3/STW	1587
Corrosive liquid, flammable, n.o.s.	L-GT*/LF*	2920
Corrosive liquid, oxidizing, n.o.s.	L-GT*	3093
Corrosive liquid, poisonous, n.o.s.	L-GT*	2922
Corrosive solid, water-reactive, n.o.s.	LTe2/SFW	3096
Coumarin derivative pesticide, liquid, flammable, poisonous	L-GT*/LTe4/LF2	3024
Coumarin derivative pesticide, liquid, poisonous	LTe4/L-GT*	3026
Coumarin derivative pesticide, liquid, poisonous, flammable	L-GT*/LTe4/LF*	3025
Coumarin derivative pesticide, solid, poisonous	LTe4/SNR	3027
Creosote	LTe4/L-GT1/CMR1	
Cresols	LTe4/LNR	2076
Crotonaldehyde, inhibited	L-GT1/LF2	1143
Crotonic acid	L-GTe*/SNR	2823
Cumene	LTe3/LF1	1918
Cupriethylenediamine, solution	L-GT*	1761
Cyanide	LTW/LTe3	
Cyanide solution, n.o.s.	LTW/LTe2	1935
Cyanides, inorganic, n.o.s.	STW/LTe2	1588
Cyanogen bromide	L-GT3/LTe3	1889
Cyclobutyl chloroformate	L-GT*/LF*	2744
Cycloheptane	LTe3/LF2	2241
Cycloheptatriene	L-GT*/LF2	2603
Cycloheptene	LTe3/LF2	2242
Cyclohexane	LTe3/LF2	1145
Cyclohexanethiol	LTe2/LF1	3054
Cyclohexanone	LTe2/LF1	1915
Cyclohexene	LTe3/LF2	2256
Cyclohexenyltrichlorosilane	L-GT*/LTe2	1762
Cyclohexyl acetate	LTe2/LF1	2243
Cyclohexyl isocyanate	L-GT2/LTe2/LF1	2488
Cyclohexylamine	LTe2/LF1	2357
Cyclohexyltrichlorosilane	L-GT*/LTe2	1763
Cyclooctadiene phosphines	LTe2/NR	2940
Cyclooctadienes	LTe3/LF1	2520
Cyclooctatetraene	LTe3/LF2	2358
Cyclopentane	LTe3/LF2	1146
Cyclopentanol	LTe2/LF1	2244
Cyclopentanone	LTe2/LF1	2245
Cyclopentene	LTe2/LF2	2246
Decahydronaphthalene	LTe2/LF1	1147
Diallyl ether	L-GT*/LF2	2360
Diallylamine	L-GT*/LF2	2359
Dibenzyldichlorosilane	STW/LTe2	2434
Dibromochloropropanes	L-GT*/LTe2	2872
Dibromodifluoromethane	L-GT*	1941
Dichloroacetic acid	L-GT*/LTe2	1764
Dichloroacetyl chloride	L-GT*	1765
Dichloroanilines	LTe3/SNR	1590
Dichlorodimethyl ether, symmetrical	L-GT1/LTe2/LF1	2249
Dichloroisocyanuric acid, dry	LTe2/NR	2465
Dichloroisopropyl ether	L-GT*/LTe2	2490
Dichloromethane	LTe2/LNR	1593
Dichlorophenyl isocyanates	LTe3/SNR	2250
Dichlorophenyltrichlorosilane	L-GT*/LTe2	1766
Dichloropropenes	LTe3/LF2	2047
Dicyclohexylamine	L-GT*/LTe2	2565

Substance Look-up Table

Part 2: Toxic liquids

Substance name	Hazard type (in order of relevance)	UN-nr
Dicyclohexylammonium nitrite	LTe2/NR	2687
Dicyclopentadiene	LTe3/LF1	2048
Diesel fuel	LTe3/LF1	1202
Diethyl sulfide	LTe3/LF2	2375
Diethylbenzene	LTe2/LF1	2049
Diethyldichlorosilane	L-GT*/LTe3/LF*	1767
Diethylenetriamine	LTe2/LNR	2079
Diethylthiophosphoryl chloride	L-GT*	2751
Difluorophosphoric acid, anhydrous	L-GT*	1768
Diisobutyl ketone	LTe3/LF1	1157
Diisobutylamine	L-GT*/LTe2/LF*	2361
Diisopropylamine	L-GT1/LF2	1158
Dimethyl sulphate	L-GT2	1595
Dimethyl thiophosphoryl chloride	L-GT*	2267
Dimethylcarbamoyl chloride	L-GT*	2262
Dimethylcyclohexanes	LTe3/LF2	2263
Dimethyldichlorosilane	L-GT2/LTe2/LF2	1162
Dimethyldiethoxysilane	LTe2/LF2	2380
Dimethyldioxanes	LTe3/LF2	2707
Dimethyl-N-propylamine	L-GT*/LF2	2266
Dimethylsulphate	LTe2/L-GT1	
Di-n-amylamine	L-GT*/LTe2/LF*	2841
Di-n-butylamine	LTe2/LF1	2248
Dinitroanilines	LTe3/SNR	1596
Dinitrobenzenes	LTe3/SNR	1597
Dinitro-o-cresol	LTe3/SNR	1598
Dinitrophenol, solution	LTe2/LNR	1599
Dinitrophenol, wetted with not less than 15% water	LTe2/NR	1320
Dinitrophenolates, wetted with not less than 15% water	LTe2/NR	1321
Dinitroresorcinol, wetted with not less than 15% water	LTe2/NR	1322
Dinitrotoluenes	LTe3/SNR	2038
Dinitrotoluenes, molten	LTe3/SNR	1600
Dioxane	LTe3/LF2	1165
Diphenyldichlorosilane	L-GT*/LTe2	1769
Diphenylmethyl bromide	LTe2/SNR	1770
Disinfectant, liquid, corrosive, n.o.s.	L-GT*	1903
Disinfectant, liquid, poisonous, n.o.s.	L-GT*	3142
Disinfectant, solid, poisonous, n.o.s.	LTe3/SNR	1601
Dithiocarbamate pesticide, liquid, flammable, poisonous	L-GT*/LF2	2772
Dithiocarbamate pesticide, liquid, poisonous	LTe2/LT*	3006
Dithiocarbamate pesticide, liquid, poisonous, flammable	L-GT*/LTe3/LF*	3005
Dithiocarbamate pesticide, solid, poisonous	LTe4/SNR	2771
Dodecylbenzenesulfonic acid	LTe2/LNR	2584
Dodecyltrichlorosilane	L-GT*/LTe2	1771
Dye, liquid, corrosive, n.o.s.	L-GT*/LTe2	2801
Dye, liquid, poisonous, n.o.s.	L-GT*/LTe2	1602
Dye, solid, corrosive, n.o.s.	LTe2/SNR	3147
Dye, solid, poisonous, n.o.s.	LTe2/SNR	3143
Environmentally hazardous substances, liquid, n.o.s.	LTe3/LNR	3082
Environmentally hazardous substances, solid, n.o.s.	LTe3/SNR	3077
Epibromohydrin	L-GT*/LF*	2558
Esters, n.o.s.	LTe2/LF2	3272
Ethanolamine	L-GT*	2491
Ethyl amyl ketone	LTe2/LF1	2271
Ethyl bromide	L-GT*/LTe2	1891
Ethyl bromoacetate	L-GT1/LTe2/LF1	1603
Ethyl chloroacetate	L-GT*/LF*	1181
Ethyl chloroformate	L-GT2/LF2	1182
Ethyl chlorothioformate	L-GT*/LF*	2826

