FLASH ENVIRONMENTAL ASSESSMENT TOOL (FEAT)

VERSION 2.0

Reference Guide
Working Document

Hazard Quantity Exposure

To identify acute environmental risks immediately following disasters

UN environment

UN Environment / OCHA Joint Unit
Prepare. Respond. Protect.

OCHA

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 was prepared as an account of work sponsored by the United Nations and the Dutch National Institute for Public Health and the Environment. Readers and users of FEAT are responsible for their operations and functions. FEAT outputs will help to prioritize 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.

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Published in Switzerland, 2017 by the UN Environment/OCHA Joint Unit

UN Environment / OCHA Joint Unit (2017) Flash Environmental Assessment Tool 2.0 Reference Guide. United Nations, Geneva, Switzerland

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Report Editor: UN Environment/OCHA Joint Unit
Cover photo: Bulk Ammonia storage facility in Madagascar; affected coastline with nearby industrial facility, Philippines; flooded village in Serbia
Photo credits: OCHA

FEAT was produced with the support of

Rijksinstituut voor Volksgezondheid en Milieu
Ministerie van Volksgezondheid, Welzijn en Sport
www.rivm.nl/en

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LIST OF ABBREVIATIONS

APELL	Awareness and Preparedness for Emergencies at Local Level
CAPP	Chemical Accident Prevention and Preparedness Programme
CAS	Chemical Abstracts Service
FEAT	Flash Environmental Assessment Tool
FEAT-P	Flash Environmental Assessment Tool-Preparedness
FEAT-R	Flash Environmental Assessment Tool-Response
GHS	Globally Harmonized System
HIT	Hazard Identification Tool
IFC	International Financial Corporation
JEU	UN Environment/OCHA Joint Unit
MIC	Methyl isocyanate
NGO	Non-Governmental Organization
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
OSOCC	On-site Operations and Coordination Centre
SDS	Safety Data Sheets
UN	United Nations
UNDAC	United Nations Disaster Assessment and Coordination
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNISDR	United Nations Office for Disaster Risk Reduction
USAR	Urban Search and Rescue

EXECUTIVE SUMMARY

The Flash Environmental Assessment Tool (FEAT) was initially developed at the request of the United Nations Environment Programme (UN Environment)/United Nations Office for the Coordination of Humanitarian Affairs (OCHA) Joint Unit (JEU) based on lessons stemming from the 2004 Indian Ocean Earthquake and Tsunami (JEU, 2007) with the aim to provide a standardized, scientific assessment methodology to prioritize the impacts of chemical accidents following large scale, sudden onset natural disasters. Version 1 of FEAT was developed by the National Institute for Public Health and the Environment of the Netherlands, with support from the Inspectorate of the (then) Ministry of Housing, Spatial Planning and the Environment of the Netherlands as well as DHV-Engineering Consultancy.

The FEAT helps to identify potential hazards posed by hazardous operations or natural disasters. The FEAT focuses on the "big and obvious" impacts and follows a step-by-step approach. As more information on hazardous operations, nearby receptors and pathways becomes available over time, the FEAT approach presents expected impacts on humans and the environment with more detail. It was envisioned that the FEAT is used at the onset of hazardous operations or a large-scale natural disaster, by international humanitarian responders that may be unfamiliar with the affected area. Other non-acute impacts should also be considered after the initial life-saving phase of the disaster.

Since its initial development, FEAT (2009) has proven to be a useful tool for assessing impacts from chemical accidents being used by national and international responders, both for emergency preparedness and emergency response. The evolution of these two different practical uses of the tool, in addition to increasing requests from the field for a 'simple-to-use mapping tool', led the JEU to initiate an evaluation and review. The result of the review was the development the FEAT 2.0 Reference Guide in 2015.

FEAT 2.0 is comprised of two parts: FEAT Preparedness (FEAT-P) and FEAT Response (FEAT-R). While the FEAT formula and scientific rigor remained the same, the revised FEAT is easier to use, reflects the latest international guidelines, such as United Nations guidelines, the International Finance Cooperation's (IFC) standards and Emergency Response handbooks, and it is more closely integrated into existing emergency management platforms and guidelines.

After piloting the FEAT 2.0 Reference Guide in 2015, the decision was made to develop the FEAT 2.0 Pocket Guide, which was completed in 2016. Although both the Reference Guide and Pocket Guide use the same methodology, the Pocket Guide was designed as a simplified and compact reference to aid disaster responders already familiar with FEAT in conducting rapid field assessments. Also in 2016, a FEAT data collection tool was developed using the open source KoBoToolbox software. The FEAT KoBo data collection tool, which can be used on both laptop computers and smartphones, facilitates the rapid field collection of information needed to complete a FEAT assessment.

Although the Pocket Guide provides summary field guidance, the FEAT Reference Guide remains as the principal reference concerning FEAT. The Reference Guide is an in depth document containing additional information such as technical details of FEAT, expanded user guidance on applying the Pocket Guide, guidance on FEAT-P, how to use the KoBo data collection tool, and contains a FEAT Question and Answer section.

FEAT 2.0, as presented in this Reference Guide, is structured in such a way that development of an electronic version of FEAT (called "e-FEAT") is feasible. Further development of FEAT would encompass a software tool to further improve the practical ease of use as well as wider coverage of chemical accident scenarios.

ACKNOWLEDGEMENTS

This document (The FEAT 2.0 Reference Guide) is the result of an international initiative launched by the JEU. With this revised tool and the development of the FEAT 2.0 Pocket Guide, the JEU and other users will be better placed to support national, regional and international disaster responders and national authorities in preparing for and responding to chemical accidents.

The objective of FEAT 2.0 is to improve chemical safety in countries where this type of emergency preparedness and response is pertinent. FEAT 2.0 builds upon international organizations' and national authorities' experience in addressing chemical accidents, and takes into account international agreements, key national/regional laws and regulations, and materials from other international Handbooks.

To develop the FEAT Reference Guide, the JEU established an Expert Working Group with selected experts working in the area of chemical accident preparedness and response. Subsequent feedback from several interested organizations resulted in the eventual development of the FEAT Pocket Guide and in improving the content and utility of all FEAT components. Much gratitude and appreciation is given for the input and expertise of the following organizations that made the current FEAT Version 2.0 Reference Guide and Pocket Guide possible.

- Danish Emergency Management Agency
- Emergency Dispatch Centres Rotterdam-Rijnmond and South Holland South Emergency Management Agency
- Federal Agency for Technical Relief, Germany
- Fire Department in the Safety Region Rotterdam-Rijnmond, The Netherlands
- Grontmij/Carl Bro
- Italian Civil Protection Department
- Joint UNEP/OCHA Environment Unit (JEU)
- Joint Research Centre (JRC), European Union
- C. Kelly, Environmental Disaster Consultant
- Los Angeles County Fire Department, United States
- Mannheim Fire Department Analytical Task Force (ATF), Germany
- Ministry of Emergency Situations of Republic of Armenia
- National Institute of Public Health and the Environment (RIVM), Centre for Sustainability, Environment and Health (DMG), The Netherlands[1]
- Office for the Coordination of Humanitarian Affairs (OCHA)
- Swiss Agency for Development and Cooperation
- UN Economic Commission for Europe (UNECE) Convention on Transboundary Effects of Industrial Accidents
- United Nations Development Programme (UNDP)
- UNECE Transport Division, Dangerous Goods and Special Cargos Section
- UNEP Division of Technology, Industry and Economics
- World Health Organization (WHO)
- United Nations Disaster Assessment and Coordination team (UNDAC)
- Secretariat of the International Search and Rescue Advisory Group (INSARAG)

[1] A special word of gratitude for RIVM for providing the summary data and updated tables. The JEU's initiative and the work on this Handbook coincided with ongoing efforts of RIVM. With support from RIVM's Director-General and in various associated projects, RIVM provided scientific data and modeling. In this context, RIVM developed major extensions of the database on which FEAT 1.0 was based. By combining the initiatives and work of the JEU, Royal HaskoningDHV and RIVM, the FEAT tables and checklists were updated and expanded with RIVM's novel data compilations and analyses.

SECTION I: INTRODUCTION

What is the FEAT?

The FEAT helps to identify and assess industrial hazards and impacts as well as interventions required to effectively prepare for, and respond to, chemical accidents. Essentially, the FEAT is a disaster risk management tool.

Regarding emergency response, the FEAT enables the assessment of environmental impacts caused by chemical releases from hazardous operations. The FEAT focuses on support of emergency response actions – i.e. activities within 72 hours after occurrence of a chemical accident. In doing so, it distinguishes hazardous operations at industrial facilities, transport, transport interfaces and pipelines. Infrastructural facilities, such as hydro dams, are not included, unless they contain specific hazardous substances associated with any of the above.

Regarding emergency preparedness, the FEAT focuses on initiating and supporting chemical risk reduction work.

Worldwide there are thousands of potentially hazardous operations. The FEAT has preselected in total 63 types of "high risk" hazardous operations in order to prioritize hazards of relevance for emergency planning. The selection is derived using the guidelines from the International Finance Corporation (IFC) with regard to the environment, health and safety (EHS - known as the "EHS Guidelines"). The FEAT supports existing international legislation, tools and mechanisms by providing a scientifically sound methodology for identifying gaps and setting priorities.

Why do we need the FEAT?

Almost every country experiences chemical accidents every year. Many hazardous substances used in industrial and infrastructure operations present a risk of chemical accidents that can cause extensive harm to people, the environment, and local or even national economies.

The UN General Assembly adopted a Resolution on International Cooperation on Humanitarian Assistance in the Field of Natural Disasters (UNGA A/RES/66/227) which "recognizes the importance of applying a multi-hazard approach to preparedness, and encourages Member States, taking into account their specific circumstances, and the United Nations system to continue to apply the approach to their preparedness activities, including by giving due regard to, inter alia, secondary environmental hazards stemming from industrial and technological accidents".

Even though the resolution is non-binding for UN Member States, the inclusion of the reference to secondary environmental hazards in a humanitarian resolution is important for recognizing, assessing and managing potential impacts on and via the environment, including those of natechs (natural-hazard triggered technological disasters), into humanitarian assistance.

Who uses the FEAT?

The FEAT is intended to be used by non-experts. As part of emergency preparedness and emergency response planning, the FEAT Handbook is a "first response" tool that provides instructions to assess and address the potential impact caused by chemical accidents. It is recommended that the user has basic training on the use of the FEAT and a basic knowledge of chemicals and hazard classification. An introductory FEAT e-learning course is available at the Environmental Emergencies Centre website at: http://www.eecentre.org/Training.aspx .

The intended users of the FEAT under preparedness and response are as follows:

- Emergency Preparedness: FEAT-P is addressed primarily to government authorities, technical institutions, and parties involved in the development (or improvement) of chemical accident programmes in order to reduce risks for neighboring communities.
- Emergency Response: FEAT-R is addressed primarily to international responders, such as members of United Nations Disaster Assessment and Coordination (UNDAC) and Urban Search and Rescue (USAR) teams, as well as local authorities, environmental entities and disaster management agencies. The FEAT can also be used by civil protection agencies from countries that are most likely to deploy internationally, either on a bilateral or multilateral basis.

The FEAT provides a unified assessment methodology to identify and prioritize secondary environmental risks. This benefits international and national response teams by improving team safety and allowing for nations to react faster to chemical accidents and mitigate or prevent deaths and injuries.

The FEAT can also be used in broader assessment schemes at the international level for capacity or humanitarian needs assessments. As an international tool developed and used by several UN agencies, the FEAT is available for free for regional organizations and Member States.

International and national response teams benefit from a single, unified assessment methodology to identify and prioritise secondary environmental risks. Using the FEAT will improve team safety and support national authorities to react faster to chemical accidents and thus prevent unnecessary and often preventable death and injury.

Emergency preparedness and response also requires political commitment and coordinated efforts. Many organizations have roles to play, in particular government bodies responsible for environmental protection, occupational health and safety, public health, civil defense and emergency response. Industry operators, community groups and non-governmental organizations (NGO's) also have roles to play.

Note: The FEAT does not replace in-depth environmental (impact) assessments. The objective is to either initiate or support emergency preparedness actions (FEAT-P), or to support initial emergency response actions – i.e. actions within 72 hours after the occurrence of the accident (FEAT-R).

Note: The FEAT does not deal with the broader issues of occupational health and safety, nor does it address chronic or ongoing pollution.

What Comprises FEAT 2.0

FEAT 2.0 is comprised of the FEAT Reference Guide, the FEAT Pocket Guide, and the FEAT KoBo data collection tool. The principal guidance document for FEAT is the FEAT 2.0 Reference Guide. This in depth document contains the technical details of FEAT, explains the FEAT core process, provides detailed information on how to apply the FEAT core process for emergency preparedness and emergency response, and explains how to provide FEAT output to other disaster management organizations.

The FEAT 2.0 Pocket Guide serves disaster workers in the field. It is a compact hands-on reference on how to conduct rapid field assessments, aimed at UNDAC teams, USAR teams, local authorities, disaster management agencies, and environmental specialists already familiar with the concept and use of FEAT. As a condensed reference to the FEAT process, the scope of the Pocket Guide is limited to the application of the core FEAT steps to emergency response.

The FEAT KoBo data collection tool is an electronic form developed using KoBoToolbox open source software to facilitate the rapid field collection of information needed to complete a FEAT assessment. The KoBo data collection tool can be used on both laptop computers and smartphones and consolidates data gathering from several field teams into one central spreadsheet for FEAT assessment.

Legal Considerations

Local jurisdictions are often bound by legal instruments and regulations that address environmental preparedness and response activities. Examples of such instruments include the Convention on the Transboundary Effects of Industrial Accidents (Industrial Accidents Convention), the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention), the Protocol on Strategic Environmental Assessment (Protocol on SEA), the Convention on the Protection and Use of the Transboundary Watercourses and International Lakes, and the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention). The FEAT is not intended to replace the provisions of any legal or regulatory frameworks a local jurisdiction is bound to. The FEAT is a voluntary tool intended to supplement existing preparedness and response structures and activities.

Definitions

Definitions of FEAT Preparedness and Response:

- *Preparedness:* Readiness for chemical accidents whereby responders are trained to act prior to the onset of an accident. This involves putting in place the systems and resources needed for appropriate emergency response in the event of an accident, including the diagnosis and treatment of injured persons and communication with the public.
- *Response:* An aggregation of decisions and measures taken to assess, contain or mitigate the effects of a chemical accident so as to prevent any further loss of life and/or property and impact to the external environment. The first and immediate response is called emergency response.[2]

The following definitions are applied for hazardous operations:

- *Industrial facilities:* Fixed industrial plants/sites at which hazardous substance(s) are produced, processed, handled, stored, used, or disposed of in such a form and quantity that there is a risk of an accident involving hazardous substance(s) that could cause serious harm to human health or damage to the environment, including property.
- *Infrastructure:* Transport and storage of hazardous substances by air, road, rail and water (sea and inland waterways), including distribution systems, waste water treatment plants, drinking water production facilities and health care operations. Transport accidents consider loss of containment of hazardous substances from the load – e.g. leak in bulk tank, rupture of drums, packaged chemicals during transport.[3]
- *Transport interfaces:* Fixed areas where hazardous substances ("dangerous goods") are transferred from one transport mode to another or stored temporarily during transfer between transport modes or equipment.
- *Pipelines:* Pipelines transporting hazardous substances. Pipelines cover long distances that are unobserved for the majority of their length. This makes them vulnerable to damage: underground damage due to third parties activities (for example through digging), natural events (e.g. landslide, earthquake), or vandalism and malicious acts.

[2] This guidance does not elaborate on recovery or rehabilitation.

[3] Transport of dangerous goods is an important issue and should be addressed in a country's overall chemical accidents programme. There are several regulations and mechanisms with regard to transport of dangerous goods, for example ADR ("Accord européen relatif au transport international des marchandises Dangereuses par Route") for international road transport, RID for international rail transport, ADN for international inland waterways transport, IMDG code for maritime transport and ICAO-TI for air transport. In general, these mechanisms help to reduce the risk of transport accidents involving dangerous goods and promote consistency between regulatory systems for hazard classification and communication of hazardous substances in different countries and between all sectors.

The text boxes on the following three pages detail other definitions used in the FEAT (Text Box A) and provide a summary of hazardous operations preselected in the FEAT (Text Box B). Definitions (Text Box A) are derived from the UNISDR Terminology, the UNEP Flexible Framework for Addressing Chemical Accident Prevention and Preparedness, the International Finance Corporation (IFC) World Bank Group, the Report of Workshop on Natech Risk Management (23-25 May 2012, Dresden, Germany) Series on Chemical Accidents No. 25, and the Seveso Directive. Information gaps were adapted and solved for the purpose of FEAT. Hazardous Operations (Text Box B) are derived from guidelines from the IFC World Bank Group.[4]

4 See www.ifc.org/ehsguidelines

TEXT BOX A: Summary of definitions used in FEAT

Acceptable risk: The level of potential losses that a society or community considers acceptable given existing social, economic, political, cultural, technical and environmental conditions.

Chemical accident: The unintentional release of one or more hazardous substances which could harm human health or the environment.

Chemical hazards: Systems where chemical accidents could occur under certain circumstances. Such events include fires, explosions, leakages or releases of toxic or hazardous substances that can cause people illness, injury, disability or death, and/or impacts on the environment, including long-term effects.

Contaminant(s): Presence of hazardous substances, waste, or oil in any environmental media at potentially hazardous concentrations.

Disaster: A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources. Disasters are often described as a result of the combination of the exposure to a hazard; the conditions of vulnerability that are present; and insufficient capacity or measures to reduce or cope with the potential negative consequences. Disaster impacts may include loss of life, injury, disease and other negative effects on human physical, mental and social well-being, together with damage to property, destruction of assets, loss of services, social and economic disruption and environmental degradation.

Emergency management: The organization and management of resources and responsibilities for addressing all aspects of emergencies, in particular preparedness, response and initial recovery steps.

Ecosystem services: The benefits that people and communities obtain from ecosystems, including "regulating services" such as regulation of floods, drought, land degradation and disease, "provisioning services" such as food and water, "supporting services" such as soil formation and nutrient cycling, and "cultural services" such as recreational, spiritual, religious and other non-material benefits.

Exposure: People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses. Measures of exposure can include the number of people or types of assets in an area. These can be combined with the vulnerability of the exposed elements to any particular hazard to estimate the risks associated with that hazard in the area of interest.

Hazard: A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. Hazards arise from a variety of geological, meteorological, hydrological, oceanic, biological, and technological sources, sometimes acting in combination.

Hazardous operation: A location, industrial plant or site at which hazardous substance(s) are produced, processed, handled, stored, transferred, used, or disposed of in such a form and quantity that there is a risk of an accident involving hazardous substance(s) that could cause serious harm to human health and/or damage to the environment.

Hazardous substance: An element, compound, mixture, or preparation which, by virtue of its chemical, physical, or (eco) toxicological properties, constitutes a hazard. Hazardous substances also include substances not normally considered hazardous but which, under specific circumstances react with other substances or operating conditions (e.g. temperature, pressure) to generate hazardous substances.

Impact: Effects caused by release of a hazardous substance in the environment.