Substance Look-up Table

Part 2: Toxic liquids

Substance name	Hazard type (in order of relevance)	UN-nr
Ethyl isocyanate	L-GT4/LTe2/LF2	2481
Ethyl nitrite, solution	L-GT*/LF2	1194
Ethyl phosphonothioic dichloride, anhydrous	L-GT*/LTe2	2927
Ethylamine, aqueous solution, with not less than 50% but not more than 70% Ethylamine	L-GT*/LF2	2270
Ethyldichlorosilane	L-GT*/LTe2/LF2	1183
Ethyldichloroarsine (ED)	L-GT2	1892
Ethylene dibromide	LTe2/LNR	1605
Ethylene dibromide and Methyl bromide mixture, liquid	L-GT*	1647
Ethylene oxide and Propylene oxide mixture, with not more than 30% Ethylene oxide	L-GT*/LF2	2983
Ethyleneimine, inhibited	L-GT3/LF2	1185
Ethylphenyldichlorosilane	L-GT*/LTe2	2435
Ethyltrichlorosilane	L-GT1/LTe2/LF2	1196
Flammable liquid, corrosive, n.o.s	L-GT1/LF2	2924
Flammable liquid, poisonous, corrosive, n.o.s.	L-GT*/LF2	3286
Flammable liquid, poisonous, n.o.s.	L-GT1/LF1	1992
Flammable liquid, poisonous, n.o.s.	L-GT1/LF2	1992
Flammable solid, poisonous, inorganic, n.o.s.	LTe2/NR	3179
Flammable solid, poisonous, n.o.s.	LTe2/NR	2926
Fluoboric acid	L-GT1	1775
Fluoroanilines	LTe2/LNR	2941
Fluorobenzene	LTe3/LF2	2387
Fluorophosphoric acid, anhydrous	L-GT*	1776
Fluorosilicic acid	L-GT*	1778
Fluorosulfonic acid	LTe3/PB1/L-GT*	1777
Fluorotoluenes	LTe3/LF2	2388
Formaldehyde, solution, flammable	LTe2/LF1	1198
Formaldehyde, solutions (Formalin) (corrosive)	L-GT1/LNR	2209
Fuel (gasoline, diesel, kerosine)	LTe1/LP	
Fuel (aviation, turbine engine)	LTe2/LF2	1863
Fumaryl chloride	LTe2/LNR	1780
Furan	LTe3/LF2	2389
Furfurylamine	L-GT*/LF*	2526
Glycerol alpha-monochlorohydrin	L-GT*	2689
Glycidaldehyde	L-GT*/LF2	2622
Heptanes	LTe3/LF2	1206
Hexachloroacetone	L-GT*/LTe2	2661
Hexachlorobutadiene	LTe3/LNR	2279
Hexachlorocyclopentadiene	LTe3/L-GT2	2646
Hexachlorophene	LTe3/SNR	2875
Hexadecyltrichlorosilane	L-GT*/LTe2	1781
Hexadiene	LTe3/LF2	2458
Hexaethyl tetraphosphate	L-GT*	1611
Hexafluoroacetone hydrate	LTe3/SNR	2552
Hexafluorophosphoric acid	LTe3/SNR	1782
Hexaldehyde	LTe2/LF1	1207
Hexamethylene diisocyanate	LTe2/LNR	2281
Hexamethylenediamine, solid	LTe2/SNR	2280
Hexamethylenediamine, solution	LTe2/LNR	1783
Hexamethyleneimine	L-GT*/LF2	2493
Hexamethylenetetramine	LTe2/NR	1328
Hexanes	LTe2/LF2	1208
Hexanols	LTe2/LF1	2282
Hexyltrichlorosilane	L-GT*/LTe2	1784
Hydrazine	LTe3/L-GT3	
Hydrazine, anhydrous	LTe3/LF1/L-GT2	2029
Hydrazine, aqueous solution, with more than 37% Hydrazine	L-GT*/LTe2/LF*	2030
Hydrazine, aqueous solution, with not more than 37% Hydrazine	L-GT*/LTe2	3293
Hydrocarbons, liquid, n.o.s.	LTe2/LF2	3295

Substance Look-up Table

Part 2: Toxic liquids

Substance name	Hazard type (in order of relevance)	UN-nr
5% Hydrogen cyanide	L-GT3/LF2	1613
Hydrofluoric acid	LTe4/L-GT*	1790
Hydrofluoric acid	LTe4/L-GT3	1790
Hydrofluoric acid and sulfuric acid mixture	L-GT3	1786
Hydrogen cyanide (AC)	L-GT4/LF2	1051
Hydrogen cyanide, anhydrous, stabilized (absorbed)	L-GT4/LTe3/LF2	1614
Hydrogen cyanide, solution in alcohol, with not more than 45% Hydrogen cyanide	L-GT3/LTe3/LF2	3294
Hydrogen fluoride, anhydrous	L-GT3	1052
Hydrogen peroxide, aqueous solution, stabilized, with more than 60% Hydrogen peroxide	LTe2/NR	2015
Hydroquinone	LTe2/SNR	2662
Hypochlorites, inorganic, n.o.s.	LTe2/NR	3212
Iodine monochloride	L-GT*	1792
Iodine pentafluoride	L-GT1	2495
Iodomethylpropanes	LTe2/LF2	2391
Iron pentacarbonyl	L-GT1/LF2	1994
Isobutanol	LTe2/LF1	1212
Isobutyl isocyanate	L-GT3/LTe2/LF2	2486
Isobutyl methacrylate	LTe3/LF1	2283
Isobutylamine	L-GT1/LF2	1214
Isobutyric anhydride	L-GT*/LTe2/LF*	2530
Isobutyryl chloride	LTe2/LF2	2395
Isocyanate solution, flammable, poisonous, n.o.s.	L-GT*/LTe3/LF*	2478
Isocyanate solution, flammable, poisonous, n.o.s.	L-GT*/LTe3/LF2	2478
Isocyanate solution, poisonous, flammable, n.o.s.	L-GT*/LTe3/LF*	3080
Isocyanate solution, poisonous, n.o.s.	L-GT*/LTe3	2206
Isocyanatobenzotrifluorides	L-GT*/LF*	2285
Isoheptenes	LTe2/LF2	2287
Isohexenes	LTe2/LF2	2288
Isooctane	LTe2/LF2	1262
Isopentane	LTe2/LF2	1265
Isopentenes	LTe2/LF2	2371
Isophoron diisocyanaat (IPDI)	L-GT*	2290
Isophoronediamine	L-GT*	2289
Isopropanol	LTe1/LF2	1219
Isopropenylbenzene	LTe2/LF1	2303
Isopropyl 2-chloropropionate	LTe2/LF1	2934
Isopropyl chloroacetate	LTe2/LF1	2947
Isopropyl isocyanate	L-GT*/LTe3/LF2	2483
Isopropylamine	L-GT2	
Isopropylamine	L-GT2/LF2	1221
Kerosene	LTe2/LF1	1223
Kerosine	LTe1/PB1,5	
Ketones, liquid, n.o.s.	LTe2/LF1	1224
Lead acetate	LTe3/SNR	1616
Lead arsenates	LTe3/SNR	1617
Lead arsenites	LTe3/SNR	1618
Lead compound, soluble, n.o.s.	LTe3/SNR	2291
Lead cyanide	LTe3/STW	1620
Lead nitrate	LTe2/NR	1469
Lead perchlorate	LTe2/NR	1470
Lead phosphite, dibasic	LTe2/NR	2989
Lead sulfate, with more than 3% free acid	LTe2/SNR	1794
Maneb	LTe4/NR	2210
Maneb, stabilized	LTe4/NR	2968
Medicine, liquid, flammable, poisonous, n.o.s.	L-GT*/LTe3/LF2	3248
Medicine, liquid, flammable, poisonous, n.o.s.	LTe3/LF1	3248
Medicine, liquid, poisonous, n.o.s.	LTe3/NR	1851
Medicine, solid, poisonous, n.o.s.	LTe3/NR	3249

Substance Look-up Table

Part 2: Toxic liquids

Substance name	Hazard type (in order of relevance)	UN-nr
Mercaptan mixture, liquid, flammable, poisonous, n.o.s.	L-GT*/LF2	1228
Mercaptan mixture, liquid, poisonous, flammable, n.o.s.	L-GT*/LF*	3071
Mercuric bromide	LTe4/SNR	1634
Mercuric chloride	LTe4/SNR	1624
Mercuric cyanide	LTe3/STW	1636
Mercuric nitrate	LTe4/SNR	1625
Mercuric oxycyanide	LTe3/STW	1642
Mercuric potassium cyanide	LTe3/STW	1626
Mercuric sulfate	LTe4/SNR	1645
Mercurous nitrate	LTe4/SNR	1627
Mercury acetate	LTe4/SNR	1629
Mercury ammonium chloride	LTe4/SNR	1630
Mercury based pesticide, liquid, flammable, poisonous	L-GT*/LTe4/LF2	2778
Mercury based pesticide, liquid, poisonous	LTe4/L-GT*	3012
Mercury based pesticide, liquid, poisonous, flammable	L-GT*/LTe4/LF*	3011
Mercury based pesticide, solid, poisonous	LTe4/SNR	2777
Mercury benzoate	LTe4/SNR	1631
Mercury compound, liquid, n.o.s.	LTe4/CMR1/L-GT*	2024
Mercury compound, solid, n.o.s.	LTe4/SNR	2025
Mercury gluconate	LTe4/SNR	1637
Mercury iodide	LTe4/SNR	1638
Mercury nucleate	LTe4/SNR	1639
Mercury oleate	LTe4/SNR	1640
Mercury oxide	LTe4/SNR	1641
Mercury potassium iodide	LTe4/SNR	1643
Mercury salicylate	LTe4/SNR	1644
Mercury thiocyanate	LTe4/SNR	1646
Metal salts of organic compounds, flammable, n.o.s.	LTe3/NR	3181
Methacrylaldehyde	L-GT2/LF2	2396
Methacrylic acid, inhibited	LTe2/LNR	2531
Methacrylonitrile, inhibited	L-GT*/LF2	3079
Methanol	LTe1/L-GT2/LF2/CMR1	1230
Methoxymethyl isocyanate	L-GT*/LF2	2605
Methyl bromoacetate	L-GT*	2643
Methyl chloroacetate	L-GT*/LF*	2295
Methyl chloroformate	L-GT3/LF2	1238
Methyl chloromethyl ether	L-GT3/LF2	1239
Methyl dichloroacetate	L-GT*	2299
Methyl iodide	L-GT2	2644
Methyl isocyanate	L-GT4/LTe2/LF2	2480
Methyl isothiocyanate	L-GT*/LF*	2477
Methyl orthosilicate	L-GT1/LF2	2606
Methyl trichloroacetate	L-GT*	2533
Methylallyl chloride	LTe2/LF2	2554
Methylcyclohexane	LTe2/LF2	2296
Methylcyclopentane	LTe2/LF2	2298
Methyldichlorosilane	L-GT3/LTe2/LF2	1242
Methylhydrazine	L-GT2/LTE2/LF2	1244
Methylpentadiene	LTe2/LF2	2461
Methylphenyldichlorosilane	L-GT*/LTe2	2437
Methyltetrahydrofuran	LTe2/LF2	2536
Methyltrichlorosilane	L-GT2/LTE2/LF2	1250
Molybdenum pentachloride	LTe4/SNR	2508
Mononitrotoluidines	STe2/SNR	2660
Monopropylamine	L-GT2/LF2	1277
Motor fuel anti-knock mixture	LTe3/L-GT1	1649
N,n-Butylimidazole	STe2/SNR	2690
N-Aminoethylpiperazine	L-GT*	2815
Naphtalene	L-TG3/PB1,5*/STe2	
Naphthalene, crude	LTe2/NR	1334

Substance Look-up Table

Part 2: Toxic liquids

Substance name	Hazard type (in order of relevance)	UN-nr
Naphthalene, molten	LTe2/NR	2304
Naphthylthiourea	L-GT*	1651
n-Butyl chloroformate	L-GT*/LF*	2743
n-Butyl isocyanate	L-GT1/LTe2/LF2	2485
n-Butylamine	L-GT1/LF2	1125
n-Decane	LTe2/LF1	2247
n-Heptaldehyde	LTe2/LF1	3056
Nickel carbonyl	L-GT4/LF2	1259
Nickel cyanide	LTe3/STW	1653
Nickel nitrate	LTe2/NR	2725
Nickel nitrite	LTe2/NR	2726
Nicotine	LTe3/NR	1654
Nicotine compound, liquid, n.o.s.	LTe3/NR	3144
Nicotine compound, solid, n.o.s.	LTe3/NR	1655
Nicotine hydrochloride	LTe3/NR	1656
Nicotine salicylate	LTe3/NR	1657
Nicotine sulfate, solid	LTe3/NR	1658
Nicotine tartrate	LTe3/NR	1659
Nitrating acid mixture	L-GT1	1796
Nitrating acid mixture	L-GT2	1796
Nitrating acid mixture, spent	L-GT2/L-GT1	1826
Nitric acid, fuming	L-GT2	2032
Nitric acid, other than red fuming	L-GT2	2031
Nitriles, flammable, poisonous, n.o.s.	LTe3/LF2	3273
Nitriles, poisonous, flammable, n.o.s.	L-GT*/LTe3/LF*	3275
Nitriles, poisonous, liquid, n.o.s.	LTe3/LNR	3276
Nitrites, inorganic, aqueous solution, n.o.s.	LTe3/NR	3219
Nitroanilines	STe2/SNR	1661
Nitroanisoles	LTe2/LNR	2730
Nitrobenzene	LTe2/LNR	1662
Nitrobenzenesulfonic acid	STe2/SNR	2305
Nitrobenzotrifluorides	STe2/SNR	2306
Nitrobromobenzenes	STe2/SNR	2732
Nitrocresols	STe2/SNR	2446
Nitronaphthalene	LTe2/NR	2538
Nitrophenols	STe2/SNR	1663
Nitrotoluenes	LTe2/LNR	1664
Nitroxylenes	LTe2/LNR	1665
N-Methylaniline	LTe2/LNR	2294
N-Methylbutylamine	L-GT*/LF2	2945
Nonanes	LTe2/LF1	1920
Nonyltrichlorosilane	STW/STe2	1799
n-Propyl chloroformate	L-GT*/LF*	2740
n-Propyl isocyanate	L-GT*/LF2	2482
Octadecyltrichlorosilane	STW/STe2	1800
Octyltrichlorosilane	STW/STe2	1801
o-Dichlorobenzene	LTe2/LNR	1591
Oil and solvents	LTe1/LF2/PB1,5	
Organic peroxide	LTe3/E/L-GT2/CMR1	
Organic peroxide type B, liquid	LTe3/NR	3101
Organic peroxide type B, liquid, temperature controlled	LTe3/NR	3111
Organic peroxide type B, solid	LTe3/NR	3102
Organic peroxide type B, solid, temperature controlled	LTe3/NR	3112
Organic peroxide type C, liquid	LTe3/NR	3103
Organic peroxide type C, liquid, temperature controlled	LTe3/NR	3113
Organic peroxide type C, solid	LTe3/NR	3104
Organic peroxide type C, solid, temperature controlled	LTe3/NR	3114
Organic peroxide type D, liquid	LTe3/NR	3105
Organic peroxide type D, liquid, temperature controlled	LTe3/NR	3115
Organic peroxide type D, solid	LTe3/NR	3106

Substance Look-up Table

Part 2: Toxic liquids

Substance name	Hazard type (in order of relevance)	UN-nr
Organic peroxide type D, solid, temperature controlled	LTe3/NR	3116
Organic peroxide type E, liquid	LTe3/NR	3107
Organic peroxide type E, liquid, temperature controlled	LTe3/NR	3117
Organic peroxide type E, solid	LTe3/NR	3108
Organic peroxide type E, solid, temperature controlled	LTe3/NR	3118
Organic peroxide type F, liquid	LTe3/NR	3109
Organic peroxide type F, liquid, temperature controlled	LTe3/NR	3119
Organic peroxide type F, solid	LTe3/NR	3110
Organic peroxide type F, solid, temperature controlled	LTe3/NR	3120
Organochlorine pesticide (DDT, Lindane, Endosulfan, Dieldrin, HCB, etc)	LTe4/cmr	
Organochlorine pesticide, liquid, flammable, poisonous	L-GT*/LTe4/LF2	2762
Organochlorine pesticide, liquid, poisonous	LTe4/L-GT*	2996
Organochlorine pesticide, solid, poisonous	LTe4/SNR	2761
Organophosphorus compound, poisonous, flammable, n.o.s.	L-GT*/LF2	3279
Organophosphorus compound, poisonous, liquid, n.o.s.	L-GT*	3278
Organophosphorus pesticide, liquid, flammable, poisonous	L-GT*/LF2	2784
Organophosphorus pesticide, liquid, poisonous	L-GT*	3018
Organophosphorus pesticide, liquid, poisonous, flammable	L-GT*/LF*	3017
Organotin compound, solid, n.o.s.	LTe4/SNR	3146
Organotin compound/pesticide	LTe4/LP	
Organotin pesticide, liquid, flammable, poisonous	L-GT*/LTe4/LF2	2787
Organotin pesticide, liquid, poisonous	LTe4/L-GT*	3020
Organotin pesticide, liquid, poisonous, flammable	L-GT*/LTe4/LF*	3019
Organotin pesticide, solid, poisonous	LTe4/SNR	2786
Paint (flammable)	LTe2/LF2	1263
Pentamethylheptane	LTe2/LF1	2286
Pentan-2,4-dione	LTe2/LF1	2310
Perchloromethyl mercaptan	L-GT1/LTe2	1670
Permanganates, inorganic, aqueous solution, n.o.s.	LTe3/NR	3214
Permanganates, inorganic, n.o.s.	LTe3/NR	1482
Pesticide, liquid, flammable, poisonous, n.o.s.	L-GT*/LTe4/LF2	3021
Pesticide, liquid, poisonous, flammable, n.o.s.	L-GT*/LTe4/LF*	2903
Pesticide, liquid, poisonous, n.o.s.	LTe4/L-GT*	2902
Pesticide, solid, poisonous	LTe4/SNR	2588
Petroleum crude oil	LTe2/LF2	1267
Petroleum distillates, n.o.s.	LTe2/LF2	1268
Phenol solution	LTe2/LNR	2821
Phenolates, liquid	LTe2/LNR	2904
Phenolic resin	LTe3/L-GT2/CMR0,5	
Phenolsulfonic acid, liquid	LTe2/LNR	1803
Phenoxyacetic acid derivative pesticide, liquid, flammable, poisonous	L-GT*/LTe2/LF*	3346
Phenoxyacetic acid derivative pesticide, liquid, poisonous	LTe2/L-GT*	3348
Phenoxyacetic acid derivative pesticide, liquid, poisonous, flammable	L-GT*/LTe2/LF*	3347
Phenoxyacetic acid derivative pesticide, solid, poisonous	STe2/SNR	3345
Phenyl chloroformate	L-GT*	2746
Phenyl isocyanate	L-GT*/LTe2/LF*	2487
Phenyl mercaptan	L-GT1/LTe2/LF1	2337
Phenylacetonitrile, liquid	LTe2/LNR	2470
Phenylacetyl chloride	L-GT*	2577
Phenylcarbylamine chloride	L-GT2/LTe2	1672
Phenylhydrazine	LTe2/LNR	2572
Phenylmercuric acetate	LTe4/SNR	1674
Phenylmercuric compound, n.o.s.	LTe4/SNR	2026
Phenylmercuric hydroxide	LTe4/SNR	1894
Phenylmercuric nitrate	LTe4/SNR	1895
Phenyltrichlorosilane	LTe2/LNR	1804
Phosphorus oxybromide, molten	L-GT*	2576
Phosphorus oxychloride	L-GT1	1810
Phosphorus trichloride	L-GT2	1809