Natech accident: A chemical accident caused by a natural hazard or a natural disaster. Chemical accidents include accidental oil and chemical spills, gas releases, and fires or explosions involving hazardous substances from fixed establishments (such as petrochemical, pharmaceutical, pesticide, storage depot), as well as oil and gas pipelines.

Natural hazard: Natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. Natural hazards are a sub-set of all hazards. The term is used to describe actual hazard events as well as the latent hazard conditions that may give rise to future events. Natural hazard events can be characterized by their magnitude or intensity, speed of onset, duration, and area of extent.

Pathway: A combination of the route of migration of the contaminant from its point of release (e.g. leaching into potable groundwater) and exposure routes (e.g., inhalation, ingestion, transdermal absorption), which would allow receptor(s) to come into actual contact with contaminants.

Preparedness: The knowledge, capacities and activities developed and deployed by governments, professional response and recovery organizations, communities and individuals, prior to the onset of an accident in order to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions.

Prevention: The outright avoidance of adverse impacts of hazards and related disasters. Prevention expresses the concept and intention to completely avoid potential adverse impacts through action taken in advance. Examples include land-use regulations that do not permit any settlement in high risk zones and risk assessment in order to reduce risks. Very often the complete avoidance of losses is not feasible and the task transforms to that of mitigation. Partly for this reason, the term prevention is sometimes used interchangeably in casual use.

Receptor: Actual or likely contact of humans, wildlife, plants, and other living organisms (e.g., cattle, fish) with the contaminants of concern.

Resilience: The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.

Residual risk: The risk that remains in unmanaged form, even when effective disaster risk reduction measures are in place and for which emergency response capacities must be maintained.

Response: The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, to reduce adverse health impacts, to ensure public safety and to meet the basic subsistence needs of the people affected.

Risk: the combination of the probability of an event and its negative consequences.

Vulnerability: The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard. There are many aspects of vulnerability, arising from various physical, social, economic, and environmental factors. Examples may include poor design and construction of buildings, inadequate protection of assets, lack of public information and awareness, limited official recognition of risks and preparedness measures, and disregard for wise environmental management. Vulnerability varies significantly within a community and over time.

Note: National standards and definitions that exist in countries should always be applied first and foremost.

TEXT BOX B: Summary of hazardous operations preselected in the FEAT

Agriculture and food production	Aquaculture Beer production (brewery) Food processing (poultry, meat, fish and dairy) Livestock and Poultry Plantation and annual crop production Sugar Manufacturing Vegetable Oil Processing
Chemicals production	Coal processing Fireworks manufacturing and warehousing Large Volume Petroleum-based Organic Chemicals Manufacturing Large Volume Compounds Manufacturing and Coal Tar Distillation Natural gas processing Nitrogenous Fertilizer Manufacturing Oleochemicals Manufacturing Pesticide production and warehousing Petroleum based manufacturing Petroleum refining Pharmaceutical and biotechnology processing Phosphate Fertilizer Manufacturing and Warehousing
Forestry	Boards and particle based products Harvesting Pulp and paper mills Saw-milling and wood based products
General manufacturing	Base Metal Smelting and Refining Cement and Lime Manufacturing Ceramic Tile and Sanitary Ware Manufacturing Construction Materials Extraction Foundries Glass Manufacturing Integrated Steel Milling Metal, Plastic, Rubber Products Manufacturing Printing Semiconductors and Electronics Manufacturing Tanning and Leather Finishing Textiles Manufacturing
Infrastructure and Transport	Drinking water production Gas distribution Health Care operations (incl. hospitals) Retail Petroleum distribution Storage at ports, harbours and terminals Storage at airports Storage Crude Oil and Petroleum Products Transport by air Transport by rail Transport by road Transport by water Waste storage and processing Waste water treatment
Mining	Mining (non-oil and gas, incl. ore processing) (Natural) Gas production (incl LNG and LPG) Oil production
Pipelines	Transfer gas by long distance pipeline Transfer liquids by long distance pipeline
Power	Electric Power Transmission and Distribution Power generation Wind energy, Geothermal Power Generation
Transport interfaces	Loading or transfer operations Marshalling yard (temporary storage)

SECTION II: BASIC TECHNICAL DETAILS OF THE FEAT

Building upon the introduction to the FEAT outlined in Section I, and in advance of Section III which deals with the specifics of using the FEAT, this section deepens the users' understanding of the FEAT by explaining the underlying logic and technical details of the tool.

Triggers: Natural or Manmade

Chemical accidents can be triggered by natural hazards (e.g. earthquake, tsunami, landslide), or by social and manmade hazards (e.g. terrorism or theft and poor maintenance). Chemical accidents can also be triggered by an accident during hazardous operations at industrial facilities, pipelines, transport operations or transport interfaces.

Impact: Hazard, Quantity and Exposure

The impact of a chemical accident is dependent on the hazardous substance involved, the quantity of hazardous substances released, and the presence and exposure of (vulnerable) receptors in the area, such as humans, livestock, or fishing grounds.

Hazardous substances can be released in to the environment by four pathways, namely: air (wind), surface water, soil and groundwater. Figure 1 visualizes the potential triggers of a chemical accident.

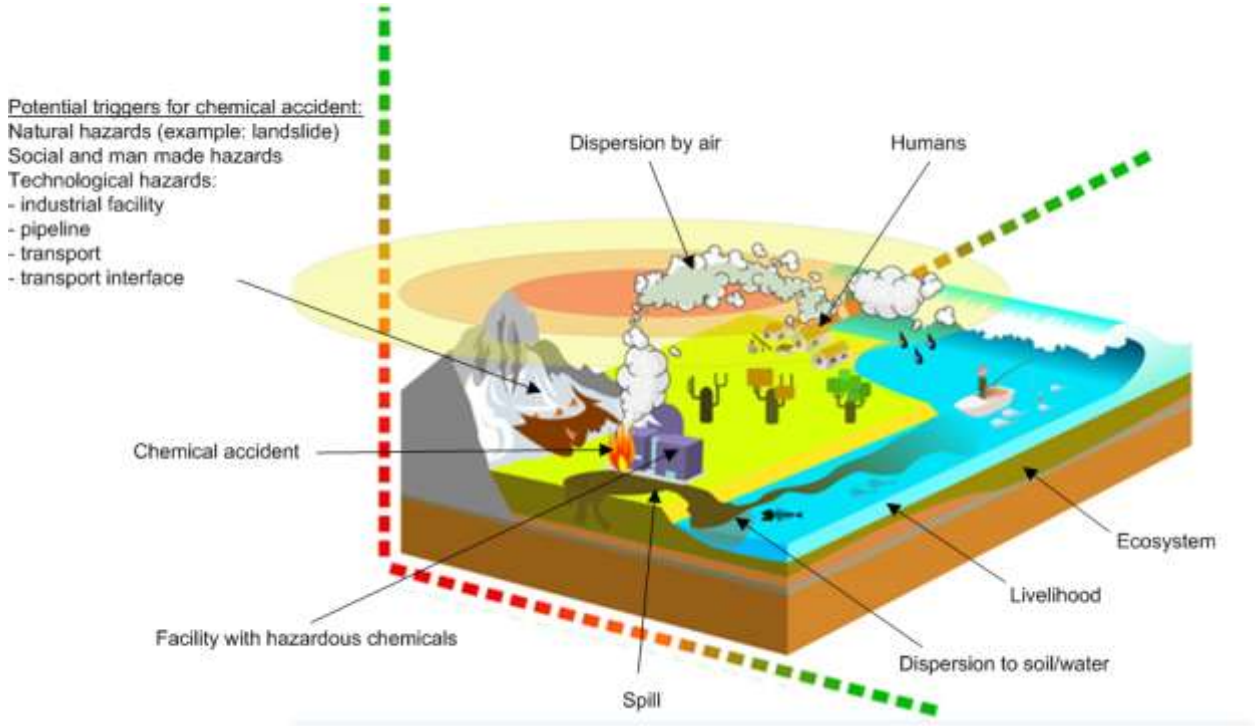


Figure 1. FEAT Infographic: Visualizing the potential triggers and distance-related expected impacts of a chemical accident. (Adapted from Posthuma et al (2014))[5]

[5] Posthuma L, Wahlstrom E, Nijenhuis R, Dijkens C, De Zwart D, Van de Meent D, Hollander A, Brand E, Den Hollander HA, Van Middelaar J, Van Dijk S, Hall L, Hoffer S. 2014. The Flash Environmental Assessment Tool: worldwide first aid for chemical accidents response, pro action, prevention and preparedness. *Environment International* 72: 140-156.

Estimating Impact: The Value-Added by the FEAT

As it is a risk management tool, the FEAT has been designed to provide quick answers in complex chemical accident situations, even in the absence of detailed information and specialized technical resources or expertise.

The FEAT provides these quick answers by combining estimates of the impact arising from the combination of thousands of hazardous substances. While the FEAT shall not give a complete or definite picture of a single situation it can provide insight into the overall impact s and especially priorities for management. The FEAT Reference Guide provides instructions for impact reduction activities in the first 72 hours, as more sophisticated equipment or assessment tools may not (yet) be available.

Integrated approach

The FEAT Handbook details a set of steps to be taken in order to prepare for, or to respond to a chemical accident. The basic activities of the FEAT are demonstrated in Figure 2. Activities are based on prevention as a foundation – emergency preparedness and response activities build on this foundation. The FEAT does not elaborate on prevention activities, however authorities and operators should be introduced to the concept.[6]

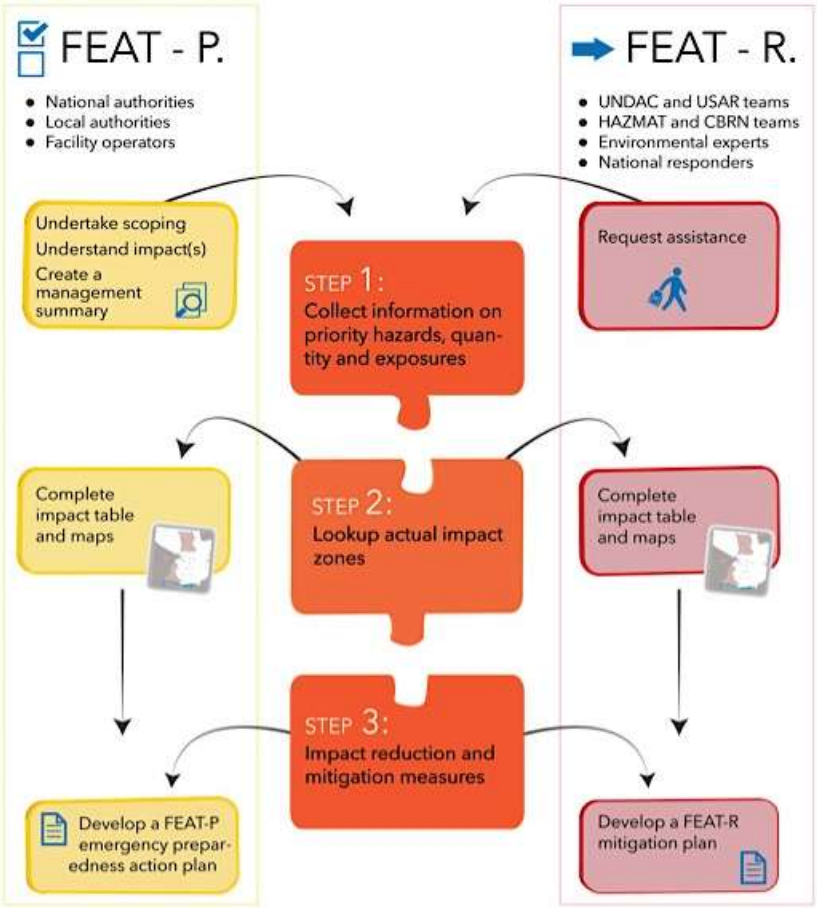


Figure 2. FEAT's Integrated Approach

[6] For prevention, several tools and guidelines are available, such as for urban planning, EIA (Environmental Impact Assessment), permitting, law enforcement, flora and fauna protection, relapse prevention and Awareness and Preparedness for Emergencies at Local Level (APELL).

Emergency Preparedness

FEAT-P provides an understanding of hazards due to a chemical accident relevant to the local setting. The FEAT is used to collect information on hazardous operations, to address specific hazards and for the selection of emergency preparedness actions. The knowledge that is generated through the FEAT assessment process ultimately provides a means for stakeholders to reduce risks to an acceptable level and to deal with the residual risk through preparedness (and eventual prevention/risk management) measures. The APELL and Flexible Framework for Chemical Accident Prevention and Preparedness are tools that can support the process chemical accident preparedness and public involvement.[7]

Emergency Response

FEAT-R includes instructions for identifying, assessing and mitigating the consequences of a chemical accident to enable the selection and implementation of (swift and/or temporary) interventions. In a disaster situation, emergency first responders face the immense task of assessing the imminent impact on human life and the environment with the aim of saving lives and livelihoods. The result of FEAT-R is an emergency response prioritization and mitigation plan, including advice for the government on appropriate follow-up actions.

The FEAT Pocket Guide provides a condensed and compact field reference focused on aiding disaster workers in conducting rapid FEAT-R emergency response assessments.

The FEAT Formula

When assessing the release of substances, the potential impact can be expressed by the following FEAT formula.

I = f (H; Q; E)

Impact = function of (Hazard; Quantity; Exposure)

I = Impact

Impacts are the potential adverse effects caused by the release of a hazardous substance to the environment. The magnitude of the impact depends on (a) the number, vulnerability and self-sufficiency of humans, and (b) the vulnerability of the physical environment due to exposure to hazardous substances. The FEAT distinguishes between impacts to humans and the environment. Human impacts are classified as lethal and health. Environmental impacts are classified as those that affect soil, lakes, or rivers. The FEAT focuses on "big and obvious" hazardous operations, i.e. operations with relatively large quantities of hazardous chemicals. FEAT does not emphasize non-chemical accidents, such as occupational incidents, fires, or dust explosions.

Impact				
Human		Environment		
Lethal	Health	Soil	Lake	River

[7] More information on the APELL and Flexible Framework for Chemical Accident Prevention and Preparedness can be found at the Environmental Emergencies Centre website: http://www.eecentre.org/apell-multi-hazard-training-kit-for-local-authorities/ and http://www.eecentre.org/flexible-framework-for-addressing-chemical-accident-prevention-and-preparedness/

The impact type is based on definitions of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS). The GHS is a standardized chemical classification and labeling system that is widely used to ensure chemical hazard information is available for the protection of human health and the environment. GHS symbols, labels, and information can be found on chemical containers, on safety data sheets (SDS), and on shipping papers.

Hazard classification is the starting point for hazard communication. It involves the identification of the hazard(s) of a chemical or mixture by assigning a category of hazard/danger using defined criteria. The GHS draws a clear distinction between classes and categories of chemical hazards in order to allow for hazard classification. The Definitions of GHS Hazard Classifications in Annex 2 provides a more detailed explanation of each GHS hazard classification.

The term "hazard classification" is used to indicate that only the intrinsic hazardous properties of substances and mixtures are considered and involves the following steps:

1. Identification of relevant data regarding the hazards of a substance or mixture.
2. Subsequent review of those data to ascertain the hazards associated with the substance or mixture.
3. A decision on whether the substance or mixture will be classified as a hazardous substance or mixture and the degree of hazard, where appropriate, by comparison of the data with agreed hazard classification criteria.

H = Hazard

Hazards result from the release of hazardous substances that can cause loss of life or adverse effects to health or the environment. The FEAT works according to the hazard classification system of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).[8] The relationship between the FEAT impact type and hazard classification of a hazardous substance is demonstrated in the Checklist: Understanding Impact (Annex 2).

Q = Quantity

The quantity is a determining factor for impact, because a larger quantity implies a more severe impact. Note that for certain substances even very small quantities can be harmful, especially when released into vulnerable areas.

E = Exposure

Exposure is related to the pathway the hazard moves through the environment (e.g. air, soil/groundwater, lake, or river); the number, vulnerability and self-sufficiency of people and the environment; as well as the resilience of property and other (vulnerable) objects in the hazard zones ("receptors") that are thereby subject to potential losses.

I = H; Q; E

By combining these determining factors the user can derive both an "Impact priority" and the "exposure distance." This information is used to prioritize hazardous operations, emergency preparedness activities and emergency response activities.

[8] The Globally Harmonized System of Classification and Labelling of Chemicals (GHS) is an internationally agreed-upon system, created by the UN. It is designed to replace the various classification and labelling standards used in different countries by using consistent criteria for classification and labelling on a global level. Its development began at the UN Rio Conference in 1992, when the International Labour Organization, the Organisation for Economic Co-operation and Development, various governments and other stakeholders met at the conference. It supersedes the relevant European Union (which has now implemented the UN GHS into EU law as the CLP Regulation) and United States standards.

The Checklist: Understanding Impact below (and in Annex 2) provides a tabular format to help understand impact relationships between common hazard types, pathways, and receptors.

CHECKLIST: UNDERSTANDING IMPACT

Hazard	Exposure				Exposure					
	Pathway				Receptor					
GHS Hazard	Air	Soil, Groundwater	Lake	River	Human	Fishing Area	Soil, Groundwater	Agricultural Area	Nature Reserve	(Critical) Infrastructure
Physical hazard										
Explosive	X				X					X
Flammable	X				X					X
Oxidizing	X				X					X
Gases under pressure	X				X					X
Health hazard										
Toxic gas	X				X				X	
Toxic liquid (volatile)	X	X	X	X	X	X	X	X	X	
Toxic liquid (not volatile)		X	X	X		X	X	X	X	
Corrosive	X				X					X
Irritant	X				X					
Health hazard	X	X	X	X	X	X	X	X	X	
Environmental hazard										
Hazards for aquatic environment		X	X	X		X	X	X	X	

Note: Volatile liquids produce hazardous vapors which can affect human health by air exposure. Assume a toxic liquid is volatile if unsure.

Figure 3. Checklist: Understanding Impact

The FEAT impact triangle provides a graphical representation of the relationship between Hazard, Quantity, Exposure and Impact (Figure 4).

Figure 4. FEAT Impact Triangle

It is important to remember that there is only a significant impact if ALL three impact factors are present. If there is NO exposure OR no relevant quantities OR no relevant hazard, then there is No significant impact (Figure 5).

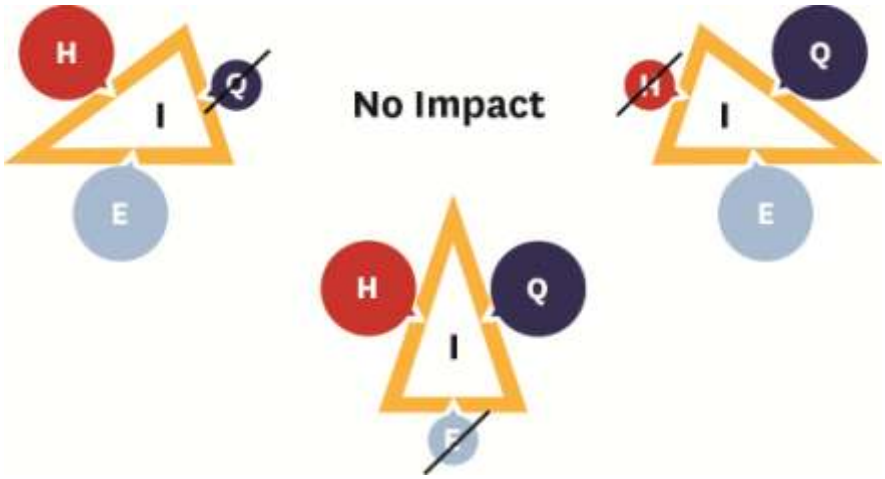


Figure 5. Illustration of No Impact Using FEAT Triangle

SECTION III: FEAT PROCESS

Section III constitutes the FEAT process. Subsections include:

- FEAT-P and FEAT-R Introductory Points
- A summary of the FEAT Lookup Tables
- The FEAT Core Process
- The FEAT-P Process
- The FEAT-R Process

Supplementary information can be found in the following annexes.