Substance Look-up Table

Part 2: Toxic liquids

Substance name	Hazard type (in order of relevance)	UN-nr
p-Nitrosodimethylaniline	LTe2/NR	1369
Poisonous liquid, corrosive, inorganic, n.o.s.	L-GT*/LTe*	3289
Poisonous liquid, flammable, n.o.s.	L-GT*/LTe*/LF2	2929
Poisonous liquid, inorganic, n.o.s.	L-GT*/LTe*	3287
Poisonous liquid, oxidizing, n.o.s.	L-GT*/LTe*	3122
Poisonous liquid, water-reactive, n.o.s.	L-GT*/LTe*	3123
Poisonous solid, corrosive, inorganic, n.o.s.	LTe3/SNR	3290
Poisonous solid, corrosive, n.o.s.	LTe3/SNR	2928
Poisonous solid, flammable, n.o.s.	LTe3/SNR	2930
Poisonous solid, inorganic, n.o.s.	LTe3/SNR	3288
Poisonous solid, oxidizing, n.o.s.	LTe3/SNR	3086
Poisonous solid, water-reactive, n.o.s.	STe2/SFW	3125
Polychlorinated biphenyls	LTe4/LNR	2315
Polyhalogenated biphenyls, liquid	LTe4/NR	3151
Polyhalogenated biphenyls, solid	LTe4/SNR	3152
Potassium arsenate	LTe3/SNR	1677
Potassium arsenite	LTe3/SNR	1678
Potassium cuprocyanide	STW/LTe3	1679
Potassium cyanide	STW/LTe3	1680
Potassium metavanadate	LTe3/SNR	2864
Propionitrile	L-GT*/LF2	2404
Propionyl chloride	L-GT2/LF2	1815
Propylene chlorohydrin	L-GT*/LF*	2611
Propyleneimine, inhibited	L-GT2/LF2	1921
Propyltrichlorosilane	L-GT1/LTe2/LF1	1816
Pyrethroid pesticide, liquid, flammable, poisonous	L-GT*/LTe4/LF2	3350
Pyrethroid pesticide, liquid, poisonous	LTe4/L-GT*	3352
Pyrethroid pesticide, liquid, poisonous, flammable	L-GT*/LTe4/LF*	3351
Pyrethroid pesticide, solid, poisonous	LTe4/SNR	3349
Pyridine	LTe3/LF2	1282
Pyrosulfuryl chloride	L-GT*	1817
Quinoline	LTe3/LNR	2656
Sec-Butyl chloroformate	L-GT*/LF*	2742
Selenium oxychloride	L-GT*	2879
Shale oil	LTe2/LF2	1288
Silver arsenite	LTe3/SNR	1683
Silver cyanide	STW/LTe3	1684
Silver nitrate	LTe3/NR	1493
Sodium ammonium vanadate	LTe3/SNR	2863
Sodium arsanilate	LTe3/SNR	2473
Sodium arsenate	LTe3/SNR	1685
Sodium arsenite, aqueous solution	L-GT*/LTe3	1686
Sodium arsenite, solid	LTe3/SNR	2027
Sodium azide	LTW/LTe2	1687
Sodium cuprocyanide, solid	STW/LTe3	2316
Sodium cuprocyanide, solution	LTW/LTe2	2317
Sodium cyanide	STW/LTe3	1689
Sodium hydrosulfide, with not less than 25% water of crystallization	L-GT*	2949
Sodium nitrate	LTe1/NR	1498
Solvents	LTe2/PB1/CMR1	
Stannic chloride, anhydrous	L-GT1/LTe3	1827
Stannic chloride, pentahydrate	LTe3/SNR	2440
Stannic phosphides	LTe3/NR	1433
Styrene monomer, inhibited	LTe2/LF1	2055
Substances, which in contact with water emit flammable gases, liquid, corrosive, n.o.s.	LTe2/NR	3129
Substances, which in contact with water emit flammable gases, liquid, n.o.s.	LTe2/NR	3148
Substances, which in contact with water emit flammable gases, liquid, poisonous, n.o.s.	LTe2/NR	3130

Substance Look-up Table

Part 2: Toxic liquids

Substance name	Hazard type (in order of relevance)	UN-nr
Substances, which in contact with water emit flammable gases, solid, n.o.s.	LTe2/NR	2813
Substances, which in contact with water emit flammable gases, solid, corrosive, n.o.s.	LTe2/NR	3131
Substances, which in contact with water emit flammable gases, solid, flammable, n.o.s.	LTe2/NR	3132
Substances, which in contact with water emit flammable gases, solid, oxidizing, n.o.s.	LTe2/NR	3133
Substances, which in contact with water emit flammable gases, solid, poisonous, n.o.s.	LTe2/NR	3134
Substituted nitrophenol pesticide, liquid, flammable, poisonous	L-GT*/LF2	2780
Substituted nitrophenol pesticide, liquid, poisonous	LTe3/LT*	3014
Substituted nitrophenol pesticide, liquid, poisonous, flammable	L-GT*/LTe3/LF*	3013
Substituted nitrophenol pesticide, solid, poisonous	LTe3/SNR	2779
Sulfur chlorides	L-GT*	1828
Sulfur trioxide	L-GT3	1829
Sulfuric acid	LTe2/LNR	1830
Sulfuryl chloride	L-GT1	1834
Tear gas devices	L-GT*	1693
Terpene hydrocarbons, n.o.s.	LTe2/LF1	2319
Tert-Butyl isocyanate	L-GT*/LF2	2484
Tert-Butylcyclohexyl chloroformate	L-GT*	2747
Tetrachloroethane	LTe2/LNR	1702
Tetrachloroethylene	LTe2/LNR	1897
Tetraethyl dithiopyrophosphate	L-GT*	1704
Tetrahydrofurfurylamine	LTe2/LF1	2943
Tetramethylsilane	LTe2/LF2	2749
Tetranitromethane	LTe2/NR	1510
Thioglycol	L-GT*	2966
Thiolactic acid	L-GT*	2936
Thionyl chloride	L-GT*	1836
Thiophosgene	L-GT*	2474
Thiophosphoryl chloride	L-GT*	1837
Titanium tetrachloride	L-GT*	1838
Toluene	LTe3/LF2	1294
Toluene diisocyanate	LTe2/L-GT1/PB0,5	2078
Toluidines	LTe2/LNR	1708
Triallylamine	L-GT*/LF*	2610
Triazine pesticide, liquid, flammable, poisonous	L-GT*/LTe3/LF2	2764
Triazine pesticide, liquid, poisonous	LTe3/LT*	2998
Triazine pesticide, liquid, poisonous, flammable	L-GT*/LTe3/LF*	2997
Triazine pesticide, solid, poisonous	LTe3/SNR	2763
Trichloroacetic acid, solution	LTe2/LF1	2564
Trichloroacetyl chloride	L-GT1	2442
Trichlorobenzenes	LTe2/LT*/CMR0,5/PB0,5	
Trichlorobenzenes, liquid	LTe2/LT*/CMR0,5/PB0,5	2321
Trichlorobutene	L-GT*	2322
Trichloroethanes	LTe2/L-GT1	
Trichloroethylene	LTe2/LNR	1710
Trichlorosilane	L-GT2/LTE2/LF2	1295
Tricresyl phosphate	L-GT*	2574
Trifluoroacetic acid	L-GT*	2699
Trimethylacetyl chloride	L-GT*/LTe2/LF*	2438
Trimethylamine, aqueous solution	L-GT2/LF2	1297
Trimethylchlorosilane	L-GT1/LTe2/LF2	1298
Trimethylcyclohexylamine	L-GT*	2326
Trimethylhexamethylene diisocyanate	L-GT*/LTe2	2328
Trimethylhexamethylenediamines	L-GT*/LTe2	2327
Tripropylamine	LTe2/LF1	2260
Turpentine	LTe2/LF1	1299

Substance Look-up Table

Part 2: Toxic liquids

Substance name	Hazard type (in order of relevance)	UN-nr
Turpentine substitute	LTe2/LF2	1300
Valeryl chloride	L-GT*/LF*	2502
Vanadium compound, n.o.s.	LTe3/SNR	3285
Vanadium oxytrichloride	L-GT*/LTe2	2443
Vanadium pentoxide	LTe3/SNR	2862
Vanadium tetrachloride	L-GT*/LTe2	2444
Vanadium trichloride	LTe3/SNR	2475
Vinyl chloroacetate	L-GT*/LTe2/LF*	2589
Vinylidene chloride, inhibited	LTe2/LF2	1303
Vinylpyridines, inhibited	L-GT*/LTe2/LF*	3073
Vinyltoluenes, inhibited	LTe2/LF1	2618
Vinyltrichlorosilane	L-GT2/LTE2/LF2	1305
Wood preservatives, liquid	LTe3/LF2	1306
Xylenes	LTe3/LF2	1307
Xylidines	LTe2/LNR	1711
Xylyl bromide	L-GT*/LTe2	1701
Zinc ammonium nitrite	LTe3/NR	1512
Zinc ashes	LTe3/NR	1435
Zinc bromate	LTe3/NR	2469
Zinc chlorate	LTe3/NR	1513
Zinc chloride, anhydrous	LTe3/SNR	2331
Zinc chloride, solution	LTe2/LNR	1840
Zinc cyanide	STW/LTe3	1713
Zinc dust	LTe3/NR	1436
Zinc nitrate	LTe3/NR	1514
Zinc permanganate	LTe3/NR	1515
Zinc peroxide	LTe3/NR	1516
Zinc phosphide	LTe3/NR	1714
Zinc resinate	LTe3/NR	2714

Substance Look-up Table

Part 3: Substances with persistent and bioaccumulating or carcinogenic, mutagenic and reprotoxic properties

Substance name	Hazard type (in order of relevance)	UN-nr
Aniline	CMR2/LTe2/LNR	1547
Arsenic	PB2/CMR2/STe3	1558
Arsenic compound, solid, n.o.s.	PB2/CMR2/STe3	1557
Arsenic chloride	PB2/CMR2/LTe2/L-GT*	1560
Arsenic compound, liquid, n.o.s.	PB2/CMR2/LTe2/L-GT*	1556
Arsenical pesticide, solid, poisonous	PB2/CMR2/STe4	2759
Asbestos	CMR2/PB2	2212
Asbestos, white	CMR2/PB2	2590
Benzene	CMR2/LTe2/LF2	1114
Brominated hydrocarbons	PB/LP/LTe3	
Chlorinated hydrocarbons	PB/LP/LTe3	
Chloroprene	CMR2/LTe1	
Dibromomethane	PB2/CMR1/LTe3/L-GT*	2664
Dioxine particlus in smoke	CMR2/PB2	
Heavy metal containing solutions/pesticides (Hg, Cr, As, Cd, Cu, Pb, Zn, etc)	PB/LP	
Hexachlorobenzene	PB2/CMR2/L-GT*/LTe2	2729
Mercury	PB2/CMR1/LTe4/L-GT*	2809
Organotin compound, liquid, n.o.s.	PB2/CMR1/LTe4/L-GT*	2788
Pentachloroethane	CMR2/PB0,5/LTe2/L-GT2	1669
Pentachlorophenol	CMR2/PB0,5/STe3/L-GT*	3155
Tetrabromoethane	PB2/CMR1/LTe4/L-GT*	2504

Substance Look-up Table

Part 4: Substances, not rated

Substance name	Hazard type (in order of relevance)	UN-nr
1,2-Dichloro-1,1,2,2-tetrafluoroethane	GNR	1958
1-Aziridinyl phosphine oxide (Tris)	LNR	2501
1-Chloro-1,2,2,2-tetrafluoroethane	GNR	1021
1-Chloro-2,2,2-trifluoroethane	GNR	1983
2-(2-Aminoethoxy)ethanol	LNR	3055
2-Amino-4,6-dinitrophenol, wetted with not less than 20% water	NR	3317
2-Amino-5-diethylaminopentane	LNR	2946
2-Bromo-2-nitropropane-1,3-diol	NR	3241
2-Dimethylaminoethyl methacrylate	LNR	2522
2-Methyl-5-ethylpyridine	LNR	2300
2-Trifluoromethylaniline	LNR	2942
5-tert-Butyl-2,4,6-trinitro-m-xylene	NR	2956
Accumulators, pressurized, pneumatic or hydraulic	GNR	1956
Acetaldehyde ammonia	SNR	1841
Acetic acid, solution, more than 10% but not more than 80% acid	LNR	2790
Acetone cyanohydrin, stabilized	LNR	1541
Acid butyl phosphate	LNR	1718
Acid, sludge	LNR	1906
Adamsite	SNR	1698
Adiponitrile	LNR	2205
Aerosol dispensers	NR	1950
Air bag inflators	NR	3268
Air bag inflators, compressed gas	NR	3353
Air, compressed	GNR	1002
Air, refrigerated liquid (cryogenic liquid)	GNR	1003
Aldol	LNR	2839
Alkali metal alcoholates, self-heating, corrosive, n.o.s.	NR	3206
Alkali metal alloy, liquid, n.o.s.	NR	1421
Alkali metal amalgam	NR	1389
Alkali metal amides	NR	1390
Alkali metal dispersion	NR	1391
Alkaline earth metal alcoholates, n.o.s.	NR	3205
Alkaline earth metal alloy, n.o.s.	NR	1393
Alkaline earth metal amalgam	NR	1392
Alkaloids, liquid, n.o.s. (poisonous)	NR	3140
Alkaloids, solid, n.o.s. (poisonous)	NR	1544
Alkyl sulfonic acids, liquid, with not more than 5% free Sulfuric acid	LNR	2586
Alkyl sulfonic acids, solid, with more than 5% free Sulfuric acid	SNR	2583
Alkyl sulfonic acids, solid, with not more than 5% free Sulfuric acid	SNR	2585
Alpha-Methylbenzyl alcohol	SNR	2937
Aluminum alkyl halides	NR	3052
Aluminum alkyl hydrides	NR	3076
Aluminum alkyls	NR	3051
Aluminum borohydride	NR	2870
Aluminum bromide, anhydrous	SNR	1725
Aluminum bromide, solution	LNR	2580
Aluminum carbide	NR	1394
Aluminum chloride, anhydrous	SNR	1726
Aluminum chloride, solution	LNR	2581
Aluminum dross	NR	3170
Aluminum ferrosilicon powder	NR	1395
Aluminum hydride	NR	2463
Aluminum nitrate	NR	1438
Aluminum phosphide	NR	1397
Aluminum powder, coated	NR	1309
Aluminum powder, pyrophoric	NR	1383
Aluminum powder, uncoated	NR	1396
Aluminum resinate	NR	2715
Aluminum silicon powder, uncoated	NR	1398
Aminophenols	LNR	2512

Substance Look-up Table

Part 4: Substances, not rated

Substance name	Hazard type (in order of relevance)	UN-nr
Ammonium bifluoride, solid	SNR	1727
Ammonium fluoride	SNR	2505
Ammonium fluorosilicate	SNR	2854
Ammonium hydrogen sulfate	SNR	2506
Ammonium nitrate fertilizer, n.o.s.	NR	2072
Ammonium nitrate fertilizer, with not more than 0.4% combustible material	SNR	2071
Ammonium nitrate fertilizers, with Calcium carbonate	NR	2068
Ammonium nitrate fertilizers, with Phosphate or Potash	NR	2070
Ammonium nitrate, liquid (hot concentrated solution)	NR	2426
Ammonium nitrate, with not more than 0.2% combustible substances	NR	1942
Ammunition, poisonous, non-explosive	NR	2016
Ammunition, tear-producing, non-explosive	NR	2017
Amyl acid phosphate	SNR	2819
Anisidines	LNR	2431
Antimony powder	SNR	2871
Antimony trichloride	SNR	1733
Argon	GNR	1006
Argon, refrigerated liquid (cryogenic liquid)	GNR	1951
Articles, pressurized, hydraulic (containing non-flammable gas)	NR	3164
Barium	NR	1400
Barium alloys, pyrophoric	NR	1854
Barium azide, wetted with not less than 50% water	NR	1571
Barium bromate	NR	2719
Barium chlorate	NR	1445
Barium compound, n.o.s.	SNR	1564
Barium hypochlorite, with more than 22% available Chlorine	NR	2741
Barium nitrate	NR	1446
Barium oxide	SNR	1884
Barium perchlorate	NR	1447
Barium permanganate	NR	1448
Barium peroxide	NR	1449
Batteries, containing Sodium	NR	3292
Batteries, dry, containing Potassium hydroxide solid	NR	3028
Batteries, wet, filled with acid	NR	2794
Batteries, wet, filled with alkali	NR	2795
Batteries, wet, non-spillable	NR	2800
Battery fluid, acid	LNR	2796
Battery fluid, alkali	LNR	2797
Battery-powered equipment (wet battery)	NR	3171
Benzaldehyde	LNR	1990
Benzenesulfonyl chloride	LNR	2225
Benzidine	SNR	1885
beta-Naphthylamine	SNR	1650
Bisulfates, aqueous solution	LNR	2837
Bisulfites, aqueous solution, n.o.s.	LNR	2693
Bombs, smoke, non-explosive, with corrosive liquid, without initiating device	NR	2028
Borate and Chlorate mixtures	NR	1458
Borneol	NR	1312
Bromochlorodifluoromethane	GNR	1974
Bromotrifluoromethane	GNR	1009
Brucine	NR	1570
Butyric acid	LNR	2820
Caesium	NR	1407
Caesium hydroxide	SNR	2682
Caesium hydroxide, solution	LNR	2681
Caesium nitrate	NR	1451
Calcium	NR	1401
Calcium arsenate	SNR	1573