- Annex 1: A summary example of how to use the FEAT for preparedness
- Annex 2: The FEAT Lookup Tables
- Annex 3: Supplemental Forms
- Annex 4: KoBo Field Data Collection Tool
- Annex 5: FEAT Questions and Answers

FEAT-P and FEAT-R Introductory Points

The FEAT methodology can be used for both emergency preparedness (FEAT-P) and emergency response (FEAT-R). Although the core process of FEAT is the same for both FEAT-P and FEAT-R, there are differences in how the methodology is applied.

FEAT-P

FEAT-P helps the user to prepare an Initial Management Summary that includes triggering events and the potential impact of chemical accidents. The Summary is prepared on a high, abstract level with the objective to gain the awareness and commitment of key stakeholders. Once commitment is gained, FEAT-P can be started in order to prepare a (national and/or regional) emergency preparedness action plan. Consultation, cooperation and communication with key stakeholders in that process is the key to success.

FEAT-R

In contrast, FEAT-R is for use in the case of a chemical accident. It is used by emergency response teams that face the difficult task of swiftly assessing imminent risks to human life and the environment with the aim of saving lives and livelihoods. FEAT-R is intended to support those first responders, such as national responders and international teams, such as UNDAC and USAR.

FEAT-R, as a "first response" tool, is mainly intended for use with the first 72 hours after the occurrence of the accident. As definite information is lacking at such times, initiating and prioritization of optional responses is crucial and important decisions have to be made as soon as possible after occurrence of the accident.

The FEAT Pocket Guide serves as the hands-on tool for field use to apply FEAT-R. It provides concise information focused on facilitating rapid FEAT-R assessments. The FEAT KoBo data collection tool, usable on both laptop computers and smartphones, provides an additional aid to expedite FEAT-R field data collection.

The result of FEAT-R is an emergency response mitigation plan, including advice for governments on appropriate follow-up actions and – if deemed required – requirements for a request for additional assistance.

FEAT Stakeholder Considerations

Ultimately, the utility of both FEAT-P and FEAT-R depends upon commitment, consultation, and cooperation of key stakeholders.

Commitment

In order to develop and implement an emergency preparedness or mitigation action plan, it is critical to have political commitment from the national authorities to ensure resources and to implement and maintain the plan.

Consultation with key stakeholders

Experience has shown that preparedness actions require active involvement of key stakeholders, including representatives of enterprises that manage hazardous operations, industry associations, neighbouring communities and, of course, local authorities. In addition, there can be resources and competencies in universities, research institutes, environmental groups, local population (community groups) and/or NGOs. UN agencies and other international organizations can also be a valuable resource. The consultations should start early in the process of the assessment and development of the preparedness actions, and a consultation mechanism must be set up and maintained.

Likewise, during a response to a chemical release, stakeholders such as Local Emergency Management Agency (LEMA) officials, industrial managers, and other local authorities should be identified early so the FEAT-R process can most effectively support local efforts to mitigate impacts.

Cooperation with key stakeholders

Cooperation among agencies, ministries, and other relevant government bodies – as well as stakeholders with a role in chemical accident prevention, preparedness and response – is the key to success. Inclusivity is the goal, which means it is important to identify all of the relevant stakeholders and establish a consultative process. Coordination helps to minimize any conflicts or overlaps with existing policies or legal requirements. In addition to national authorities, consideration should also be given to those bodies at the local or regional level that have already determined roles and responsibilities, or should be involved in the process. For example, in many countries land-use planning, monitoring installations, emergency preparedness, and/or emergency response are the responsibilities of local or regional authorities.

Each country should consider how the cooperative effort can best be initiated and maintained, taking into account local customs and practices. For example, to start the process, a consultative meeting could be organized, chaired by an independent party. Alternatively, a lead agency might be identified that can convene a meeting with other authorities, or there may already be an inter-agency task force that can be charged with initiating discussions. If such mechanisms are not present, it is recommended to establish a task force on the country, region or local level.

FEAT Tables

The FEAT process utilizes a series of lookup tables. These tables allow maximum flexibility in different and evolving accident conditions. Both in preparedness and response, the tables and checklists can be used independently. The following summarizes the content of the FEAT tables.

Hazardous Operations Table

This table contains a summary of hazardous operations. For each hazardous operation the following default information is provided:

- Facility (e.g. Chemicals production)
- Facility Operation type (e.g. petroleum refining)
- Hazardous substance(s) (e.g. petroleum)
- Most common[9] hazardous substance (e.g. petroleum)
- Hazardous substance form (i.e. solid, liquid, gas)
- GHS hazard classifications (e.g. "Asp. Tox 1", "Aquatic Chronic 2" etc.)
- First priority response GHS hazard label and classification (e.g. "Flammable", "Flam. Liq1")
- Second priority response GHS hazard label and classification (e.g. "Aquatic Chronic", "Aquatic Chronic 2")

Tip: (Large) Infrastructure, such as hydrodams, is not part of the FEAT as no hazardous substances are being handled, produced, stored or transported. It is up to the user whether and how to include other types of hazards.

Substance Table

This table contains a summary of the most commonly utilized hazardous substances, ranked either by chemical name (alphabetical) or by CAS number. It also provides information on the form of the substance and the first and second priority response. The checklist is a summary derived from:

- Annex I of UNECE Convention on Transboundary Effects of Industrial Accidents
- Seveso III Directive
- United States Environmental Protection Agency (EPA)[10]

Pictogram Table

This table contains a cross reference demonstrating the relation between "GHS hazard classification" in pictogram/symbol form and the priority hazard.

Definitions of GHS Hazard Classifications

This table contains definitions for each GHS hazard class.

[9] The term "most common" means: a normative situation or hazardous substance, or being a considered as a general, standard or common practice

[10] http://www.epa.gov/emergencies/

Quantity Table

This table summarizes the typical size and spill rate for several types of containment units for transport or storage. This information can be used to estimate the quantity or spill rate in order to determine the total quantity that is (or has been) released.

Exposure Distance Table

With this table the user can determine the exposure distance by assessing the hazard (i.e. highest hazard classification) and the quantity for each hazard classification. In order to provide the user with exposure distances, several assumptions have been made as well as a selection of typical hazardous substances as "representatives" for a particular hazard classification.

Due to the extremely large variety (i.e. physical and chemical properties) of hazardous substances, there is also a large variety in exposure distances, in particular for toxic and aquatic hazardous substances. For this reason, the displayed exposure distances for environment are:

- the median ("average") exposure distance
- the range in exposure distance, visualized between brackets (minimum exposure distance - maximum exposure distance).[11]

Checklist: Understanding Impact

This checklist provides a graphical relationship between hazards, pathways, and potential exposures. It is not all inclusive and is provided to assist in understanding likely exposure potential.

Checklist: Triggering Events and Failure Types

This checklist provides information on:

- Triggering events: This can be used to identify and describe triggering events that can cause chemical accidents at a facility, in a region or country
- Failure types: This can be used to identify and describe defects in design, (chemical) process or quality, which are the underlying cause of a failure or which initiate a process which leads to a chemical accident. Human errors are included as a failure type

Checklist: for Emergency Preparedness and Response Interventions

This checklist provides the user with a (non-limitative) checklist of generalized interventions for emergency preparedness and emergency response.

[11] While the FEAT is based on scientific rigor, assumptions have been made in order to simplify the tool as much as possible. Exposure distances, as demonstrated, are for (swift) indication and priorization purposes only. For determining or calculation of exact or exposure distances, dedicated models and specialists should be consulted.

FEAT Core Process

Although there are differences in the preliminary actions and final outputs of FEAT-P and FEAT-R, the core steps of FEAT are applicable to both. This section details the core FEAT process with following sections providing how to apply the core FEAT steps to FEAT-P and FEAT-R. The 3 core steps of FEAT consist of:

1. Collecting information on priority hazards, quantity and exposures.
2. Looking up potential impact zones.
3. Advising on impact reduction and mitigation measures.

Assessment results are captured in the Impact Table (Figure 6 and Annex 2). The Impact Table supports the assessment process and facilitates standardized reporting. The following basic impact table is used in this section for illustrative purposes.

Impact Table

Area/ Location:										
Date/Time:										
Hazard Entry Point operation and/or substance		**Hazard Classification** priority responses	**Physical State** (gas, liquid, solid)	**Quantity** [kg]	**Receptor/s**	**Impact Zone [km]**				
Operation Type (and location)	**Substance** (and CAS #)					**Human**		**Environment**		
						Lethal	**Health**	**Soil**	**Lake**	**River**

Figure 6. FEAT Impact Table

Note: For field use, besides the essential information captured, in the Impact Table it is recommended to make notes on ambient air and water temperature, wind force and direction and any other details. These details are highly relevant for experts following up on rapid FEAT assessments with more detailed assessments. Recording GPS coordinates in decimal degrees and impact zones in meters can also aid in the production of impact zone maps. In addition, it is recommended to record comments on site observations or needs. All of this information can be recorded on the FEAT Impact Table Field Version found in Annex 2.

Note: In lieu of completing an excel Impact Table, the FEAT KoBo data collection tool may be used to electronically collect FEAT input data for compilation in an Impact Table at a central location. See Annex 4 on the deployment and use of the FEAT KoBo data collection tool.

➢ STEP 1: COLLECT INFORMATION ON PRIORITY HAZARDS, QUANTITY AND EXPOSURES

➢ First, determine the most likely hazard(s)

The FEAT entry points for determining the most likely hazard are the **type of operation/facility** present, the **name of the chemical substance** involved, and the **labeling** on the containment of a product. The name of the substance (and its form at which it has been released, e.g. gas, liquid, solid) is the preferred entrance to define the hazard because this information is the most specific and allows for the most accurate assessment of the impact. In disaster situations, however, information concerning potential chemical hazards may be limited to the type of facility present or a pictogram on a container. A strength of FEAT is that it is able to provide impact estimates based on this less specific information. As more detailed information becomes available, FEAT can be used to provide more specific impact estimates.

The following details how to use FEAT to determine the "priority" hazards using the Hazardous Operations Table, Substance Table, Pictogram Table and GHS Definitions Table. "Priority" hazards are predefined expert assumptions of the most likely hazard of a substance. If you know the type of facility/operation but do not have specific hazardous substance information, use the **Hazardous Operations Table** to determine hazards. If you know the name of a substance, use the **Substance Table** to determine hazards. If you only have information from the container labeling of a substance, use the **Pictogram** and **GHS Definitions Tables** to determine hazards.

➢ Using the Hazardous Operations Table

Check if a previous Impact Table is available.[12] If available, download it and select relevant hazardous operations.[13]

If a previous Impact Table is not available or is incomplete, use the **Hazardous Operations Table** (Annex 2) to identify hazardous operations in the area. This table provides the user with default information on the most commonly used hazardous substances at facilities in case specific chemical information is not available. See the practical guidance box to using the Operations Table below on how to use the Operations Table to determine priority hazards. Record the following information in the FEAT Impact Table:

1. The operation type
2. The default substance
3. The default substance form (Gas, Liquid, Solid)
4. The default first and second priority hazard classification(s)

Record each hazardous operation and priority hazard classification(s) on the FEAT Impact Table.

Tip: Information that can be helpful in identifying hazardous operations include listings of industrial facilities, activity descriptions (e.g. in permits), records of quantities of hazardous substances manufactured and imported in the country, information on the percentage of industry that uses and handles hazardous substances, chemical data profiles that collect information on the nature and extent of hazardous substances in the country and general industry and trade data. Industrial activities as defined by the UNECE Convention on Transboundary Effects of Industrial Accidents should be regarded as priority.

If possible, identify, verify and update information on hazardous substances with the operators of facilities, either by phone contact or by conducting a site visit.

[12] Previously completed Impact Tables are available from the Virtual OSOCC (http://vosocc.unocha.org/). Some previous versions of Impact Tables may be called "HIT's" (Hazard Identification Tool).

[13] Upon finalisation of this step it is recommended to provide feedback to the originator of the previous Impact Table and to share updates and information by uploading updated results

STEP 1:
Collect information on priority hazards, quantity and exposures

Practical guidance to using the **Hazardous Operations Table**

1. **Look up the type of facility** and the type of operation you are dealing with in column 1 and 2.

Hazardous Operation		Hazard			Entry Point Exposure Distance Table (FEAT-H) (default choice by expert opinion)	
		Hazardous Substance			First Priority Response	
Facility type	Operation type	Examples of most common hazardous substances at facility	Most common substance	Physical State	GHS hazard	Hazard classification
Agriculture and food production	Aquaculture	Disease control, oil, fertilizers, aquatonic chemicals, antifoulants	antibiotics (veterinary drugs)	solid	Health hazard	Muta 1B
	Beer production (brewery)	ammonia, solvents, acid, alkalis, neutral detergents, disinfectants, (chlorine compounds), hydrogen peroxide, formaldehyde	ammonia	gas	Toxic gas	Acute Tox. 3
	Food processing (poultry, meat, fish and dairy)	ammonia, solvents, acid, alkalis, neutral detergents, disinfectants, (chlorine compounds), hydrogen peroxide, formaldehyde, hydrogen	ammonia	gas	Toxic gas	Acute Tox. 2

2. **Enter the corresponding priority hazard classification** in the Impact Table and carry out the impact assessment after estimating the quantity and possibilities of exposure.

Hazard Entry Point		Hazard Classification	Physical State (gas, liquid, solid)	Quantity [kg]	Receptor/s	Impact Zone [km]				
Operation Type	Substance					Human		Environment		
						Lethal	Health	Soil	Lake	River
		Muta 1B								

Note! The Hazardous Operations Table provides you with commonly used substances in the listed operations. If you are able to find information on the actual substances used in the operation please switch to the Substance or Pictogram Table since these provide more specific information on the hazard.

➢ Using the Substance Table

STEP 1: Collect information on priority hazards, quantity and exposures

Operators (or others) may have information on the hazardous substances on-site and hazard classifications, assuming this information is accessible and operators are willing and able to provide it. If you have the name of a hazardous substance, look up hazard data with the **Substance Table** (Annex 2).

See the practical guidance box to using the Substance Table below on how to use the Substance Table to determine priority hazards. Record the following information in the FEAT Impact Table:

- The hazardous operation type (if known)
- The hazardous substances
- The hazardous substance form (Gas, Liquid, or Solid)
- The first and second priority hazard classification for each substance

! Practical guidance to using the Substance Table

1. **Find your substance** (alphabetic order) in the first column of the table and, if available, confirm the **CAS number**, a unique numerical identifier assigned by Chemical Abstracts Service (CAS) to every chemical substance.

Checklist Priority Hazardous Substances				Entry point Exposure (FEAT-R) [default choice by expert opinion]			
				First Priority Response		Second priority Response	
Hazardous Substance	CAS Number	Hazard Classification	Physical state (gas, liquid, solid)	GHS Hazard	Hazard Classification	GHS Hazard	Hazard Classification
Acetylene	[illegible]	Flam. Gas 1	Gas	Flammable	Flam. Gas 1		
1,1-Dimethylhydrazine [Hydrazine, 1,1-dimethyl-]	57-14-7	Aquatic Chronic 3, Acute Tox. 3, Carc. 1B, Muta. 2, Skin Corr. 1B, Flam. Liq. 2,	Liquid	Flammable	Flam. Liq. 1	Aquatic Chronic	Aquatic Chronic 2
Acrolein [2-Propenal]	107-02-8	Aquatic Acute 1, Aquatic Chronic 1, Acute Tox. 1, Acute Tox. 2, Acute Tox. 3, Carc. 2, Skin Corr. 1B, Flam. Liq. 2	Liquid	Toxic liquid	Acute Tox. 1	Aquatic Chronic	Aquatic Chronic 1

2. **Enter the corresponding priority hazard classification** in the Impact Table to carry out the impact assessment after estimating the quantity and possibilities of exposure.

Hazard Entry Point		Hazard Classification	Physical State (gas, liquid, solid)	Quantity [kg]	Receptor/s	Impact Zone [km]				
Operation Type	Substance					Human		Environment		
						Lethal	Health	Soil	Lake	River
		Acute Tox. 1								
		Aquatic Chronic 1								

➢ Using the Pictogram Table

If the only information available is labeling on the containment of the substance, use the **Pictogram Table** (Annex 2) to determine default priority hazards. See the practical guidance to using the Pictogram Table below on how to use the Pictogram table to determine priority hazards. Record the following on the Impact Table

- The substance form (Gas, Liquid, or Solid)
- The first and second priority hazard classification for each substance

If the containment has more than one label attached, list all the corresponding hazards for each label for the contained substance.

Caution: Containers may be improperly marked or labeled. Always try to confirm the identity of the hazardous substances with industry operators, shipping papers, safety data sheets (SDS's), etc.

STEP 1:
Collect information on priority hazards, quantity and exposures

! Practical guidance to using the **Pictogram Table**

1. **Match the depicted pictogram** in the first column of the table with the pictogram present on the substance containment. Be aware that there might be different pictograms indicating the same hazard. These refer to old and new labelling systems.

Hazard Pictograms					Priority Hazard
GHS Hazard	GHS Pic-togram	Ex. UN Trans. picto	Old Sym-bols	Hazard Classification	Hazard Classification
Physical hazard					
Explosive				Category 1.1, 1.2, 1.5, Unst. Expl Self react. A, B, C Org. Perox. A, B, C	Ox. Sol. 1
Flammable				Flam. Gas 1, Flam. Liq. 1, 2, Flam. Aerosol 1, Pyr. Liq. 1, Water-react. 1	Flam. Liq. 1

2. **Enter the corresponding priority hazard classification** in the Impact Table and carry out the impact assessment after estimating the quantity and possibilities of exposure.

Hazard Entry Point		Hazard Classification	Physical State (gas, liquid, solid)	Quantity [kg]	Receptor/s	Impact Zone [km]				
Operation Type	Substance					Human		Environment		
						Lethal	Health	Soil	Lake	River
		flam. Liq.1								

3. **If the containment has more than one label attached**, list all the corresponding hazards as starting points of more than one impact assessment of the contained substance.

Note! If one of the tables provides more than one priority hazard as the most likely hazard, use both of the hazards to perform two impact assessments (create two rows in the Impact Table).

Caution! Containers may be improperly marked or labeled.

- **Second, determine the released quantity of hazardous substances**

STEP 1: Collect information on priority hazards, quantity and exposures

Determine the quantity of the hazardous substance that was released. Information on quantities is preferably gathered from people with knowledge of the operation or situation, e.g. facility operators. If unknown, use the **Quantity Table** (Figure 7 and Annex 2) to estimate the quantity released.