Substance Look-up Table

Part 4: Substances, not rated

Substance name	Hazard type (in order of relevance)	UN-nr
Calcium arsenate and Calcium arsenite mixture, solid	SNR	1574
Calcium carbide	NR	1402
Calcium chlorate	NR	1452
Calcium chlorate, aqueous solution	NR	2429
Calcium chlorite	NR	1453
Calcium cyanamide, with more than 0.1% Calcium carbide	NR	1403
Calcium dithionite	NR	1923
Calcium hydride	NR	1404
Calcium hypochlorite, dry	NR	1748
Calcium hypochlorite, hydrated, with not less than 5.5% but not more than 16% water	NR	2880
Calcium manganese silicon	NR	2844
Calcium nitrate	NR	1454
Calcium oxide	SNR	1910
Calcium perchlorate	NR	1455
Calcium permanganate	NR	1456
Calcium peroxide	NR	1457
Calcium phosphide	NR	1360
Calcium resinate	NR	1313
Calcium resinate, fused	NR	1314
Calcium silicide	NR	1405
Calcium, metal and alloys, pyrophoric	NR	1855
Caproic acid	LNR	2829
Carbon dioxide	GNR	1013
Carbon dioxide and Ethylene oxide mixtures, with not more than 6% Ethylene oxide	GNR	1952
Carbon dioxide and Nitrous oxide mixture	GNR	1015
Carbon dioxide and Oxygen mixture	GNR	1014
Carbon dioxide, refrigerated liquid	GNR	2187
Carbon dioxide, solid	SNR	1845
Carbon tetrachloride	LNR	1846
Carbon, activated	NR	1362
Carbon, animal or vegetable origin	NR	1361
Castor beans, meal, pomace or flake	NR	2969
Caustic potash, dry, solid	SNR	1813
Caustic potash, liquid	LNR	1814
Caustic soda, bead	SNR	1823
Caustic soda, solution	LNR	1824
Celluloid, in blocks, rods, rolls, sheets, tubes, etc., except scrap	NR	2000
Celluloid, scrap	NR	2002
Cerium, slabs, ingots or rods	NR	1333
Cerium, turnings or gritty powder	NR	3078
Chemical kit	NR	3316
Chemical sample, poisonous	NR	3315
Chlorate and Magnesium chloride mixture	NR	1459
Chlorates, inorganic, aqueous solution, n.o.s.	NR	3210
Chlorates, inorganic, n.o.s.	NR	1461
Chloric acid, aqueous solution, with not more than 10% Chloric acid	NR	2626
Chlorites, inorganic, n.o.s.	NR	1462
Chlorodifluoromethane	GNR	1018
Chlorodifluoromethane and Chloropentafluoroethane mixture	GNR	1973
Chloropentafluoroethane	GNR	1020
Chloroplatinic acid, solid	SNR	2507
Chlorotetrafluoroethane and Ethylene oxide mixture, with not more than 8.8% Ethylene oxide	GNR	3297
Chlorotrifluoromethane	GNR	1022
Chlorotrifluoromethane and Trifluoromethane azeotropic mixture with approximately 60% Chlorotrifluoromethane	GNR	2599
Cobalt naphthenates, powder	NR	2001
Cobalt resinate, precipitated	NR	1318

Substance Look-up Table

Part 4: Substances, not rated

Substance name	Hazard type (in order of relevance)	UN-nr
Compressed gas, oxidizing, n.o.s.	GNR	3156
Copra	NR	1363
Corrosive liquid, acidic, inorganic, n.o.s.	LNR	3264
Corrosive liquid, acidic, organic, n.o.s.	LNR	3265
Corrosive liquid, basic, inorganic, n.o.s.	LNR	3266
Corrosive liquid, basic, organic, n.o.s.	LNR	3267
Corrosive liquid, self-heating, n.o.s.	LNR	3301
Corrosive solid, acidic, inorganic, n.o.s.	SNR	3260
Corrosive solid, acidic, organic, n.o.s.	SNR	3261
Corrosive solid, basic, inorganic, n.o.s.	SNR	3262
Corrosive solid, basic, organic, n.o.s.	SNR	3263
Corrosive solid, n.o.s.	SNR	1759
Corrosive solid, oxidizing, n.o.s.	SNR	3084
Corrosive solid, poisonous, n.o.s.	SNR	2923
Corrosive solid, self-heating, n.o.s.	SNR	3095
Cotton	NR	1365
Cotton waste, oily	NR	1364
Cresylic acid	LNR	2022
Cyanuric chloride	SNR	2670
Decaborane	NR	1868
Devices, small, hydrocarbon gas powered, with release device	NR	3150
Dibutylaminoethanol	LNR	2873
Dichlorodifluoromethane	GNR	1028
Dichlorodifluoromethane and Difluoroethane azeotropic mixture with approximately 74% Dichlorodifluoromethane	GNR	2602
Dichlorodifluoromethane and Ethylene oxide mixture, with not more than 12.5% Ethylene oxide	GNR	3070
Dichlorofluoromethane	GNR	1029
Didymium nitrate	NR	1465
Diethyl sulfate	LNR	1594
Diethylzinc	NR	1366
Diisooctyl acid phosphate	LNR	1902
Dimethylzinc	NR	1370
Diphenyldichloroarsine (ED)	SNR	1699
Dipicryl sulfide, wetted with not less than 10% water	NR	2852
Disodium trioxosilicate	SNR	3253
Dispersant gas, n.o.s.	GNR	1078
Elevated temperature liquid, n.o.s., at or above 100¦C (212¦F), and below its flash point	LNR	3257
Elevated temperature solid, n.o.s., at or above 240¦C (464¦F)	SNR	3258
Engines, internal combustion, flammable gas powered	NR	3166
Ethanolamine	LNR	2491
Ethyl oxalate	LNR	2525
Ethyl phosphonous dichloride, anhydrous	NR	2845
Ethylene oxide and Pentafluoroethane mixture, with not more than 7.9% Ethylene oxide	GNR	3298
Ethylene oxide and Tetrafluoroethane mixture, with not more than 5.6% Ethylene oxide	GNR	3299
Fabrics impregnated with weakly nitrated Nitrocellulose, n.o.s.	NR	1353
Ferric arsenate	SNR	1606
Ferric arsenite	SNR	1607
Ferric chloride	SNR	1773
Ferric chloride, solution	LNR	2582
Ferric nitrate	NR	1466
Ferrocerium	NR	1323
Ferrosilicon	NR	1408
Ferrous arsenate	SNR	1608
Ferrous metal borings, shavings, turnings or cuttings	NR	2793
Films, nitrocellulose base	NR	1324

Substance Look-up Table

Part 4: Substances, not rated

Substance name	Hazard type (in order of relevance)	UN-nr
Fire extinguisher charges, corrosive liquid	NR	1774
Fire extinguishers with compressed gas	NR	1044
Firelighters, solid, with flammable liquid	NR	2623
Fish meal, stabilized	SNR	2216
Fish meal, unstabilized	NR	1374
Flammable solid, corrosive, inorganic, n.o.s.	NR	3180
Flammable solid, corrosive, n.o.s.	NR	2925
Flammable solid, inorganic, n.o.s.	NR	3178
Flammable solid, n.o.s.	NR	1325
Flammable solid, organic, molten, n.o.s.	NR	3176
Flammable solid, oxidizing, n.o.s.	NR	3097
Fluoroacetic acid	SNR	2642
Fluorosilicates, n.o.s.	SNR	2856
Furfuryl alcohol	LNR	2874
Gallium	SNR	2803
Gas cartridges	NR	2037
Gas sample, non-pressurized, flammable, n.o.s., not refrigerated liquid	NR	3167
Gas sample, non-pressurized, poisonous, flammable, n.o.s., not refrigerated liquid	NR	3168
Gas sample, non-pressurized, poisonous, n.o.s., not refrigerated liquid	NR	3169
Gas, refrigerated liquid, n.o.s.	GNR	3158
Gas, refrigerated liquid, oxidizing, n.o.s.	GNR	3311
Genetically modified micro-organisms	NR	3245
Guanidine nitrate	NR	1467
Hafnium powder, dry	NR	2545
Hafnium powder, wetted with not less than 25% water	NR	1326
Helium	GNR	1046
Helium, refrigerated liquid (cryogenic liquid)	GNR	1963
Heptafluoropropane	GNR	3296
Hexafluoroethane	GNR	2193
Hexafluoropropylene	GNR	1858
Hydrides, metal, n.o.s.	NR	1409
Hydriodic acid	LNR	1787
Hydrobromic acid	LNR	1788
Hydrochloric acid	LNR	1789
Hydrogen peroxide and Peroxyacetic acid mixture, with acid(s), water and not more than 5% Peroxyacetic acid, stabilized	NR	3149
Hydrogen peroxide, aqueous solution, with not less than 20% but not more than 60% Hydrogen peroxide (stabilized as necessary)	NR	2014
Hydrogen peroxide, aqueous solution, with not less than 8% but less than 20% Hydrogen peroxide	NR	2984
Hydrogendifluorides, n.o.s.	SNR	1740
Hydroxylamine sulfate	SNR	2865
Hypochlorite solution	LNR	1791
Infectious substance, affecting animals only	NR	2900
Infectious substance, affecting humans	NR	2814
Insecticide gas, n.o.s.	GNR	1968
Iron oxide, spent	NR	1376
Isopropyl acid phosphate	LNR	1793
Isosorbide dinitrate mixture	NR	2907
Isosorbide-5-mononitrate	NR	3251
Krypton	GNR	1056
Krypton, refrigerated liquid (cryogenic liquid)	GNR	1970
Lead dioxide	NR	1872
Life-saving appliances, not self-inflating	NR	3072
Life-saving appliances, self-inflating	NR	2990
Lighter refills (cigarettes) (flammable gas)	NR	1057
Liquefied gas (nonflammable)	GNR	1058

Substance Look-up Table

Part 4: Substances, not rated

Substance name	Hazard type (in order of relevance)	UN-nr
Liquefied gas, n.o.s.	GNR	3163
Liquefied gas, oxidizing, n.o.s.	GNR	3157
Lithium	NR	1415
Lithium alkyls	NR	2445
Lithium aluminum hydride	NR	1410
Lithium aluminum hydride, ethereal	NR	1411
Lithium batteries	NR	3090
Lithium batteries contained in equipment	NR	3091
Lithium borohydride	NR	1413
Lithium ferrosilicon	NR	2830
Lithium hydride	NR	1414
Lithium hydride, fused solid	NR	2805
Lithium hydroxide	SNR	2680
Lithium hydroxide, solution	LNR	2679
Lithium hypochlorite, dry	NR	1471
Lithium nitrate	NR	2722
Lithium nitride	NR	2806
Lithium peroxide	NR	1472
Lithium silicon	NR	1417
London purple	SNR	1621
Magnesium	NR	1869
Magnesium alkyls	NR	3053
Magnesium alloys powder	NR	1418
Magnesium aluminum phosphide	NR	1419
Magnesium arsenate	SNR	1622
Magnesium bromate	NR	1473
Magnesium chlorate	NR	2723
Magnesium diamide	NR	2004
Magnesium diphenyl	NR	2005
Magnesium fluorosilicate	SNR	2853
Magnesium granules, coated	NR	2950
Magnesium hydride	NR	2010
Magnesium nitrate	NR	1474
Magnesium perchlorate	NR	1475
Magnesium peroxide	NR	1476
Magnesium phosphide	NR	2011
Magnesium silicide	NR	2624
Maleic acid	SNR	2215
Malononitrile	SNR	2647
Manganese nitrate	NR	2724
Manganese resinate	NR	1330
Matches, "strike anywhere"	NR	1331
Matches, fusee	NR	2254
Matches, safety	NR	1944
Matches, wax "vesta"	NR	1945
Mercuric arsenate	SNR	1623
Metal alkyl halides, n.o.s.	NR	3049
Metal alkyl hydrides, n.o.s.	NR	3050
Metal alkyls, n.o.s.	NR	2003
Metal catalyst, wetted	NR	1378
Metal hydrides, flammable, n.o.s.	NR	3182
Metal powder, flammable, n.o.s.	NR	3089
Metal powder, self-heating, n.o.s.	NR	3189
Metaldehyde	NR	1332
Metallic substance, water-reactive, n.o.s.	NR	3208
Metallic substance, water-reactive, self-heating, n.o.s.	NR	3209
N,N-Diethylaniline	LNR	2432
N,N-Dimethylaniline	LNR	2253
Naphthylurea	SNR	1652
N-Butylaniline	LNR	2738

Substance Look-up Table

Part 4: Substances, not rated

Substance name	Hazard type (in order of relevance)	UN-nr
Neon	GNR	1065
Neon, refrigerated liquid (cryogenic liquid)	GNR	1913
N-Ethylaniline	LNR	2272
N-Ethylbenzyltoluidines	SNR	2753
N-Ethyl-N-benzylaniline	LNR	2274
N-Ethyltoluidines	LNR	2754
Nickel catalyst, dry	NR	2881
Nitrates, inorganic, aqueous solution, n.o.s.	NR	3218
Nitrates, inorganic, n.o.s.	NR	1477
Nitrites, inorganic, n.o.s.	NR	2627
Nitrocellulose membrane filters	NR	3270
Nitrocellulose mixture, without plasticizer, without pigment	NR	2557
Nitrocellulose with alcohol	NR	2556
Nitrocellulose with water, not less than 25% water	NR	2555
Nitrogen	GNR	1066
Nitrogen and Rare gases mixture	GNR	1981
Nitrogen, refrigerated liquid (cryogenic liquid)	GNR	1977
Nitroglycerin mixture, desensitized, solid, n.o.s., with more than 2% but not more than 10% Nitroglycerin	NR	3319
Nitroguanidine (Picrite), wetted with not less than 20% water	NR	1336
Nitrostarch, wetted with not less than 20% water	NR	1337
Nitrosylsulfuric acid	SNR	2308
Nitrous oxide	GNR	1070
Nitrous oxide, refrigerated liquid	GNR	2201
Octafluorobut-2-ene	GNR	2422
Octafluorocyclobutane	GNR	1976
Octafluoropropane	GNR	2424
Organic pigments, self-heating	NR	3313
Organophosphorus pesticide, solid, poisonous	SNR	2783
Osmium tetroxide	SNR	2471
Oxidizing liquid, corrosive, n.o.s.	NR	3098
Oxidizing liquid, n.o.s.	NR	3139
Oxidizing liquid, poisonous, n.o.s.	NR	3099
Oxidizing solid, corrosive, n.o.s.	NR	3085
Oxidizing solid, flammable, n.o.s.	NR	3137
Oxidizing solid, poisonous, n.o.s.	NR	3087
Oxidizing solid, self-heating, n.o.s.	NR	3100
Oxidizing solid, water-reactive, n.o.s.	NR	3121
Oxygen	GNR	1072
Oxygen and Rare gases mixture	GNR	1980
Oxygen generator, chemical	NR	3356
Oxygen, refrigerated liquid (cryogenic liquid)	GNR	1073
Paint (corrosive)	LNR	3066
Paper, unsaturated oil treated	NR	1379
Paraformaldehyde	NR	2213
Pentaborane	NR	1380
Pentaerythrite tetranitrate mixture, desensitized, solid, n.o.s., with more than 10% but not more than 20% PETN	NR	3344
Pentafluoroethane	GNR	3220
Perchlorates, inorganic, aqueous solution, n.o.s.	NR	3211
Perchlorates, inorganic, n.o.s.	NR	1481
Perchloric acid, with more than 50% but not more than 72% acid	NR	1873
Perchloric acid, with not more than 50% acid	LNR	1802
Peroxides, inorganic, n.o.s.	NR	1483
Persulfates, inorganic, aqueous solution, n.o.s.	NR	3216
Persulfates, inorganic, n.o.s.	NR	3215
Phenacyl bromide	SNR	2645
Phenetidines	LNR	2311
Phenol, molten	SNR	2312
Phenol, solid	SNR	1671

Substance Look-up Table

Part 4: Substances, not rated

Substance name	Hazard type (in order of relevance)	UN-nr
Phenolates, solid	SNR	2905
Phenylenediamines	SNR	1673
Phosphogene oxime (CX)	SNR	2811
Phosphoric acid	LNR	1805
Phosphorous acid	SNR	2834
Phosphorus heptasulfide, free from yellow and white Phosphorus	NR	1339
Phosphorus oxybromide	SNR	1939
Phosphorus pentabromide	SNR	2691
Phosphorus pentachloride	SNR	1806
Phosphorus pentasulfide, free from yellow and white Phosphorus	NR	1340
Phosphorus pentoxide	SNR	1807
Phosphorus sesquisulfide, free from yellow and white Phosphorus	NR	1341
Phosphorus tribromide	LNR	1808
Phosphorus trioxide	SNR	2578
Phosphorus trisulfide, free from yellow and white Phosphorus	NR	1343
Phosphorus, amorphous	NR	1338
Phosphorus, white, dry or under water or in solution	NR	1381
Phosphorus, white, molten	NR	2447
Phthalic anhydride	SNR	2214
Picric acid, wet, with not less than 10% water	NR	1344
Piperazine	SNR	2579
Plastic molding compound	NR	3314
Plastic, nitrocellulose-based, spontaneously combustible, n.o.s.	NR	2006
Poisonous solid, self-heating, n.o.s.	SNR	3124
Polymeric beads, expandable	SNR	2211
Potassium	NR	2257
Potassium borohydride	NR	1870
Potassium bromate	NR	1484
Potassium chlorate	NR	1485
Potassium chlorate, aqueous solution	NR	2427
Potassium dithionite	NR	1929
Potassium fluoride	SNR	1812
Potassium fluoroacetate	SNR	2628
Potassium fluorosilicate	SNR	2655
Potassium hydrogen sulfate	SNR	2509
Potassium hydrogendifluoride	SNR	1811
Potassium monoxide	SNR	2033
Potassium nitrate	NR	1486
Potassium nitrate and Sodium nitrate mixture	NR	1499
Potassium nitrate and Sodium nitrite mixture	NR	1487
Potassium nitrite	NR	1488
Potassium perchlorate	NR	1489
Potassium permanganate	NR	1490
Potassium peroxide	NR	1491
Potassium persulfate	NR	1492
Potassium phosphide	NR	2012
Potassium sodium alloys	NR	1422
Potassium sulfide, anhydrous	NR	1382
Potassium sulfide, hydrated, with not less than 30% water of crystallization	SNR	1847
Potassium superoxide	NR	2466
Potassium, metal alloys	NR	1420
Propionic anhydride	LNR	2496
Pyrophoric liquid, inorganic, n.o.s.	NR	3194
Pyrophoric organometallic compound, n.o.s.	NR	3203
Pyrophoric solid, inorganic, n.o.s.	NR	3200
Pyrophoric solid, n.o.s.	NR	2846
Rare gases mixture	GNR	1979
Refrigerant gas R-134a	GNR	3159
Refrigerant gas R-14	GNR	1982