If you are unsure of containment quantity details, assume the largest quantity. Record the quantity released on the Impact Table. **For FEAT-P**: Record the entire amount of the containment

Modality	Default		Unit Conversions
	Instantaneous Release (Typical Quantity) [kg]	Continuous Release [kg/s]	
INDUSTRY			**Weight**
Default: large storage tank	100,000,000	100	1 kilogram (kg) = 2.2 pounds (lbs)
Intermediate Bulk Container (IBC)	1,000	1	1 pound (lb) = 454 grams (g) = 0.454 kilograms (kg)
Drum	200	1	1 metric tonne = 1,000 kilograms (kg)
Gas bottle	50	1	1 metric tonne = 1.1023 short tons
Storage hazardous substances (mixed)	10,000	0.5	1 short ton = 0.907 metric tonnes
Ship (un)loading	100,000,000	100	1 short ton = 2,000 pounds
Storage tank- large	100,000,000	100	
Storage tank - medium	10,000,000	10	**Distance**
Storage tank - small	1,000,000	1	1 kilometer (km) = 0.621 miles
Process installation - large: e.g. vessels	100,000	10	1 mile = 1.61 kilometers (km)
Process installation - small: e.g. flanges	10,000	1	1 meter (m) = 3.281 feet (ft)
TRANSPORT RAIL/ROAD			1 meter (m) = 1.094 yards (yd)
Default: tank truck	25,000	100	1 yard (yd) = 0.914 meters (m)
Tank truck (default)	25,000	100	1 yard (yd) = 3 feet (ft)
Instantaneous	25,000	100	1 foot (ft) = 0.305 meters (m)
Large leak	5,000	100	
Small leak	1,000	10	
Rail wagon (default)	80,000	100	
Packed unit	10,000		
Container (default)	10,000	100	
Container small	25,000	100	
Container large	50,000	100	
Tank container	30,000	100	
Truck (toppled)	20,000	10	
Estimate for airplanes is the quantity of the kerosene refueling tankwagon	50,000	100	

Figure 7. Quantity Table

- **Third, Determine potential exposures**

Using the hazard information recorded from the above steps and any other information that may be available, determine potential exposure pathways (e.g. air, soil, lakes, rivers) and receptors (e.g. humans, crops, fish, etc.) that may be exposed to the released hazardous substances. Possible exposure information may be obtained from informants, field observations, maps (e.g. topographic, settlement, population, infrastructure, and others), and satellite imagery. Locations and features of particular importance include, but are not limited to; locations of releases (or potential releases), location of people, rivers, lakes, fishing grounds, drinking water sources, agricultural areas, irrigation channels, and drainage systems. For FEAT-R, noting weather conditions such as temperature, rain, wind speed, and wind direction is also useful. The following provides an example of potential exposure pathways and associated receptors for different forms of hazardous substances.

- **Gas:** Contact of humans with gaseous substances that disperse through the air.
- **Liquids**: Often directly target the aquatic environment, soil and groundwater. Humans may be indirectly exposed to liquids via drainage systems, groundwater wells or use of contaminated water. Emergency response fire fighting water runoff may potentially disperse hazardous substances into soil, aquatic environments, or sewage systems.
- **Vapour and/or Gas:** Humans May be exposed to gas that evaporates from volatile liquids.
- **Solids:** usually pose little exposure although dust and micro-particles may disperse by the wind, solute in water, or drift in water.

The Checklist: Understanding Impact in Annex 2 (figure 3) may also be used to help understand impact relationships between common hazard types, pathways, and receptors.

➢ STEP 2: LOOKUP ACTUAL IMPACT ZONES

➢ Determine exposure distances using the Exposure Distance Table

! Practical guidance to using the Exposure Distance Table

1. **Look up the priority hazard classification in the second column.** Find the released or potentially released quantity in the column 'quantity' and look up the corresponding impact distances to be considered for the different types of potential impact (human lethal, human health, environment-soil, environment-lake, environment-river).

Hazard			Quantity	Priority Hazard [expert opinion]				
				Human		Environment		
GHS Hazard	Hazard Classification	Explanation	kg	Lethal	Health	Soil	Lake	River
				km	km	km	km	km
Physical hazard								
Explosive	Category 1.1, 1.2, 1.3, Unst. Expl	Mass explosion, fragments	1,000	0.2 km	0.4 km			
	Self react. A, B, C	Explosive when heated	10,000	0.3 km	0.7 km			
	Org. Perox. A, B, C	Explosive when heated	100,000	0.6 km	1.3 km			
			1,000,000	1.3 km	3.2 km			
Flammable	Flam. Gas 1	Extremely flammable	1,000,000	0.2 km	0.3 km			
	Flam. Liq. 1, 2	Flashpoint < 23 °C	10,000,000	0.4 km	0.6 km			
	Flam. Aerosol 1	Extremely flammable	100,000,000	1.2 km	1.8 km			

2. **Enter the corresponding priority hazard classification** in the Impact Table and carry out the impact assessment after estimating the quantity and possibilities of exposure.

Hazard Entry Point		Hazard Classification	Physical State (gas, liquid, solid)	Quantity [kg]	Receptor/s	Impact Zone [km]				
						Human		Environment		
Operation Type	Substance					Lethal	Health	Soil	Lake	River
		Category 1.1 explosive		1,000		0.2 km	0.4 km			

Note! Use the **Checklist: Understanding Impact** to establish the links between hazards and exposure (routes and receptors) from the impact assessment after estimating the quantity and possibilities of exposure.

Use the **Exposure Distance Table** to determine impact distances for humans (lethal and health) and the environment (soil, lake, and river) for the priority hazard classifications. See the practical guidance box to using the Exposure Distance Table below for instruction on how to use the Exposure Distance Table. Record the Impact Distances for each hazardous substance in the Impact Table.

➢ Identify potentially exposed receptors

Using the information on potential exposure pathways and receptors from step 1 and the FEAT Impact Distances, determine the likely receptors and routes of exposure for each substance. Record receptors and routes of exposure in the Receptor/s column in the Impact Table.

➢ Ensure the Impact Table is complete

Make sure the Impact Table is complete. Figure 11 provides a summary of where information may be found to complete the Impact table.

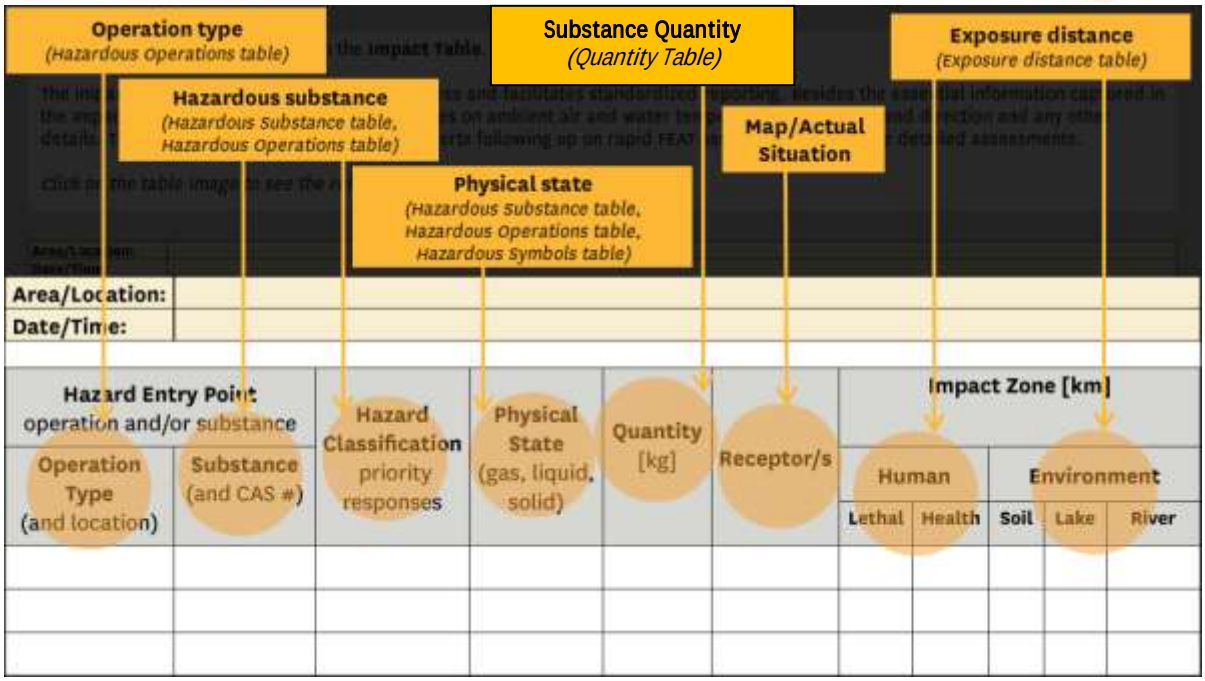


Figure 11. Summary of Information Sources to Complete a FEAT Impact Table

➢ Verify and update hazard information

Verify and update hazard information: check if the hazardous substances are actually present at all hazardous operations. This may be done by site visits or by checking with industry operators (See the FEAT-P and FEAT-R sections of the Reference Guide for more information). Replace default data with actual data, where available. Check in particular the name of hazardous substance, the hazard classification and the actual quantity released (or potentially released).

Once the FEAT Impact Table is complete it is often useful to collect more detailed chemical hazard information to aid technical response teams, medical personnel, and Local Emergency Management officials in preparedness and mitigation measures. This information can include, but is not limited to:

- Chemical name (product name or trade name is not sufficient). (Should be recorded on FEAT Impact Table)
- CAS number[14] (Record on FEAT Impact Table)
- Aggregation (gas, liquid, solid)
- Detailed Chemical and Physical Properties
- Health Hazards
- Fire Hazards
- PPE
- Environmental Conditions
- Recommended Monitoring/Sampling equipment
- Recommended Decontamination
- Hazard and precautionary statements

[14] Every hazardous substance has a so called "CAS Registry Number". A CAS number is an unique numerical identifier assigned by Chemical Abstracts Service (CAS) (https://www.cas.org/content/chemical-substances).

This detailed chemical hazard information can be summarized on a form such as the **Hazardous Substance Data Sheet** in Annex 2 or other similar format.

Tip: Use Safety Data Sheets, chemical handbooks or internet websites to collect detailed chemical hazard information.[15] Hazardous substances listed in the Annex of the Seveso Directive (as in Annex I of the UNECE Convention on Transboundary Effects of Industrial Accidents) are regarded as priority. The result of this step is a set of hazard data.

Note: An initial FEAT Impact Assessment begins with assessing the impacts of the first and second priority response hazard classifications for each hazardous substance. For a complete FEAT assessment, the FEAT process needs to be completed for all hazard classifications listed for each substance.

➢ Create hazard impact maps

Creating hazard impact maps should give an insight into the potential exposure to humans and environment in the proximity of an accident. This objective is met by visualizing locations of hazardous operations and plotting exposure distances on the map.

1. Select a mapping instrument, such as Google Maps, Open Street Maps, Bing Maps or satellite information
2. Create hazard map:
   - Prepare Layer 1: Select geographical area
   - Prepare Layer 2: Mark locations of hazardous operations on the map (Figure 8)
   - Prepare Layer 3: Plot exposure distances for each hazard (Figures 9 and 10)

Figure 8. Example of Marking Locations of Hazardous Locations

[15] The database used for FEAT is the European Chemicals Agency (ECHA) http://echa.europa.eu/home

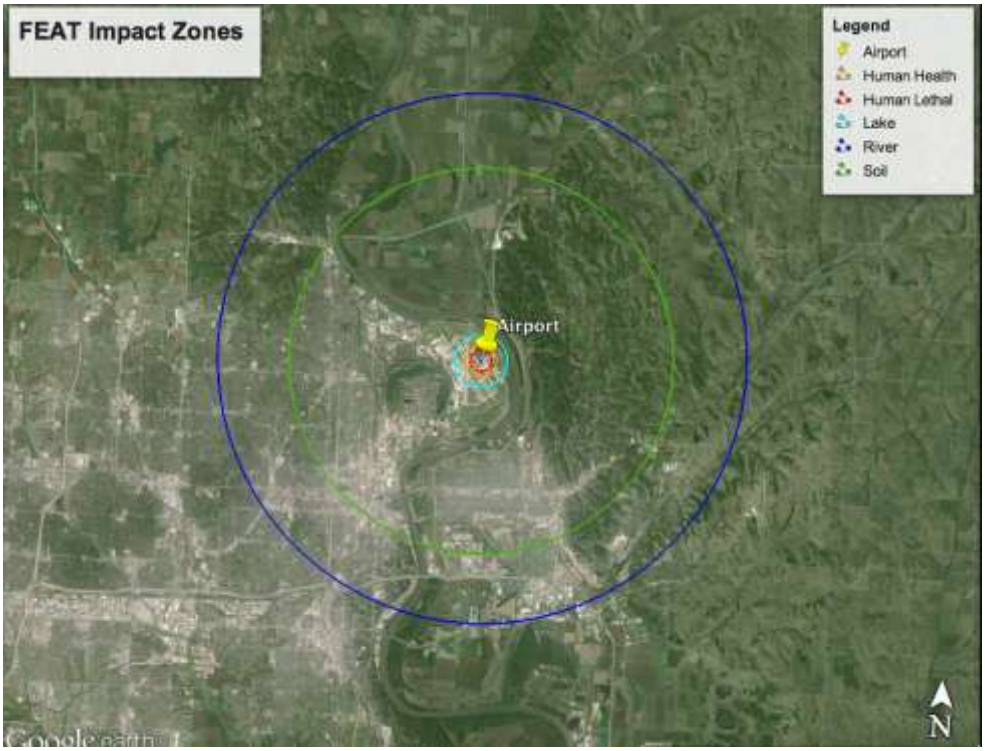


Figure 9. Example of Impact Zone Map

Figure 10. Example of Impact Zone Map

➢ STEP 3: IMPACT REDUCTION AND MITIGATION MEASURES

The third step in the FEAT Core Process is to develop either risk preparedness measures and Emergency Preparedness Action Plan (FEAT-P) or a FEAT Mitigation Plan (FEAT-R) to mitigate the impacts of actual (or threatened) releases of hazardous substances. Development of these plans is detailed in the FEAT-P and FEAT-R sections of this Reference Guide respectively.

➢ Provide FEAT Assessment Results with all Relevant Stakeholders

Once the FEAT Assessment is completed, information on impacts as well as reduction or mitigation measures needs shared with all relevant stakeholders.

- Provide all FEAT assessment results and mitigation suggestions to relevant stakeholders such as the Local Emergency Management Officials (LEMA), political leaders, NGO's, and others.
- Upload the FEAT Impact Table and maps to the Virtual On Site Operations Coordination Center (VOSOCC) if activated.
    - Choose the "Environmental Risks" tab under the "Operational Environment" section of the VOSOCC.
    - Upload the FEAT Impact Table, Impact Distance Maps, and photos to the VOSOCC.
    - Provide an environmental risk situation summary, mitigation plan information, and any other relevant comments in the "Environmental Risks" section of the VOSOCC.

Note on scope of FEAT Impact Assessment in the field

- The FEAT Tables offer an expert opinion on the most likely priority hazard(s) of a substance, hazardous operation or a hazard label encountered focusing on hazards impacts of most concern. FEAT users should verify the predefined expert opinion with the actual situation in the field. Some notes and guidance:

- In some cases a chemical substance poses more than one type of hazard that needs to be taken into account. Several toxic liquids are hazardous to humans as well as to the aquatic environment. For example, a toxic liquid may flow into a river harming fishing grounds and at the same time enter the drinking water system with subsequent direct human health impacts. FEAT lists both hazards as priority concern, and the user should perform an impact assessment for both hazards.

- The form of the substance is an important factor when establishing priority hazards and possibilities of exposure. FEAT uses the form of a substance under ambient conditions to predefine the hazards. Liquids with high volatility may cause impact due to evaporation. The Exposure Distance Table provides estimates for toxic liquids' toxic impacts on humans due to evaporation (assuming a spill of 1500 m^2 or 10.000 m^2 depending on the amount of substance). Worst cases for impact distances may be estimated by using the distance indicating the most toxic gas (Coded "Acute tox1") with an estimate of the quantity evaporating.

- Substances flammable under ambient conditions often also pose a hazard of vapour cloud explosion in case they're not (properly) contained. FEAT evaluates substances as explosive in case of explosive properties even without containment. Highly flammable substances are not listed as explosive but may explode in certain conditions (heated containment). FEAT provides an expert opinion of the most likely priority hazard, but does not include all kind of exceptions and specific situations. FEAT users must check the full range of possible hazards present in order to assess possibilities of serious impact caused by substances and situations other than those included in the Pocket Guide.

- Distance–concentration relationships were analyzed to determine impacts for the different exposure pathways in standard scenarios. Local lake or river shapes will differ from the standard scenarios. When local conditions differ from the defaults, expert judgment can be used to evaluate the tabulated ranking results, e.g., a water body twice as deep as the standard water body yields a halved impact distance as modified from the lookup table results. Exposure assessment for gases was done assuming a wind speed of 5 m/s (moderate, light breeze; 3 Beaufort; small branches and leaves are moving continuously) and a Pasquill stability class D (neutral conditions). Concentrations for liquids were assessed in relation to various pathways, whereby the lookup tables represent the outcomes for predefined conditions (emission to a standard lake, river and soil, respectively). For a standard lake (depth 1 m, cylindrical shape), a critical impact distance was defined as the lake radius (in m) for which it would hold that the critical concentration for an endpoint would not be passed. For a standard river (depth 1 m, width 50 m), a critical impact distance was defined as the length of the affected river stretch (in m). For soil, the standard scenario was based on the standard lake scenario, and led as if dispersion occurs via a small water layer (2 cm thick) on the earth.

- Although the above explanation of the core FEAT steps focused on estimating impacts for only the priority response hazard classifications of hazardous substances, a complete FEAT assessment should be completed for all hazard classifications of hazardous substances in FEAT-P and for all hazard classifications of hazardous substances with a first or second priority hazard classification that are confirmed to be released in FEAT-R.

FEAT-P Process

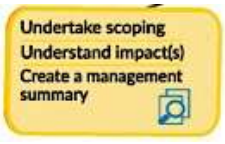
The following process outlines the application of the FEAT core steps for emergency preparedness. The FEAT-P process includes:

- FEAT-P Preliminary Steps
  - Undertaking scoping
  - Understanding impacts
  - Creating a management summary
- Applying the core FEAT steps
  - STEP 1: Collecting information on
    - Hazards
    - Quantity of hazards
    - Exposures
  - STEP 2: Looking up impact zones
    - Completing FEAT Impact Table
    - Creating impact maps
  - STEP 3: Impact Reduction and Mitigation measures
    - Preparing an Emergency Preparedness Action Plan
    - Providing results to stakeholders
- Develop a FEAT-P Emergency Preparedness Action Plan

FEAT-P Preliminary Steps

Prior to conducting a FEAT-P assessment, three preliminary steps are performed to determine the potential impact of chemical accidents and to raise awareness for preparedness activities.

First, undertake scoping



Select an area that is practical, to keep a good overview and to keep control over the data collected. It may be practical to select an entire country if the number of hazardous operations is limited. Another option is to select areas with concentrations of hazardous operations – for example industrial areas.