Substance Look-up Table

Part 4: Substances, not rated

Substance name	Hazard type (in order of relevance)	UN-nr
Refrigerant gas R-404A	GNR	3337
Refrigerant gas R-407A	GNR	3338
Refrigerant gas R-407B	GNR	3339
Refrigerant gas R-407C	GNR	3340
Refrigerating machines, containing Ammonia solutions (UN2073)	NR	2857
Resorcinol	SNR	2876
Rubber scrap, powdered or granulated	NR	1345
Rubidium	NR	1423
Rubidium hydroxide	SNR	2678
Rubidium hydroxide, solution	LNR	2677
Seed cake, with more than 1.5% oil and not more than 11% moisture	NR	1386
Seed cake, with not more than 1.5% oil and not more than 11% moisture	NR	2217
Selenates	SNR	2630
Selenic acid	SNR	1905
Selenium compound, n.o.s.	SNR	3283
Selenium disulfide	SNR	2657
Self-heating liquid, corrosive, inorganic, n.o.s.	NR	3188
Self-heating liquid, corrosive, organic, n.o.s.	NR	3185
Self-heating liquid, inorganic, n.o.s.	NR	3186
Self-heating liquid, organic, n.o.s.	NR	3183
Self-heating liquid, poisonous, inorganic, n.o.s.	NR	3187
Self-heating liquid, poisonous, organic, n.o.s.	NR	3184
Self-heating solid, corrosive, inorganic, n.o.s.	NR	3192
Self-heating solid, corrosive, organic, n.o.s.	NR	3126
Self-heating solid, inorganic, n.o.s.	NR	3190
Self-heating solid, inorganic, poisonous, n.o.s.	NR	3191
Self-heating solid, organic, n.o.s.	NR	3088
Self-heating solid, organic, poisonous, n.o.s.	NR	3128
Self-heating solid, oxidizing, n.o.s.	NR	3127
Self-reactive liquid type B	NR	3221
Self-reactive liquid type B, temperature controlled	NR	3231
Self-reactive liquid type C	NR	3223
Self-reactive liquid type C, temperature controlled	NR	3233
Self-reactive liquid type D	NR	3225
Self-reactive liquid type D, temperature controlled	NR	3235
Self-reactive liquid type E	NR	3227
Self-reactive liquid type E, temperature controlled	NR	3237
Self-reactive liquid type F	NR	3229
Self-reactive liquid type F, temperature controlled	NR	3239
Self-reactive solid type B	NR	3222
Self-reactive solid type B, temperature controlled	NR	3232
Self-reactive solid type C	NR	3224
Self-reactive solid type C, temperature controlled	NR	3234
Self-reactive solid type D	NR	3226
Self-reactive solid type D, temperature controlled	NR	3236
Self-reactive solid type E	NR	3228
Self-reactive solid type E, temperature controlled	NR	3238
Self-reactive solid type F	NR	3230
Self-reactive solid type F, temperature controlled	NR	3240
Silicon powder, amorphous	NR	1346
Silicon tetrachloride	LNR	1818
Silver picrate, wetted with not less than 30% water	NR	1347
Soda lime, with more than 4% Sodium hydroxide	SNR	1907
Sodium	NR	1428
Sodium aluminate, solution	LNR	1819
Sodium aluminum hydride	NR	2835
Sodium borohydride	NR	1426

Substance Look-up Table

Part 4: Substances, not rated

Substance name	Hazard type (in order of relevance)	UN-nr
Sodium borohydride and Sodium hydroxide solution, with not more than 12% Sodium borohydride and not more than 40% Sodium hydroxide	LNR	3320
Sodium bromate	NR	1494
Sodium cacodylate	SNR	1688
Sodium chlorate	NR	1495
Sodium chlorate, aqueous solution	NR	2428
Sodium chlorite	NR	1496
Sodium chloroacetate	SNR	2659
Sodium dinitro-o-cresolate, wetted with not less than 15% water	NR	1348
Sodium dithionite	NR	1384
Sodium fluoride	SNR	1690
Sodium fluoroacetate	SNR	2629
Sodium fluorosilicate	SNR	2674
Sodium hydride	NR	1427
Sodium hydrogendifluoride	SNR	2439
Sodium hydrosulfide, solid, with less than 25% water of crystallization	NR	2318
Sodium methylate	NR	1431
Sodium monoxide	SNR	1825
Sodium nitrite	NR	1500
Sodium pentachlorophenate	SNR	2567
Sodium perchlorate	NR	1502
Sodium permanganate	NR	1503
Sodium peroxide	NR	1504
Sodium peroxoborate, anhydrous	NR	3247
Sodium persulfate	NR	1505
Sodium phosphide	NR	1432
Sodium picramate, wetted with not less than 20% water	NR	1349
Sodium sulfide, anhydrous	NR	1385
Sodium sulfide, hydrated, with not less than 30% water	SNR	1849
Sodium superoxide	NR	2547
Solids containing corrosive liquid, n.o.s.	NR	3244
Solids containing flammable liquid, n.o.s.	NR	3175
Solids containing poisonous liquid, n.o.s.	NR	3243
Strontium arsenite	SNR	1691
Strontium chlorate	NR	1506
Strontium nitrate	NR	1507
Strontium perchlorate	NR	1508
Strontium peroxide	NR	1509
Strontium phosphide	NR	2013
Strychnine	NR	1692
Substances, which in contact with water emit flammable gases, solid, self-heating, n.o.s.	NR	3135
Sulfamic acid	SNR	2967
Sulfur	NR	1350
Sulfur hexafluoride	GNR	1080
Sulfur, molten	NR	2448
Sulfuric acid, fuming	LNR	1831
Sulfuric acid, spent	LNR	1832
Sulfurous acid	LNR	1833
Tear gas candles	SNR	1700
Tetraethylenepentamine	LNR	2320
Tetrahydrophthalic anhydrides	SNR	2698
Tetramethylammonium hydroxide	SNR	1835
Thallium chlorate	NR	2573
Thallium compound, n.o.s.	SNR	1707
Thallium nitrate	SNR	2727
Thioglycolic acid	LNR	1940
Thiourea dioxide	NR	3341
Titanium disulfide	NR	3174

Substance Look-up Table

Part 4: Substances, not rated

Substance name	Hazard type (in order of relevance)	UN-nr
Titanium hydride	NR	1871
Titanium powder, dry	NR	2546
Titanium powder, wetted with not less than 25% water	NR	1352
Titanium sponge granules	NR	2878
Titanium trichloride mixture	SNR	2869
Titanium trichloride, pyrophoric	NR	2441
Toxins, extracted from living sources, liquid, n.o.s.	NR	3172
Triallyl borate	LNR	2609
Tributylamine	LNR	2542
Trichloroacetic acid	SNR	1839
Trichloroisocyanuric acid, dry	NR	2468
Triethylenetetramine	LNR	2259
Trifluoromethane, refrigerated liquid	GNR	3136
Trinitrobenzene, wetted with not less than 30% water	NR	1354
Trinitrobenzoic acid, wetted with not less than 30% water	NR	1355
Trinitrotoluene (TNT), wetted with not less than 30% water	NR	1356
Urea hydrogen peroxide	NR	1511
Urea nitrate, wetted with not less than 20% water	NR	1357
Vanadyl sulfate	SNR	2931
Xanthates	NR	3342
Xenon	GNR	2036
Xenon, refrigerated liquid (cryogenic liquid)	GNR	2591
Xylenols	SNR	2261
Zinc arsenate	SNR	1712
Zinc dithionite	SNR	1931
Zinc fluorosilicate	SNR	2855
Zirconium hydride	NR	1437
Zirconium metal, powder, wet	NR	1358
Zirconium nitrate	NR	2728
Zirconium picramate, wetted with not less than 20% water	NR	1517
Zirconium powder, dry	NR	2008
Zirconium scrap	NR	1932
Zirconium tetrachloride	SNR	2503
Zirconium, dry, coiled wire, finished metal sheets or strips	NR	2858
Zirconium, dry, finished sheets, strips or coiled wire	NR	2009

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