If a country has national legislation regarding a chemical accidents programme, for example the Seveso Directive, US Risk Management Program, or the Korean Industrial Safety and Health Law, or if a country is party to the Convention on the Transboundary Effects of Industrial Accidents, the activities within the scope of this legislation should be identified as priority sites. The same is valid for the hazardous substances identified in Annex I of the convention. Findings from the use of the FEAT should be communicated to appropriate organizations and stakeholders to ensure that appropriate emergency management actions are taken and that timely and accurate requests for additional, specialized equipment or expertise are made.

➢ Second, understand impacts

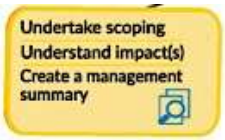
Use the Checklist: Triggering Events and Failure Types (Figure 11 and Annex 2) to identify triggering events and failure types for chemical accidents.

Tip: Involve key stakeholders in the process. Information sources include (environmental) authorities or industry associations.

Checklist: Triggering Events and Failure types	
Triggering events	**Failure types**
<u>Natural hazards:</u> • Avalanche • Earthquake • Flood, tsunami • Landslide, mud stream • Typhoon, storm, hurricane, cyclone, drought, tornado • Wildfire • Volcanic eruption	• Natural origin • Hydrological • Meteorological • Climate change • Side effects of human actions (e.g. deforestation)
<u>Social and man-made hazards</u> • Crime • Arson • Civil disorder • Terrorism • War	• Deliberate acts
<u>Hazardous operations:</u> • Chemicals production • Forestry • Agriculture and food production • Oil and Gas Exploration and Production • General manufacturing • Mining' • Transport and infrastructure • Transport interfaces • Pipelines • Small and medium enterprises	• General: Human error, inadequate operational control, lack of maintenance, lacking safety culture • Industrial facilities: corrosion, erosion, high level (overfilling), high pressure (overpressure, vacuum), high temperature, chemical reactions, mechanical, damage, failure of components, external impact (extreme weather conditions, collapse of structure) • Transport: accidents, (in) loading, overfilling • Pipelines: corrosion, overloading from above (e.g., heavy vehicles, building works), damage during excavation, sabotage, vandalism, theft, impact with vehicles or moving objects, natural hazards (earthquakes, flooding,.), subsidence, (seasonal) melting of the permafrost

Figure 11. Checklist: Triggering Events and Failure Type

The Checklist: Understanding Impact (Figure 12 and Annex 2) can then be used to assist in describing the relationship between common chemical hazards and typical exposures.



- Hazards: Select applicable physical hazards, health hazards and/or hazards for the aquatic environment.
- Exposure:
  - Consider pathways how hazardous substances spread in the environment
  - Identify receptors in the proximity of the chemical accident location

CHECKLIST: UNDERSTANDING IMPACT

Hazard	Exposure				Exposure					
	Pathway				Receptor					
GHS Hazard	Air	Soil, Groundwater	Lake	River	Human	Fishing Area	Soil, Groundwater	Agricultural Area	Nature Reserve	(Critical) Infrastructure
Physical hazard										
Explosive	X				X					X
Flammable	X				X					X
Oxidizing	X				X					X
Gases under pressure	X				X					X
Health hazard										
Toxic gas	X				X				X	
Toxic liquid (volatile)	X	X	X	X	X	X	X	X	X	
Toxic liquid (not volatile)		X	X	X		X	X	X	X	
Corrosive	X				X					X
Irritant	X				X					
Health hazard	X	X	X	X	X	X	X	X	X	
Environmental hazard										
Hazards for aquatic environment		X	X	X		X	X	X	X	

Note: Volatile liquids produce hazardous vapors which can affect human health by air exposure. Assume a toxic liquid is volatile if unsure.

Figure 12. Checklist: Understanding Impact

➢ Third, create a FEAT-P Management Summary

Describe the output of this step on a strategic level, for example as a "Management Summary." Keep it short, simple and to the point. One of the main objectives of this step is to raise awareness and to gain a first insight into the potential impacts (types and magnitudes) of chemical accidents. Figure 13 is an illustration of a sample Management Summary.

FEAT-P Management Summary – Understanding Impact	
Case	Farland
Country baseline information	Farland is a developing country with approx. 2 million inhabitants. Farland has two big cities: Port city (400.000 people, located at the coast) and Metropolis (250.000 people, located 50 km inland). The industrial sector of Farland is rapidly developing. The main industry is the production of textile (garments), agriculture (crops, sugar production) and food processing (diary and frozen fish processing). Several industrial zones are located near Metropolis. There is also an oil terminal located at the port area of Port city, Farlands's capital. An oil pipeline is running from Port city land inwards to Metropolis. A pesticide storage is located in the North west of Farland, in the mountains, The Farland River runs down from the mountains to Port city and Farland sea. The city of Metropolis is located at the estuary. The river is used by the downstream population for drinking water, household use and irrigation of rural fields with crops.
Triggering event	**Description**
Natural hazards: • Geographical extend • Magnitude • Potential of triggering another natural hazard	An earthquake can occur at Farland with a magnitude of 7.5 (Richterscale). If an earthquake occurs at sea, it can trigger a tsunami. If the tsunami hits the coastline of Farland, the oil terminal at the port area of Port city could be heavily affected. It is assumed that the industrial zones around Metropolis would be less affected. The coastal population of Port city however would be heavily exposed to tsunami waves. If the earthquake occurs near/at Farland, buildings and structures may collapse.
Social and manmade incidents	Social and manmade hazards, such as arson or terrorism, are not likely to occur, as the socio-economic situation is stable and crime rates are relatively low. Theft from the oil from the pipeline has occurred sporadically before.
Hazardous operations: • Industrial facilities	Chemical accidents can occur due to human failure or lack of maintenance. The oil storage, located near the estuary, could have direct loss of containment of oil into Farland river. This can lead to adverse impact (pollute) to aquatic life and the coral reef at the coast of Farland. An accident at the pesticide storage could lead to significant impact on the environment (river, soil, and groundwater). The warehouse (frozen fish) has refrigerating installations containing ammonia. A toxic cloud of ammonia can have severe impact on inhabitants of Port city. The garments industry is using several (highly) toxic liquids. A chemical accident could pollute Farland river and drinking water.
Hazardous operations: • Transport modalities (road, railway, water)	Oil, solvents and chemical products are transported by road (trucks), rail and small tankers, sailing up and down Farland river. A collision or a road accident could lead to a chemical accident.
Hazardous operations: • Transport interfaces	There is a marshalling yard near Metropolis, where several types of hazardous substances are handled. Human error (e.g. by not following procedures) could lead to a chemical accident.
Hazardous operations: • Pipelines	Spills from the pipeline may be due to lack of maintenance of the pipeline, pump stations and/or valves and flanges.

Figure 13. FEAT-P Management Summary

➢ Apply FEAT Core Steps

Following the preliminary steps of scoping, understanding impacts, and the creation of a FEAT-P Management Summary, the FEAT core steps are then applied to assess impacts of hazardous substances in the designated area.

➢ STEP 1: Collect Information on Priority Hazards, Quantity, and Exposures

- First, determine **hazards** using the:
  - Hazardous Operations Table
  - Substance Table
  - Pictogram Table
  - GHS Definitions Table
    (See Section 3.3, FEAT Core Process)
- Second, determine the **quantity** of hazardous substances from:
  - Direct knowledge (facility operators)
  - Quantity Table
    (See Section 3.3, FEAT Core Process)
- Third, determine potential **exposures** using:
  - Hazard information collected
  - Local informants
  - Field observations
  - Maps / Imagery
  - Checklist: Understanding Impact
    (See Section 3.3, FEAT Core Process)

➢ STEP 2: Lookup Actual Impact Zones

- Determine impact zones using the Exposure Distance Table
- Identify potentially exposed receptors
- **Ensure Impact Table is complete**
- Verify and update hazard information
- **Create hazard impact maps**
  (See Section 3.3, FEAT Core Process)

➢ STEP 3: Impact Reduction and Mitigation Measures

- Identify and initiate emergency preparedness actions
- Define risk reduction strategy
- Define priorities
- **Develop an emergency preparedness action plan**
- **Provide FEAT Assessment Results with all relevant stakeholders**
  - LEMA and government officials
  - NGO's
  - Upload to VOSOCC

As the application of step 3 differs between FEAT-P and FEAT-R, the following provides the application of step 3 to emergency preparedness. The final output is a FEAT-P Emergency Preparedness Action Plan used to start and guide risk reduction.

➢ Develop a FEAT-P Emergency Preparedness Action Plan

The FEAT-P Emergency Preparedness Action Plan shall be prepared in cooperation with key stakeholders – as preparedness planning is a joint responsibility of government authorities and industry. Consult:

- Public authorities: Responsible for preparedness planning to protect the community, the environment, and property outside the boundaries of the installation.
- Owners/operators: Responsible for on-site preparedness planning, addressing possible impacts within the boundaries of the installation (on-site plans), and for providing the information needed by authorities to develop community emergency plans.
- Other parties: Such as (representatives of) communities that are subject to exposure of risks. These parties can be invited to collaborate in the process of emergency preparedness planning.

The activities in this step are as follows:

1. Identify and initiate emergency preparedness actions.
2. Define the risk reduction strategy.
3. Define priorities.
4. Prepare Emergency Preparedness Action Plan.

➢ Identify and initiate emergency preparedness actions

Identify and initiate adequate preparedness planning actions and develop testing of emergency preparedness plans in order to ensure that adverse effects of chemical accidents are effectively mitigated. It is not possible to totally eliminate the risk of a chemical accident at hazardous installations even with the best accident prevention system in place. In other words, not all incidents can be avoided and there is always a residual risk that an accident can occur.

➢ Define risk reduction strategy

Develop a long-term, strategic level risk reduction action plan. The FEAT helps to identify which facilities take priority, including an indication of those that could fall into a chemical accident prevention and preparedness programme (CAPP).[16]

Tip: Make a plan of facilities where emergency preparedness plans shall be tested. Do not forget to assign responsibilities and timescales for the actions. Integrate individual emergency plans and develop CAPP programmes at the national, local and/or regional levels.

[16] The United Nations Environmental Programme is leading an International Initiative – the Flexible Framework Initiative for Addressing Chemical Accident Prevention and Preparedness ("the Flexible Framework Initiative") – promotes improved chemical accident prevention and preparedness (CAPP), particularly in fast-growing economies and developing countries that need support to address the increased risks of chemical accidents. The Flexible Framework Initiative aims to:

- increase countries' understanding of issues related to chemical accident prevention and preparedness
- improve the capacity of relevant institutions, agencies and experts to address the risks of chemical accidents
- help countries to develop and implement an appropriate chemical accident prevention and preparedness programme.

➢ Define priorities

This activity includes defining priorities. As part of this step, the insights – as gained in the first two activities of this step – shall be used to prioritize local, regional and/or national actions related to emergency preparedness. Develop a realistic time line to move forward in light of the availability of resources. At-risk populations may need to be involved at this process.

Tip: Prioritization can help to identify which elements of the preparedness activities should be further developed and implemented first, recognizing that it is generally not possible to establish an Emergency Preparedness Action Plan covering all elements of chemical accidents and that a plan can be expanded as resources and experience allow. Staffing and other resource constraints need to be taken into account so that any plan that is established can be effectively implemented and enforced.

➢ Develop the FEAT-P Emergency Preparedness Action Plan

The final step is to draw up the FEAT-P Emergency Preparedness Action Plan. The plan shall include measures for risk reduction and preparedness planning, priority and time table (see previous steps). Preparedness planning can be differentiated through the roles of authorities (information management, inspections, land-use planning), industry requirements (notification, safety management systems), and methods for communicating with the public. While FEAT-P supports prioritizing these actions, it does not provide detailed instructions on how to undertake these tasks. There are other UN handbook documents available for elaborating upon specific aspects of prevention and preparedness.[17]

NOTE: ACTIONS FOR AUTHORITIES

Authorities shall identify emergency preparedness actions that should be developed or incorporated. Decisions concerning the actions should reflect a realistic assessment of what can be done given available resources – human, financial, and technical – and the political and regulatory context. It can start with a limited number of elements to address the most pressing needs and expand as experience and resources allow.

Tip: Each country needs to carefully consider how best to initiate and maintain its emergency preparedness action plan. This is not a one-time decision but, rather, an iterative process that will evolve over time. It is essential to periodically review the actions to determine whether it is achieving its goals and whether there is a need to amend or expand the actions in light of new information, changing risks, resources, priorities, and experience.

[17] Reference is made to the Flexible Framework where the user can find more information on the specific roles and responsibilities of authorities and industry. The "*Flexible Framework for Addressing Chemical Accident Prevention and Preparedness: A Guidance for Governments*" (UNEP, 2010) contains guidance for each preparedness and prevention element of a typical national or regional chemical accidents programme. For further information please refer to http://www.capp.eecentre.org/upload/images/pub_FF_Brochure_English.pdf

NOTE: ACTIONS FOR OPERATORS

A checklist for actions by operators of hazardous operations (see) includes actions in order to meet obligations and operating installations safely as specified.

NOTE: INFORMATION AND PARTICIPATION OF THE PUBLIC

The public shall be informed of, and may be involved in decision making on preparing the Emergency Preparedness Action Plan. Information to the public should be provided to those potentially affected in the event of an accident. The responsibility for carrying out the information dissemination should be identified and usually involves a joint effort between authorities and industry. Further information on how to carry-out public information and coordination activities is provided in other UN handbook documents.[18]

[18] Awareness and Preparedness for Emergencies at Local Level: A Process for improving community preparedness for the risks of technological accidents at the local level (UNEP, 2014).

Sample FEAT-P Emergency Preparedness Action Plan		
Actions for Authorities	Goal	How
• Planning • Institutional and Legal System • Information Management and Communication • Early Warning systems • Resource base (human, materials, funds) • Response mechanisms and coordination • Education, Training, Risk Awareness • Exercises	• Clearly identify which authorities are responsible for each element of the chemical accidents programme. • Ensure that the authorities have the resources (including appropriate levels of trained staff) to fulfill their responsibilities. • Take the steps necessary to implement the elements of the chemical accidents programme and promote chemical safety by all stakeholders	• Allocate roles and responsibilities. • Start this process by undertaking an assessment of the authorities' roles, and the resources required. • Consider whether there should be more than one authority involved in the implementation; minimize overlaps. • Ensure qualified staff to carry out the authorities' roles. • Maintain training programmes (training) to ensure continuing competency. • Seek help from external sources if the expertise needed to carry out some of their responsibilities is not available internally. • Establish a mechanism to help ensure cooperation among authorities. • Address the establishment of enforcement procedures
Actions for operators	Goal	How
• General Obligation to Operate Safely • Notification • Safety Management • Hazard Identification and Risk Assessment • Resource base • Response mechanisms and coordination • Education, Training, Risk Awareness • Preparedness Planning • Exercises	• Establish a safety culture, reflected in policies and procedures, with all employees understanding acting accordingly. • Develop and implement a safety management system so that hazards and risks are identified and assessed, appropriate technology is used, procedures are in place, and an effective organizational structure is established. • Prepare for any accidents that might occur. • Seek continuous improvements.	• Know the hazards and risks at installations where there are hazardous substances. Conduct risk analysis activities to understand the potential hazards and consequences of an accident. • Promote a "safety culture" that is known and accepted by workers and managers throughout the enterprise. • Establish safety management systems and regularly monitor/review their implementation. • Utilize "inherently safer technology" principles in designing and operating hazardous installations. • Be especially diligent in managing change. • Prepare for any accidents that might occur. • Assist others to carry out their respective roles and responsibilities. • Seek continuous improvement.

Sample FEAT-P Emergency Preparedness Action Plan (Continued)		
Information and participation of the public	Goal	How
• Participation in preparing Preparedness Plan • Information to public to be provided	• The potentially affected public is aware of the risks in their community and know how to act in the event of an accident.	• Identify installations with the potential for accidents with off-site effects and define the related population at risk in the event of an accident. • Establish a system to communicate with the potentially affected public (which can be done by the industry, by public authorities, through third parties or through some combination of these). • Communicate in a language and form that can be understood by the target audience. • The information needs to be realistic • Several channels should be used to circulate information, choosing those that are appropriate for the community (e.g., in newspapers, television/radio) • Assign the responsibility for communication with the public. • Ensure that the information to be provided to the public is consistent with the emergency planning strategies. • Periodically test the effectiveness of the communication scheme to increase the likelihood that the information is reaching the right audience. • Provide information to the media so that they have the necessary background to be an effective source of information should an accident occur. • Establish means for the public to communicate with authorities and industry. • Include the public across borders if there is a risk of an accident with transboundary effects.

FEAT-R Process

➢ FEAT-R Preliminary Step (Request Assistance)

Prior to applying the FEAT core steps during a major environmental emergency, international assistance may be requested.

➢ How to request international assistance (if requested by the government of the affected country)

International assistance in the event of a major environmental emergency or industrial accident can be requested from other countries bilaterally, through regional organizations and through the United Nations system. Within the UN, the Joint UNEP/OCHA Environment Unit (JEU) is the mechanism that mobilizes and coordinates assistance to countries affected by environmental emergencies and natural disasters that have resulted in a significant environmental impact.

The activities in this step are as follows:

1. Establish contact with the UN and provide baseline disaster information.
2. Describe the triggering event and stricken (area/country)
   - Natural disaster, or;
   - Social, man-made accident, or;
   - Hazardous operations at industrial facility, transport, transport interface and/or pipeline.
3. Describe immediate and acute needs.

Humanitarian and specialized environmental emergency assistance is requested by Member States through the UN Resident Coordinator in country, and/or OCHA's Country of Regional Offices. It is important to note that international assistance can be requested in case of an overwhelming national situation with insufficient national capacity to cope, as well as clearly demonstrated acute an urgent humanitarian consequences. Please consult also the Environmental Emergencies Guidelines (http://www.eecentre.org/eeguidelines/).

In extreme urgent and acute situations, assistance can be requested by contacting OCHA's Emergency Duty Officer: +41 22 917 1600.

➢ Apply FEAT Core Steps

Following the request of international assistance (if made) the FEAT core steps are applied to assess impacts of hazardous substances in the affected area.

➢ STEP 1: Collect Information on Priority Hazards, Quantity, and Exposures

- First, determine **hazards** using the:
  - Hazardous Operations Table
  - Substance Table
  - Pictogram Table
  - GHS Definitions Table
    (See section 3.3: FEAT Core Process)

- Second, determine the **quantity** of hazardous substances from:
  - Direct knowledge (facility operators)
  - Quantity Table
    (See section 3.3: FEAT Core Process)

- Third, determine potential **exposures** using:
  - Hazard information collected
  - Local informants
  - Field observations
  - Maps / Imagery
  - Checklist: Understanding Impact
    (See section 3.3: FEAT Core Process)

➢ Conducting site assessments

When completing Step 1 of the FEAT-R process, conducting site assessments is invaluable in identifying all factors relevant to the emergency response, such as the nature and extent of the chemical accident and potential exposure information.

Tip: Before performing the on-site assessment in the field, make sure that the basic safety practices are known, personal protective equipment is provided and precautionary measures for field assessments are agreed upon and applied. This is of major importance when conducting surveillance of situations involving hazardous substances. If you are unsure about the safety of the situation or how to protect yourself, do not perform the on-site assessment.

- ➢ Go to locations of relevance and conduct interviews and/or site visits. This activity includes noting local observations, such as casualties, dead animals or particular smells. Describe the following items:
  1. The affected area.
  2. The most hazardous operations (as selected in the previous step), including:
     a. Type of hazardous operations (or operations that are exposed).
     b. Hazardous substances involved.
  3. Pathways by which the hazardous substance are (likely to be) released into the environment. For example, if the facility is located near the river/sea, assess the actual current direction (water), (prevailing) wind direction, and consult the weather forecast.
  4. Receptors in the area (human and environment).
  5. The impact on humans and environment.

In addition, collect and review (the results of) monitoring reports that are already prepared and available. For example, air measurement results or water sampling results.

Ensure that no hazards have been overlooked. If the on-site assessment reveals additional hazardous operations and/or substances that were released or have a strong potential to be released, then complete a FEAT assessment on these operations / substances as well.

Tip: The organization in charge of the information collection should consult with other stakeholders – for example local authorities or fire services – who may maintain industry inventories or other records of interest. Ministries of health, labour, industry and environment may also be potential sources for such data. NGOs, such as industry associations, research institutions, and environmental groups might also have relevant information.

- Conclude whether there is actual impact by answering the following three impact-determining questions with the information you have collected:
  1. Have hazardous substances been released?
  2. Have pathways, by which hazardous substances are transported into the environment, been identified and confirmed? (e.g. by air or water)
  3. Are there actual human or environmental exposures? (Creation of a hazard impact map described below can be useful in answering this question)
  4. If the answer to all three questions is "Yes" then there is an impact. Describe the actual impact on the basis of the observations, the confirmed data, the interview results and other data collected.

Tip: Do not only look at actual impact, but also at the *potential* impact, in particular when the accident is still ongoing.

STEP 2: Lookup Actual Impact Zones

- Determine impact zones using the Exposure Distance Table
- Identify potentially exposed receptors
- **Ensure Impact Table is complete**
- Verify and update hazard information
- **Create hazard impact maps**

If you do not have complete information, summarize the major information gaps and recognized needs (see Step R-3). All items (as deemed required) can be mentioned here, for example gaps regarding:

- Hazardous operations.
- Hazards: Hazardous substances released, quantity, physical or chemical properties, or Loss of Containment details.
- Resources: Equipment and resources/capacity for impact reduction, decision-making.
- Expertise: Knowledge gaps, gaps in expertise.
- Communication: Stakeholders, communication lines.
- Emergency response information: Response plans or response details.
- Logistic services or (missing) infrastructure or equipment

STEP 3: Impact Reduction and Mitigation Measures

- Determine emergency response strategy
- Draw up recommendations
- **Prepare FEAT-R Mitigation Plan**
- Provide FEAT Assessment Results with all relevant stakeholders
  - LEMA and government officials
  - NGO's
  - Upload to VOSOCC

As the application of step 3 differs between FEAT-P and FEAT-R, the following provides the application of step 3 to emergency response. The final output is a FEAT-R Mitigation Plan used to reduce the impacts of the chemical releases.

➢ Develop a FEAT-R Mitigation Plan

The Mitigation Plan can be developed separately, or integrated into an overall disaster response plan. Either way, the plan needs to contain sufficiently detailed information and to address needs, priorities and next steps.

The plan may also include advice to the national authorities on, for example, alternative risk reduction measures.

➢ Determine the emergency response strategy

Prepare the emergency response strategy according to the following elements:

a. Situation analysis.
b. Goals and actions
   - Needs assessment.
   - Action plan.
   - Status and Follow up actions.

Tip: (Preliminary) Interventions are intended to avoid, reduce or minimize impact, taking the actual observed adverse impact into account.

Tip: Select interventions in cooperation with local key stakeholders and response specialists. The Emergency Response Guidebook (ERG), GHS database on internet, and the Checklist for Emergency Preparedness and Response Interventions (Annex 2) are useful aids to select interventions for particular hazardous substances. For releases of unknown substances, reference the ERG Guide Number 111 for immediate emergency response direction.

➢ Draw up recommendations

Assess the results of the "FEAT-R Impact Assessment" and draw up recommendations:

a. Major gaps.

b. Recommendations.

c. Request for additional capacity (if required).

If there are not sufficient resources for reduction or control of the impact: request for additional assistance. A request for (additional) international assistance can be sent to the United Nations Resident Coordinator in country, OCHA Country or Regional Office, or to the OCHA Duty Officer in acute and urgent instances. The JEU can mobilize such international assistance. Discuss options for moving people from the affected area and humanitarian needs.

➢ Develop the FEAT-R Mitigation Plan

Summarize all of the above into an Emergency Response Plan. Draw the plan, summarizing a) the response strategy, b) follow up, c) recommendations and – if applicable – d) a description of additional capacity, or any other resources or equipment, required to ensure sustainable impact reduction.

Sample FEAT-R Mitigation Plan		
Case	Textiles manufacturing plant "Wear out" at Farland	
Situation analyses	Situation report and problems	A chemical accident has occurred at a textiles manufacturing plant (called "Wear out") at Smallville, near the city of Metropolis, in Farland. The accident occurred at 24-04-2013 at approx. 13.40 PM. Approximately 10 tons of benzene is unintentionally released due to rupture of a storage tank. Most of the benzene is spilled into Farland river via the unpaved premises around the facility. It is observed that Farland River has been polluted up to 5 km (at least), large amounts of dead fish are encountered and decolourisation of the water (pink, purple) in Farland River is clearly visible. Due to the fact that benzene is volatile, gaseous substances are originated and drifting towards Smallville, located next to the manufacturing plant. Approx. 20 people have been hospitalized with respiratory problems. They are still under observation. A penetrating smell is still perceptible around the plant. Responders have discovered another tank (approx. 5 to 10 m^3) labeled with "MIC". This tank may be filled with Methyl Isocyanate and could be leaking as well.
Response strategy	Goals and Strategies	The first priority is to stop the flow of (liquid) hazardous substances towards Farland River. Liquids released shall be contained and emission of gaseous substances to the air (due to evaporation) shall be minimized. The second priority it to take care of casualties and to investigate why many other people are having respiratory problems. It has to be found out if there are any other leaks or hazardous substances leaking. Other priorities: water quality of drinking water and water for irrigation of fields (both derived from Farland River), remediation of the soil and ground water, repair of the tank.
	Needs Assessment	Needs are: 1) communications systems in order to inform the public and/or evacuation; 2) specialized doctors and medics for treating human casualties with respiratory problems; 3) Technical experts for investigation of hazardous substances and to look for other leaks.

Sample FEAT-R Mitigation Plan		
		In addition, there is the need for: 1) dikes in order to (temporarily) stop and contain the liquid flow towards river; 2) means to repair the solvent storage tank; 3) communication to inform farmers to stop irrigation of fields with crops; 4) communication with the drinking water production plant in order to stop the water intake from Farland River.
	Action Plan	Provide sustainable emergency response interventions in order to control the spill of hazardous substances, provide technical and medical experts and provide communication systems in order to inform the public, farmers and the drinking water facility.
	Mobilizing Resources	Resources to: 1) build dikes and repair the tank(s), including equipment such as shovels; 2) (drinking) water and air quality monitoring, 3) determination of hazards and effects due to release of hazardous substances; 4) civil staff for soil remediation 5) specialized doctors and medics for treatment of casualties.
	Conclusions	The chemical accident seems to be under control, but sustainable interventions and further investigation is absolutely required. Several uncertainties are health issues (respiratory problems) and the extent of the impact. It needs to be found out where respiratory issues come from. In addition, it has to be checked if other tanks (containing hazardous substances) are leaking as well.

Sample FEAT-R Mitigation Plan		
Follow up	Preliminary interventions	In according the Emergency Response Guidebook[19] the following preliminary interventions are executed for benzene (ref. ERG, number 1114). Immediate precautionary measures taken are: • Spill is isolated for at least 50 meters in all directions • Unauthorized personnel are kept away. • Instructions given: to stay upwind, keep out of low areas and to ventilate closed spaces before entering. Protective clothing provided: • Wear positive pressure self-contained breathing apparatus (SCBA). • Structural firefighters' protective clothing will only provide limited protection. Instructions on fire caution: • Benzene has a very low flash point: Use of water spray when fighting fire may be inefficient. • Large Fire: Water spray, fog or regular foam. Do not use straight streams. Move containers from fire area. • Fire involving Tanks or Car/Trailers: fight fire from maximum distance or use unmanned hose holders or monitor nozzles, Cool containers with flooding quantities of water until well after fire is out, Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank, ALWAYS stay away from tanks engulfed in fire. Spill instructions: • Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area) • All equipment used when handling the product must be grounded. • Do not touch or walk through spilled material.

[19] The Emergency Response Guidebook (*Guidebook for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Transportation Incident* (ERG)) is used by emergency response personnel (such as firefighters, and police officers) in Canada, Mexico, and the United States when responding to a transportation emergency involving materials. It is produced by the United States Department of Transportation, Transport Canada, and the Secretariat of Communications and Transportation (Mexico).

Sample FEAT-R Mitigation Plan		
		• Stop leak if you can do it without risk. • Prevent entry into waterways, sewers, basements or confined areas • A vapour suppressing foam may be used to reduce vapours. • Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers • Use clean non-sparking tools to collect absorbed material • Dike far ahead of liquid spill for later disposal, Water spray may reduce vapour; but may not prevent ignition in closed spaces.
Recommen-dations	Interventions	Continue and evaluate effectiveness of interventions mentioned above. In addition, a) Start air and (drinking) water quality monitoring b) Find out where respiratory problems come from c) Check origin of solvents (chemical name, CAS number, etc.). d) Check for potential leaks of other hazardous substances, such as MIC. Make sure the air quality is safe before return of people back home. The water quality shall be checked before resuming water intake and irrigation of fields. Quality sampling and monitoring of air, groundwater, water in River Farland and drinking water is essential. Finally, determine the extent of the soil and ground water pollution and provide equipment (shovels and substances) to build a sand wall/dike around liquid spill and to remediate polluted soil and purification of groundwater.
	Additional capacity	Experts on the area of chemical substances are not available in Farland. International assistance is required. Medical experts are not available at Metropolis hospital and shall be mobilized from the hospital of Port city.

ANNEX 1: FEAT-P (PREPAREDNESS) SUMMARY EXAMPLE

This annex provides a summary example of the FEAT-P process with a focus on how to complete the Impact Table using the core FEAT steps. The example uses the fictional case of "Farland" (See Figure 14). Step-by-step, the information is collected, reviewed and assessed. Please note that the example is for demonstration purposes only so as to explain the FEAT. The example is not to be regarded as complete nor fully detailed.

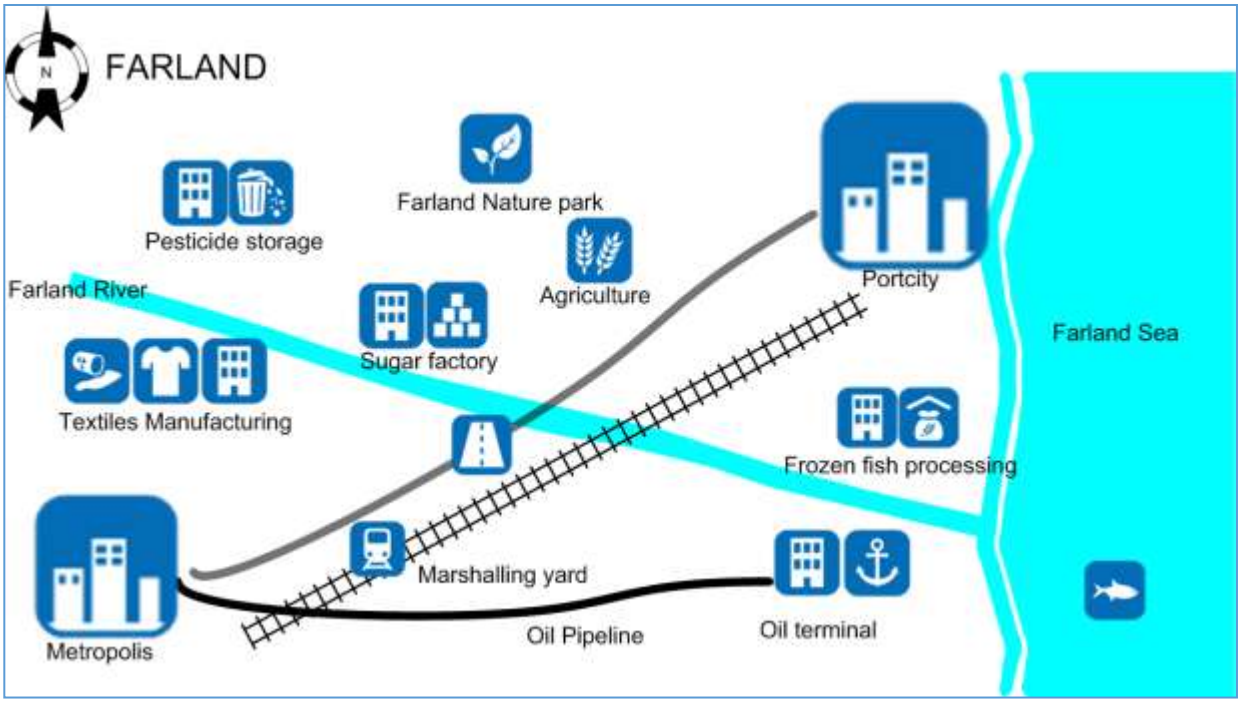


Figure 14 Case "Farland"

Introduction

Farland (map in Figure 14) is a developing country with approx. 2 million inhabitants. Farland has two big cities: Port city (400.000 people, located at the coast) and Metropolis (250.000 people, located 50 km inland). The industrial sector of Farland is rapidly developing. The main industry is the production of textile (garments), agriculture (sugar production) and food processing (diary and frozen fish processing). Several industrial zones are located near Metropolis. There is also an oil terminal located at the port area of Port city. An oil pipeline is running from Port city land inwards to Metropolis. A pesticide storage is located in the North West of Farland, in the mountains. Farland River runs down from the mountains to Port city and Farland Sea. The city of Metropolis is located at the estuary. The river is used by the downstream population for drinking water, household use and irrigation of rural fields with crops.

The FEAT-P example elaborates on four potential accident scenarios:

1. A textile manufacturing plant (benzene)
2. A Pesticide storage facility (carbamate pesticide)
3. A marshalling yard (acrylonitrile)
4. An oil Pipeline (petroleum, crude oil)

➢ Preliminary Actions

Undertake scoping
Understand impact(s)
Create a management summary

1. Select an Area or country
2. Identity triggering events and failure causes using the Checklist: Triggering Events and Failure Types as a guide.
3. Describe hazards and exposures on a strategic level in a Management Summary using the Checklist: Understanding Impact as a guide.

➢ Apply FEAT Core Process

➢ STEP 1: Collect Information on Priority Hazards, Quantity and Exposures

STEP 1:
Collect information on priority hazards, quantity and exposures

➢ Identify priority hazards using the Hazardous Operations, Substance or Pictogram Tables.

In this example, the only information given is on hazardous operations. Therefore, use the Hazardous Operations Table to find information on an estimated hazardous substance, its form, and priority hazard classifications. This information is recorded in the FEAT Impact Table.

Hazardous Operation		Hazard			Entry Point Exposure Distance Table (FEAT-II) [default choice by expert opinion]			
		Hazardous Substance		Hazard Classification	First Priority Response		Second Priority Response	
Facility type	Operation type	Examples of most common hazardous substances at facility	Physical State	Abbreviation according to GHS	GHS hazard	Hazard classification	GHS hazard	Hazard classification
Chemicals production	Pesticide production and warehousing	insecticides, fungicides, acaricides (or anti- cides), nematicides and rodenticides	solid	Aquatic Acute 1, Aquatic Acute 1, Acute Tox. 4, Carc. 2	Aquatic Acute	Aquatic Acute 1	-	
General manufacturing	Textiles manufacturing	hydrogen peroxide, sodium hypochlorite, sodium chlorite, sulfur dioxide gas, ammonia, caustic soda, solvents, lubricants, toxic and persistent organic and inorganic textile preservation chemicals (e.g. brominated and chlorinated compounds, dieldrin, arsenic, and mercury)	liquid	Aquatic Chronic 3, Asp. Tox. 1, Carc. 1A, Carc. 1B, Eye Irrit. 2, Muta. 1B, Skin Irrit. 2, STOT RE 1, Flam. Liq. 2, Pres. Gas	Flammable	Flam. Liq. 2	-	
Pipelines	Transfer liquids by long-distance pipeline	oil	liquid	Aquatic Chronic 3, Asp. Tox. 1, Flam. Liq. 1	Flammable	Flam. Liq. 1	-	
Transport interfaces	Marshalling yard (temporary storage): transfer by intermodal trailer (e.g. tankcontainer)	toxic liquid	liquid	Aquatic Chronic 2, Acute Tox. 2, Acute Tox. 3, Carc. 1B, Carc. 2, Eye Dam. 1, Repr. 2, Skin Irrit. 2, Skin Sens. 1, STOT SE 3, Flam. Liq. 2	Health hazard	Carc. 1B	Aquatic chronic	Aquatic chronic 2

➢ Determine the quantity of hazardous substances

Because actual quantities are unknown, record the largest quantity listed for each hazardous substance in the Quantity Table.

FEAT Impact Table

Area/Location: Farland

Date/Time: dd-mm-yyyy/xxxx (24 hour time)

Hazard Entry Point operation and/or substance		Hazard Classification - priority response	Physical State (gas, liquid, solid)	Quantity [kg]	Receptor/s	Impact Zone [km]				
						Human		Environment		
Operation Type (and location)	Substance (and CAS #)					Lethal	Health	Soil	Lake	River
Textiles Manufacturing	Benzene	Flam. Liq. 2	Liquid	100 000 000						
Pesticide Production and Warehousing	Carbamate Pesticide	Aquatic Acute 1	Solid	5 000						
Marshalling Yard	Acrylonitrile	Carc. 1B	Liquid	Any						
		Aquatic Chronic 2	Liquid	50 000						
Transfer Liquids by Long Distance Pipeline	petroleum (crude oil)	Flam Liq. 1	Liquid	100 000 000						

➢ **Determine potential exposures**

- Using the available hazard information, map, and the Checklist: Understanding Impact, potential exposure pathways and receptors include:
  - Pathways
    - Soil/Groundwater,
    - River
    - Sea.
  - Receptors
    - Humans
    - Fishing Area
    - Agricultural Area
    - Nature Reserve
    - Critical Infrastructure

➢ **STEP 2: Lookup Actual Impact Zones**

➢ **Determine Impact Zones Using the Exposure Distance Table.**

Using the Exposure Distance Table, look up and record the Impact Zones for the priority hazards.

Hazard			Quantity	Exposure Distance				
				Human		Environment		
GHS Hazard	Hazard classification	Explanation	kg	Lethal	Health	Soil	Lake	River
				[km]	[km]	[km]	[km]	[km]
Flammable	Flam. Gas 1	Extremely flammable	1,000,000	0,2 km	0,3 km			
	Flam. Liq. 1, 2	Flashpoint < 23 °C	10,000,000	0,4 km	0,6 km			
	Flam. Aerosol 1	Extremely flammable	100,000,000	1,2 km	1,8 km			
	Pyr. Liq. 1	Ignites < 5 minutes						
Health hazard	Carc. 1A, 1B Muta. 1A, 1B Repr. 1A, 1B	May cause carcinogenic, mutagenic, repotoxic mutation		> 5 km	> 5 km	> 10 km	> 4,5 km	> 10 km
Aquatic acute	Aquatic Acute 1	Causes serious injury to an aquatic organism in short period of time	100			2,8 km (0,1 - 11)	0,4 km (0 - 1,5)	10 km (0 - >10)
			1,000			8,9 km (0,4 - >10)	1,3 km (0,1 - 4,8)	>10 km (0,2 - >10)
			5,000			>10 km (0,8 - >10)	2,8 km (0,1 - 10)	>10 km (0,8 - >10)
Aquatic ohronic	Aquatic Chronic 2	Acute adverse effects to aquatic organisms	1,000			1 km (0,6 - >10)	0,1 km (0,1 - 5,8)	1,3 km (0,4 - >10)
			10,000			3,3 km (1,8 - >10)	0,5 km (0,3 - >10)	>10 km
			50,000			7,3 km (4 - >10)	1 km (0,6 - >10)	>10 km

Area/Location: Farland
Date/Time: dd-mm-yyyy/xxxx (24 hour time)

Hazard Entry Point operation and/or substance		Hazard Classification - priority response	Physical State (gas, liquid, solid)	Quantity [kg]	Receptor/s	Impact Zone [km]				
						Human		Environment		
Operation Type (and location)	Substance (and CAS #)					Lethal	Health	Soil	Lake	River
Textiles Manufacturing	Benzene	Flam. Liq. 2	Liquid	100 000 000		1,2 km	1,8 km			
Pesticide Production and Warehousing	Carbamate Pesticide	Aquatic Acute 1	Solid	5 000				>10 km (0,8 - >10)	2,8 km (0,1 - 10)	>10 km (0,8 - >10)
Marshalling Yard	Acrylonitrile	Carc. 1B	Liquid	Any		> 5 km	> 5 km	> 10 km	> 4,5 km	> 10 km
		Aquatic Chronic 2	Liquid	50 000				7,3 km (4 - >10)	1 km (0,6 - >10)	> 10 km
Transfer Liquids by Long Distance Pipeline	petroleum (crude oil)	Flam Liq. 1	Liquid	100 000 000		1,2 km	1,8 km			

➢ **Identify potentially exposed receptors.**

Using the FEAT Impact Zones combined with the potential exposure pathway and receptor information from step 1, determine the likely receptors and routes of exposure for each substance and record in the Impact Table.

- Ensure the Impact Table is complete (see below)

- Verify and update hazard information

- Create hazard impact maps

FEAT Impact Table
Area/Location: Farland
Date/Time: dd-mm-yyyy/xxxx (24 hour time)

Hazard Entry Point operation and/or substance		Hazard Classification - priority response	Physical State (gas, liquid, solid)	Quantity [kg]	Receptor/s	Impact Zone [km]				
						Human		Environment		
Operation Type (and location)	Substance (and CAS #)					Lethal	Health	Soil	Lake	River
Textiles Manufacturing	Benzene	Flam. Liq. 2	Liquid	100 000 000	Pathways of river, soil/groundwater, and sea impacting area people	1,2 km	1,8 km			
Pesticide Production and Warehousing	Carbamate Pesticide	Aquatic Acute 1	Solid	5 000	Pathways of river, soil/groundwater, and Farland Sea impacting fishing areas, agriculture areas and the Farland Nature Park			>10 km (0,8 - >10)	2,8 km (0,1 - 10)	>10 km (0,8 - >10)
Marshalling Yard	Acrylonitrile	Carc. 1B	Liquid	Any	Pathways of river, soil/groundwater, and sea impacting area people, agricultural areas, fishing areas, and water transportaion routes.	> 5 km	> 5 km	> 10 km	> 4,5 km	> 10 km
		Aquatic Chronic 2	Liquid	50 000	Pathways of river, soil/groundwater, and sea impacting area people, agricultural areas, fishing areas, and water transportaion routes.			7,3 km (4 - >10)	1 km (0,6 - >10)	> 10 km
Transfer Liquids by Long Distance Pipeline	petroleum (crude oil)	Flam Liq. 1	Liquid	100 000 000	Pathways of soil/groundwater, river and sea impacting area people.	1,2 km	1,8 km			

- Step 3: Impact Reduction and Mitigation Measures

  - Develop an Emergency Preparedness Action Plan

1. Identify emergency preparedness actions
2. Define risk reduction strategy
3. Define priorities
4. Prepare Emergency Preparedness Action Plan

ANNEX 2: FEAT TABLES AND CHECKLISTS

FEAT IMPACT TABLE FIELD VERSION

FEAT Impact Table														
Area /Location:														
Date / Time:														
Hazard Entry Point operation and/or substance				Hazard Classification - priority response	Physical State (gas, liquid, solid)	Quantity [kg]	Receptor/s	Impact Zone [m]					Comments (observations or needs)
								Human		Environment			
Operation Type	Latitude (Decimal Deg.)	Longitude (Decimal Deg.)	Substance (and CAS #)					Lethal	Health	Soil	Lake	River	

HAZARDOUS OPERATIONS TABLE (1/12)

Hazardous Operation		Hazard			Entry Point Exposure Distance Table (FEAT-R) [*default choice by expert opinion*]			
		Hazardous Substance		Hazard Classification	First Priority Response		Second Priority Response	
Facility type	Operation type	Examples of most common hazardous substances at facility	Physical State	Abbreviation according to GHS	GHS hazard	Hazard classification	GHS hazard	Hazard classification
Agriculture and food production	Aquaculture	Disease control, oil, fertilizers, aquatoxic chemicals, antifoulants	solid	Carc. 1A, Carc. 1B, Carc. 2, Lact., Muta. 1B, Muta. 2, Repr. 1B, Repr. 2, Resp. Sens. 1, STOT RE 1, STOT RE 2, STOT SE 1	Health hazard	Muta 1B		
	Beer production (brewery)	ammonia, solvents, acid, alkalis, neutral detergents, disinfectants, (chlorine compounds), hydrogen peroxide, formaldehyde	gas	Aquatic Acute 1, Aquatic Chronic 2, Acute Tox. 2, Acute Tox. 3, Asp. Tox. 1, Skin Corr. 1B, Flam. Gas 1, Flam. Gas 2, Flam. Liq. 3, Liq. Gas	Toxic gas	Acute Tox. 2		
	Food processing (poultry, meat, fish and dairy)	ammonia, solvents, acid, alkalis, neutral detergents, disinfectants, (chlorine com- pounds), hydrogen peroxide, formaldehyde, hydrogen	gas	Aquatic Acute 1, Aquatic Chronic 2, Acute Tox. 2, Acute Tox. 3, Asp. Tox. 1, Skin Corr. 1B, Flam. Gas 1, Flam. Gas 2, Flam. Liq. 3, Liq. Gas	Toxic gas	Acute Tox. 2		
	Livestock and poultry	disinfecting agents, antibiotic and hormonal products, pesticides	solid	Aquatic Acute 1, Aquatic Acute 4, Acute Tox. 4, Carc. 2	Aquatic Acute	Aquatic Acute 1		
	Plantation and annual crop production	pesticides	liquid	Acute Tox. 1, Acute Tox. 2, Eye Irrit. 2A, Muta. 2, Repr. 1B, Repr. 2, Skin Corr. 1B, STOT RE 1	Toxic liquid	Acute Tox. 1		
	Sugar manufacturing	ethanol, organic chemicals	liquid	Muta. 1B, Repr. 1A, Repr. 2, Skin Corr. 1B, STOT RE 1, STOT SE 1, Flam. Liq. 2, Met. Corr. 1	Flammable	Flam. Liq. 2		

HAZARDOUS OPERATIONS TABLE (2 / 12)

Hazardous Operation		Hazard			Entry Point Exposure Distance Table (FEAT-R) [*default choice by expert opinion*]			
		Hazardous Substance		Hazard Classification	First Priority Response		Second Priority Response	
Facility type	Operation type	Examples of most common hazardous substances at facility	Physical State	Abbreviation according to GHS	GHS hazard	Hazard classification	GHS hazard	Hazard classification
Agriculture and food production	Vegetable oil processing	acids, alkalis, solvents, hydrogen, (n-)hexane	liquid	Aquatic Chronic 2, Asp. Tox.1, Repr. 2, Skin Irrit. 2, STOT RE 1, STOT RE 2, STOT SE 2, STOT SE 3, Flam. Liq. 2	Flammable	Flam. Liq. 2	Aquatic chronic	Aquatic chronic 2
Chemicals production	Coal processing	ammonia, fuel, synthetic gas, liquid hydrocarbons, methanol, coal, gasoline	gas	Aquatic Acute 1, Aquatic Chronic 2, Acute Tox.2, Acute Tox. 3, Asp. Tox. 1, Skin Corr. 1B, Flam.Gas 1, Flam. Gas 2, Flam. Liq. 3, Liq. Gas	Toxic gas	Acute Tox. 2		
	Fireworks manufacturing and warehousing	ammoniumnitrate and ammonia, oxidizing agents and metal salts	solid	STOT SE 1, Ox. Liq. 1, Ox. Liq. 3, Ox. Sol. 1, Ox. Sol. 2, Ox. Sol. 3	Explosive	Ox. Sol. 1		
	Large volume petroleum-based organic chemicals manufacturing	liquefied petroleum gas (LPG), gasoline, kerosene, diesel oil, heating oil, fuel oil, bitumen, asphalt, sulfur, propane/propylene mixtures, naphtha	liquid	Aquatic Chronic 2, Aquatic Chronic 3, Asp. Tox.1, Carc. 1A, Carc. 1B, Muta. 1B, Repr. 2, STOT RE1, STOT RE 2, Flam. Gas 1, Flam. Liq. 1, Flam.Liq. 2, Flam. Liq. 3	Flammable	Flam. Liq. 1	Aquatic chronic	Aquatic chronic 2
	Large volume compounds manufacturing and coal tar distillation	acids (nitric, hydrochloric, sulfuric, hydrofluoric, phosphoric acid), chloralkalis (e.g. chlorine, caustic soda, soda ash, etc.), carbon black, and coal tar distillation (naphthalene, phenanthrene, anthracene)	liquid	Aquatic Acute 1, Aquatic Acute 4, Aquatic Chronic 2, Acute Tox. 4, Skin Corr. 1A, Skin Corr. 1C, STOT RE 1, STOT SE 1, Flam. Liq. 3	Corrosive	Skin Corr. 1A	Aquatic chronic	Aquatic chronic 2
	Natural gas processing	natural gas, liquid hydrocarbons, methanol	gas	Flam. Gas 1, Liq. Gas, Ref. Liq. Gas	Flammable	Flam. Gas 1	-	

HAZARDOUS OPERATIONS TABLE (3 / 12)

Hazardous Operation		Hazard			Entry Point Exposure Distance Table (FEAT-R) [*default choice by expert opinion*]			
		Hazardous Substance		Hazard Classification	First Priority Response		Second Priority Response	
Facility type	Operation type	Examples of most common hazardous substances at facility	Physical State	Abbreviation according to GHS	GHS hazard	Hazard classification	GHS hazard	Hazard classification
Chemicals production	Nitrogenous fertilizer manufacturing	ammonia (NH3), urea, nitric acid (HNO3), ammonium nitrate, ammonium sulfate, urea-ammonium sulfate (UAS), urea ammonium nitrate (UAN) liquid fertilizers	gas	Aquatic Acute 1, Aquatic Chronic 2, Acute Tox. 2, Acute Tox. 3, Asp. Tox. 1, Skin Corr. 1B, Flam. Gas 1, Flam. Gas 2, Flam. Liq. 3, Liq. Gas	Toxic gas	Acute Tox. 2	-	
	Oleochemicals manufacturing	acids, glycerin, biodiesel	liquid	Flam. Liq. 2, Acute Tox. 4, Asp. Tox. 1, Carc. 2, Skin Irrit. 2, STOT RE 2, Aquatic Acute 2, Aquatic Chronic 2	Flammable	Flam. Liq. 2	-	
	Pesticide production and warehousing	insecticides, fungicides, acaricides (or miti- cides), nematicides and rodenticides	solid	Aquatic Acute 1, Aquatic Acute 4, Acute Tox. 4, Carc. 2	Aquatic Acute	Aquatic Acute 1	-	
	Petroleum ba-sed manufac-turing	hydrocarbons, Vinyl Chloride Monomer (VCM), ethylbenzene	liquid	Aquatic Acute 4, Aquatic Chronic 3, Acute Tox. 4, Asp. Tox. 1, Asp. Tox. 2, Carc. 2, STOT RE 2, Flam. Liq. 2	Flammable	Flam. Liq. 2	-	
	Petroleum refining	petroleum	liquid	Aquatic Chronic 2, Aquatic Chronic 3, Asp. Tox. 1, Carc. 1A, Carc. 1B, Muta. 1B, Repr. 2, STOT RE 1, STOT RE 2, Flam. Gas 1, Flam. Liq. 1, Flam. Liq. 2, Flam. Liq. 3	Flammable	Flam. Liq. 1	Aquatic chronic	Aquatic chronic 2

HAZARDOUS OPERATIONS TABLE (4 / 12)

Hazardous Operation		Hazard			Entry Point Exposure Distance Table (FEAT-R) [*default choice by expert opinion*]			
		Hazardous Substance		Hazard Classification	First Priority Response		Second Priority Response	
Facility type	Operation type	Examples of most common hazardous substances at facility	Physical State	Abbreviation according to GHS	GHS hazard	Hazard classification	GHS hazard	Hazard classification
Chemicals production	Pharmaceutical and biotechnology processing	solvents, acids, mixed chemicals, natural gas, methanol, isopropyl alcohol	Mixed	Aquatic Chronic 2, Carc. 2, Lact., Repr. 1A, Repr. 1B, Repr. 2, STOT RE 1, STOT RE 2	Health hazard	Repr. 1A	Aquatic chronic	Aquatic chronic 2
	Phosphate fertilizer manufacturing and warehousing	phosphoric acid, single superphosphate (SSP), triple superphosphate (TSP), and compound fertilizers (NPK)	liquid	Aquatic Chronic 3, Skin Corr. 1B, Skin Corr. 1C, Met. Corr. 1	Corrosive	Skin Corr. 1B	-	
Forestry	Boards and particle based products	resins, formaldehyde, pesticides and fungicides	liquid	Acute Tox. 2, Acute Tox. 3, Carc. 1A, Carc. 2, Muta. 2, Resp. Sens. 1, Skin Corr. 1B, Skin Corr. 1C, Skin Sens. 1, STOT RE 1, STOT SE 1, STOT SE 2, Flam. Gas 1, Liq. Gas, Met. Corr. 1	Health hazard	Carc. 1A	-	
	Harvesting	fuels and lubricants, pesticides	liquid	Aquatic Chronic 2, Aquatic Chronic 3, Asp. Tox. 1, Carc. 1B, Muta. 1B, Repr. 2, Flam. Liq. 1, Flam. Liq. 2, Flam. Liq. 3	Flammable	Flam. Liq. 1	Aquatic chronic	Aquatic chronic 2
	Pulp and paper mills	PCDD (poly chlorinated dibenzodioxins) and PCDF (poly chlorinated dibenzofurans) Gas: sulfur dioxide, chlorine, chlorine dioxide, terpenes, oxygen Liquid: sodium hydroxide, sulfuric acid, turpentine, sodium hypochlorite, aqueous solution of chlorine dioxide, hydrogen peroxide, biocides, solvents	liquid	Aquatic Acute 1, Aquatic Chronic 2, Aquatic Chronic 3, Skin Corr. 1A, Skin Corr. 1B, STOT SE 1, Met. Corr. 1, Ox. Gas 1	Health hazard	STOT SE 1	Aquatic chronic	Aquatic chronic 2

HAZARDOUS OPERATIONS TABLE (5 / 12)

Hazardous Operation		Hazard			Entry Point Exposure Distance Table (FEAT-R) [*default choice by expert opinion*]			
		Hazardous Substance		Hazard Classification	First Priority Response		Second Priority Response	
Facility type	Operation type	Examples of most common hazardous substances at facility	Physical State	Abbreviation according to GHS	GHS hazard	Hazard classification	GHS hazard	Hazard classification
Forestry	Saw-milling and wood based products	polynuclear aromatic hydrocarbons, pentachlorophenol, compounds of chrome, copper and arsenic toxic, phenols, resins, acids, solvents, pesticides, chromated copper arsenate (CCA), copper oxide and quaternary ammonium (ACQ), copper azole and borates	liquid	Aquatic Chronic 3, Asp. Tox. 1, Carc. 1A, Carc. 1B, Eye Irrit. 2, Muta. 1B, Skin Irrit. 2, STOT RE 1, Flam. Liq. 2, Pres. Gas	Flammable	Flam. Liq. 2	-	
General manufacturing	Base metal melting and refining	acids, alkalis, chemical reagents, process gases (e.g. oxygen, carbon dioxide, argon, nitrogen, chlorine, hydrogen)	liquid	Acute Tox. 1, Acute Tox. 2, Asp. Tox. 1, Skin Corr. 1A, Skin Corr. 1B, STOT RE 1, STOT SE 1, Met. Corr. 1, Ox. Liq. 1, Ox. Liq. 3	Toxic liquid	Acute Tox. 1	-	
	Cement & lime manufacturing	fuel (coal, cokes, natural gas), acids	gas	Flam. Gas 1, Liq. Gas, Ref. Liq. Gas	Flammable	Flam. Gas 1	-	
	Ceramic tile & sanitary ware manufacturing	fuel (coal, cokes, natural gas), acids	gas	Flam. Gas 1, Liq. Gas, Ref. Liq. Gas	Flammable	Flam. Gas 1	-	
	Construction materials extraction	fuels, lubricants, explosives, acids	liquid	Aquatic Chronic 2, Aquatic Chronic 3, Asp. Tox. 1, Carc. 1A, Carc. 1B, Muta. 1B, Repr. 2, STOT RE 1, STOT RE 2, Flam. Gas 1, Flam. Liq. 1, Flam. Liq. 2, Flam. Liq. 3,	Flammable	Flam. Liq. 1	Aquatic chronic	Aquatic chronic 2

HAZARDOUS OPERATIONS TABLE (6 / 12)

Hazardous Operation		Hazard			Entry Point Exposure Distance Table (FEAT-R) [*default choice by expert opinion*]			
		Hazardous Substance		Hazard Classification	First Priority Response		Second Priority Response	
Facility type	Operation type	Examples of most common hazardous substances at facility	Physical State	Abbreviation according to GHS	GHS hazard	Hazard classification	GHS hazard	Hazard classification
General Manufacturing	Foundries	isopropyl alcohol, resins, solvents, organic based coatings	liquid	Eye Irrit. 2, Eye Irrit. 2A, Repr. 2, STOT RE 2,	Flammable	Flam. Liq. 2	-	
	Glass manufacturing	syngas, natural gas, oil, solvents, liquid petroleum products (methanol, naphtha, gasoline, kerosene, diesel fuel)	gas	Flam. Gas 1, Liq. Gas, Ref. Liq. Gas	Flammable	Flam. Gas 1	-	
	Integrated steel milling	naphthalene, heavy oil compounds, aromatic hydrocarbons, oxygen, acids, solvents, flammable gas (oxigas), isopropyl alcohol, resins, coal	gas	Diss. Gas, Flam. Gas 1	Flammable	Flam. Gas 1	-	
	Metal, plastic, rubber products manufacturing	acids, solvents, pentane, black acrid smoke and carbon monoxide (at rubber fire), acids and alkalis (e.g. hydrochloric, sulfuric, and nitric acids), organics (e.g. ethylene glycol, acetic aldehyde and formaldehyde, straight oils, soluble oils, semi-synthetic fluids, synthetic fluids	liquid	Eye Irrit. 2, Eye Irrit. 2A, Repr. 2, STOT RE 2, STOT SE 1, STOT SE 3, Flam. Liq. 2	Flammable	Flam. Liq. 2	-	
	Printing	nitric acid, phosphoric acid, solvents, ammonia, ink solvent, lacquers, glues, adhesives, urethane	liquid	Aquatic Chronic 3, Asp. Tox. 1, Carc. 1A, Carc. 1B, Eye Irrit. 2, Muta. 1B, Skin Irrit. 2, STOT RE 1, Flam. Liq. 2, Pres. Gas	Flammable	Flam. Liq. 2	-	

HAZARDOUS OPERATIONS TABLE (7 / 12)

Hazardous Operation		Hazard			Entry Point Exposure Distance Table (FEAT-R) [*default choice by expert opinion*]			
		Hazardous Substance		Hazard Classification	First Priority Response		Second Priority Response	
Facility type	Operation type	Examples of most common hazardous substances at facility	Physical State	Abbreviation according to GHS	GHS hazard	Hazard classification	GHS hazard	Hazard classification
General manufacturing	Semicon-ductors and electronics manufacturing	gallium arsenide (GaAs), acids, solvents (isopropyl alcohol), developers (e.g., iso- paraffinic hydrocarbons), cleaning solutions, cyanide solutions	solid	Aquatic Chronic 3, Carc. 1A, Carc. 1B, Repr. 1A, STOT RE 1, STOT RE 2	Health hazard	Carc. 1A	-	
	Tanning and leather finishing	biocides/antiseptics/fungicides, deliming chemicals, solvents, aromatic substances: dyes	solid	Carc. 1B, Carc. 2, Muta. 2, Resp. Sens. 1, STOT RE 2, STOT SE 2, Flam.Sol. 1, Flam.Sol. 2	Health hazard	Carc. 1B	-	
	Textiles manufacturing	hydrogen peroxide, sodium hypochlorite, sodium chlorite, sulfur dioxide gas, ammonia, caustic soda, solvents, lubricants, toxic and persistent organic and inorganic textile preservation chemicals (e.g. brominated and chlorinated compounds, dieldrin, arsenic, and mercury)	liquid	Aquatic Chronic 3, Asp. Tox. 1, Carc. 1A, Carc. 1B, Eye Irrit. 2, Muta. 1B, Skin Irrit. 2, STOT RE 1, Flam. Liq. 2, Pres. Gas	Flammable	Flam. Liq. 2	-	
Infrastructure and transport	Drinking water production	sulphate, hypochlorites, sodium dioxide	gas	Aquatic Acute 1, Acute Tox. 1, Acute Tox. 2, Acute Tox. 3, Eye Irrit. 2, Skin Irrit. 2, STOT RE 2, STOT SE 3, Liq. Gas, Ox. Gas 1	Toxic Gas	Acute Tox. 1	Aquatic Acute	Aquatic Acute 1
	Gas distribution	natural gas	gas	Flam. Gas 1, Liq. Gas, Ref. Liq. Gas,	Flammable	Flam. Gas 1	-	

HAZARDOUS OPERATIONS TABLE (8 / 12)

Hazardous Operation		Hazard			Entry Point Exposure Distance Table (FEAT-R) [*default choice by expert opinion*]			
		Hazardous Substance		Hazard Classification	First Priority Response		Second Priority Response	
Facility type	Operation type	Examples of most common hazardous substances at facility	Physical State	Abbreviation according to GHS	GHS hazard	Hazard classification	GHS hazard	Hazard classification
Infrastructure and transport	Health care operations (incl. hospitals)	ethylene oxide, (compressed) toxic, liquid or gas (in bottles) including compressed and/or liquified Oxygen, laboratory (mixed) chemicals, acids, cleaning agents	gas	Aquatic Chronic 3, Acute Tox. 2, Acute Tox. 3, Carc. 1B, Eye Irrit. 2, Eye Irrit. 2A, Muta. 1B, Skin Irrit. 2, STOT RE 1, STOT SE 3, Flam. Gas 1, Liq. Gas	Health hazard	Carc. 1B	-	
	Retail petroleum distribution	petroleum, LPG	gas	Flam. Gas 1, Liq. Gas, Ref. Liq. Gas	Gas under pressure	Liq. Gas 1	-	
	Storage at ports harbours and terminals	flammable liquid	liquid	Aquatic Chronic 2, Aquatic Chronic 3, Asp. Tox. 1, Carc. 1A, Carc. 1B, Muta. 1B, Repr. 2, STOT RE 1, STOT RE 2, Flam. Gas 1, Flam. Liq. 1, Flam. Liq. 2, Flam. Liq. 3,	Flammable	Flam. Liq. 1	Aquatic chronic	Aquatic chronic 2
	Storage at airports	jet fuel, diesel, and gasoline, de-icing fluids (e.g. propylene glycol)	liquid	Aquatic Chronic 2, Aquatic Chronic 3, Asp. Tox. 1, Flam. Liq. 3	Flammable	Flam. Liq. 3	Aquatic chronic	Aquatic chronic 2
	Storage crude oil and petro-leum products	flammable liquid	liquid	Aquatic Chronic 3, Asp. Tox. 1, Flam. Liq. 1	Flammable	Flam. Liq. 1	-	
	Transport by air	dangerous cargo, fuel, de-icing fluids (e.g. propylene glycol)	liquid	Aquatic Chronic 2, Aquatic Chronic 3, Asp. Tox. 1, Flam. Liq. 3	Flammable	Flam. Liq. 3	Aquatic chronic	Aquatic chronic 2

HAZARDOUS OPERATIONS TABLE (9 / 12)

Hazardous Operation		Hazard			Entry Point Exposure Distance Table (FEAT-R) [*default choice by expert opinion*]			
		Hazardous Substance		Hazard Classification	First Priority Response		Second Priority Response	
Facility type	Operation type	Examples of most common hazardous substances at facility	Physical State	Abbreviation according to GHS	GHS hazard	Hazard classification	GHS hazard	Hazard classification
Infrastructure and transport	Transport by rail	flammable liquid	liquid	Aquatic Chronic 2, Aquatic Chronic 3, Asp. Tox. 1, Carc. 1A, Carc. 1B, Muta. 1B, Repr. 2, STOT RE 1, STOT RE 2, Flam. Gas 1, Flam. Liq. 1, Flam. Liq. 2, Flam. Liq. 3	Flammable	Flam. Liq. 1	Aquatic chronic	Aquatic chronic 2
	Transport by road	flammable liquid	liquid	Aquatic Chronic 2, Aquatic Chronic 3, Asp. Tox. 1, Carc. 1A, Carc. 1B, Muta. 1B, Repr. 2, STOT RE 1, STOT RE 2, Flam. Gas 1, Flam. Liq. 1, Flam. Liq. 2, Flam. Liq. 3	Flammable	Flam. Liq. 1	Aquatic chronic	Aquatic chronic 2
	Transport by water	flammable liquid	liquid	Aquatic Chronic 2, Aquatic Chronic 3, Asp. Tox. 1, Carc. 1A, Carc. 1B, Muta. 1B, Repr. 2, STOT RE 1, STOT RE 2, Flam. Gas 1, Flam. Liq. 1, Flam. Liq. 2, Flam. Liq. 3	Flammable	Flam. Liq. 1	Aquatic chronic	Aquatic chronic 2
	Waste storage and processing	several types of hazardous chemicals, methane storage and contaminants found in industrial sites (e.g. heavy metals)	liquid	Aquatic Chronic 3, Asp. Tox. 1, Carc. 1A, Carc. 1B, Eye Irrit. 2, Muta. 1B, Skin Irrit. 2, STOT RE 1, Flam. Liq. 2, Pres. Gas	Flammable	Flam. Liq. 2	-	
	Waste water treatment	flammable liquid, acids, solvents	liquid	Acute Tox. 2, Acute Tox. 3, Carc. 2, Repr. 1B, STOT SE 1, STOT SE 2, Flam. Liq. 2, Ox. Liq. 1	Flammable	Flam. Liq. 2	-	

HAZARDOUS OPERATIONS TABLE (10 / 12)

Hazardous Operation		Hazard			Entry Point Exposure Distance Table (FEAT-R) [*default choice by expert opinion*]			
		Hazardous Substance		Hazard Classification	First Priority Response		Second Priority Response	
Facility type	Operation type	Examples of most common hazardous substances at facility	Physical State	Abbreviation according to GHS	GHS hazard	Hazard classification	GHS hazard	Hazard classification
Mining	Mining (non-oil and gas, incl ore processing)	(sodium) cyanide, solvents, (sulphuric and nitric) acid, explosives, sodium hydroxide, hydrogen peroxide, mercury, waste from tailings, chemical or physi- cal treatment of ore	liquid	Aquatic Acute 1, Aquatic Chronic 1, Acute Tox. 1, Acute Tox. 2, STOT RE 1, STOT SE 1, Flam. Liq. 1	Toxic liquid	Acute Tox. 1	Aquatic Acute	Aquatic Acute 1
	(Natural) Gas production (incl LNG & LPG)	LPG, LNG, CNG, condensate	gas	Flam. Gas 1, Liq. Gas, Ref. Liq. Gas	Gas under pressure	Liq. Gas 1	-	
	Oil production	liquid hydrocarbons, condensate, drilling fluids, chemicals, Naturally Oc- curring Radioactive Materials (NORM)	liquid	Aquatic Chronic 3, Asp. Tox. 1, Flam. Liq. 1	Flammable	Flam. Liq. 1	-	
Pipelines	Transfer gas by long distance pipeline	natural gas	gas	Flam. Gas 1, Liq. Gas, Ref. Liq. Gas	Flammable	Flam. Gas 1	-	
Pipelines	Transfer liquids by long distance pipeline	oil	liquid	Aquatic Chronic 3, Asp. Tox. 1, Flam. Liq. 1	Flammable	Flam. Liq. 1	-	
Power	Electric power transmission & distribution	oil and fuel, (oil-based) pesticides (creosote, pentachlorophenol, chromated copper arsenate, PCB's	liquid	Asp. Tox. 1, Muta. 2, Resp. Sens. 1, STOT RE 1, STOT RE 2, STOT SE 2, Flam. Liq. 3	Flammable	Flam. Liq. 3	-	
	Power generation	coal, cokes, oil, natural gas, liquefied ammonia, chlorine, sodium hypochlorite	gas	Aquatic Acute 1, Aquatic Chronic 2, Acute Tox. 2, Acute Tox. 3, Asp. Tox. 1, Skin Corr. 1B, Flam. Gas 1, Flam. Gas 2, Flam. Liq. 3, Liq. Gas	Toxic gas	Acute Tox. 2	-	

HAZARDOUS OPERATIONS TABLE (11 / 12)

Hazardous Operation		Hazard			Entry Point Exposure Distance Table (FEAT-R) [*default choice by expert opinion*]			
		Hazardous Substance		Hazard Classification	First Priority Response		Second Priority Response	
Facility type	Operation type	Examples of most common hazardous substances at facility	Physical State	Abbreviation according to GHS	GHS hazard	Hazard classification	GHS hazard	Hazard classification
Power	Wind energy, geothermal power generation	flammable gas, oil-based drilling fluids	gas	Flam. Gas 1, Liq. Gas, Ref. Liq. Gas	Flammable	Flam. Gas 1	-	
Transport interfaces	Loading or transfer operations: tanktruck, hopper, intermodal trailer and containers, portable tank	toxic liquid	liquid	Aquatic Chronic 2, Acute Tox. 2, Acute Tox. 3, Carc. 1B, Carc. 2, Eye Dam. 1, Repr. 2, Skin Irrit. 2, Skin Sens. 1, STOT SE 3, Flam. Liq. 2	Health hazard	Carc. 1B	Aquatic chronic	Aquatic chronic 2
Transport interfaces	Marshalling yard (temporary storage): transfer by intermodal trailer (e.g. tankcontainer)	toxic liquid	liquid	Aquatic Chronic 2, Acute Tox. 2, Acute Tox. 3, Carc. 1B, Carc. 2, Eye Dam. 1, Repr. 2, Skin Irrit. 2, Skin Sens. 1, STOT SE 3, Flam. Liq. 2	Health hazard	Carc. 1B	Aquatic chronic	Aquatic chronic 2
Small & medium enterprises	Several types of facilities	Several types of hazardous chemicals	Mixed	Several types of hazardous chemicals				

SUBSTANCE TABLE (1/10)

Checklist Priority Hazardous Substances				Entry point Exposure (FEAT-R) [default choice by expert opinion]			
				First Priority Response		Second Priority Response	
Hazardous Substance	CAS Number	Hazard Classification	Physical State	GHS Hazard	Hazard Classification	GHS Hazard	Hazard Classification
Acetylene	74-86-2	Flam. Gas 1	**Gas**	Flammable	Flam. Gas 1		
1,1-Dimethylhydrazine [Hydrazine, 1,1-dimethyl-]	57-14-7	Aquatic Chronic 2, Acute Tox. 3, Carc. 1B, Muta. 2, Skin Corr. 1B, Flam. Liq. 2	**Liquid**	Flammable	Flam. Liq. 1	Aquatic Chronic	Aquatic Chronic 2
Acrolein [2-Propenal]	107-02-8	Aquatic Acute 1, Aquatic Chronic 1, Acute Tox. 1, Acute Tox. 2, Acute Tox. 3, Carc. 2, Skin Corr. 1B, Flam. Liq. 2	**Liquid**	Toxic liquid	Acute Tox. 1	Aquatic Chronic	Aquatic Chronic 1
Acrylonitrile [2-Propenenitrile]	107-13-1	Aquatic Chronic 2, Acute Tox. 2, Acute Tox. 3, Carc. 1B, Carc. 2, Eye Dam. 1, Repr. 2, Skin Irrit. 2, Skin Sens. 1, STOT SE 3, Flam. Liq. 2	**Liquid**	Health hazard	Carc. 1B	Aquatic Chronic	Aquatic Chronic 2
Acryloyl chloride [2-Propenoyl chloride]	814-68-6	Acute Tox. 1, Skin Corr. 1A, Skin Corr. 1B, Flam. Liq. 2, Met. Corr. 1	**Liquid**	Toxic liquid	Acute Tox. 1		
Allyl alcohol [2-Propen-1-ol]	107-18-6	Aquatic Acute 1, Acute Tox. 1, Acute Tox. 2, Acute Tox. 3, Eye Irrit. 2, Eye Irrit. 2A, Skin Irrit. 2, STOT RE 1, STOT SE 3, Flam. Liq. 2, Flam. Liq. 3	**Liquid**	Toxic liquid	Acute Tox. 1	Aquatic Acute	Aquatic Acute 1
Allylamine [2-Propen-l-amine]	107-11-9	Aquatic Chronic 2, Acute Tox. 1, Acute Tox. 2, Acute Tox. 3, Skin Corr. 1A, Flam. Liq. 2	**Liquid**	Toxic liquid	Acute Tox. 1	Aquatic Chronic	Aquatic Chronic 2
Ammonia (anhydrous)	7664-41-7	Aquatic Acute 1, Aquatic Chronic 2, Acute Tox. 2, Acute Tox. 3, Asp. Tox. 1, Skin Corr. 1B, Flam. Gas 1, Flam. Gas 2, Flam. Liq. 3, Liq. Gas	**Gas**	Toxic gas	Acute Tox. 2	-	

SUBSTANCE TABLE (2/10)

Checklist Priority Hazardous Substances				Entry point Exposure (FEAT-R) [default choice by expert opinion]			
Hazardous Substance	CAS Number	Hazard Classification	Physical State	First Priority Response		Second Priority Response	
				GHS Hazard	Hazard Classification	GHS Hazard	Hazard Classification
Ammonia (conc 20% or greater)	7664-41-7	Aquatic Acute 1, Aquatic Chronic 2, Acute Tox. 2, Acute Tox. 3, Asp. Tox. 1, Skin Corr. 1B, Flam. Gas 1, Flam. Gas 2, Flam. Liq. 3, Liq. Gas	**Liquid**	Toxic liquid	Acute Tox. 2	Aquatic Chronic	Aquatic Chronic 2
Ammonium nitrate	6484-52-2	STOT SE 1, Ox. Liq. 1, Ox. Liq. 3, Ox. Sol. 1, Ox. Sol. 2, Ox. Sol. 3	**Solid**	Explosive	Ox. Sol. 1	-	
Arsenic trichloride	7784-34-1	Acute Tox. 2, Carc. 1B, Skin Corr. 1B	**Liquid**	Health hazard	Carc. 1B	-	
Arsenic trihydride	7784-42-1	Aquatic Acute 1, Aquatic Chronic 1, Acute Tox. 1, Acute Tox. 2, STOT RE 2, STOT SE 1, Flam. Gas 1, Liq. Gas	**Gas**	Toxic gas	Acute Tox. 1	-	
Carbonyl dichloride [Phosgene]	75-44-5	Acute Tox. 1, Acute Tox. 2, Repr. 1A, Skin Corr. 1B, STOT RE 1, STOT RE 2, STOT SE 1, Liq. Gas	**Gas**	Toxic gas	Acute Tox. 1		
Chlorine	7782-50-5	Aquatic Acute 1, Acute Tox. 1, Acute Tox. 2, Acute Tox. 3, Eye Irrit. 2, Skin Irrit. 2, STOT RE 2, STOT SE 3, Liq. Gas, Ox. Gas 1	**Gas**	Toxic gas	Acute Tox. 1	Aquatic Acute	Aquatic Acute 1
Chlorine dioxide [Chlorine oxide (ClO2)]	10049-04-4	Aquatic Acute 1, Acute Tox. 2, Acute Tox. 3, Skin Corr. 1B, Liq. Gas, Ox. Gas 1	**Gas**	Toxic gas	Acute Tox. 2	-	
Chloroform[Methane, trichloro-]	67-66-3	Aquatic Chronic 3, Acute Tox. 2, Acute Tox. 3, Acute Tox. 4, Carc. 2, Eye Irrit. 2, Muta. 2, Repr. 2, Skin Irrit. 2, STOT RE 1, STOT RE 2	**Gas**	Toxic gas	Acute Tox. 2	-	
Chloromethyl ether [Methane, oxybis[chloro-]	542-88-1	Acute Tox. 2, Acute Tox. 3, Acute Tox. 4, Carc. 1A, Flam. Liq. 2	**Liquid**	Health hazard	Carc. 1A	-	
Chloromethyl methyl ether [Methane, chloromethoxy-]	107-30-2	Acute Tox. 4, Carc. 1A, Flam. Liq. 2	**Liquid**	Health hazard	Carc. 1A	-	

SUBSTANCE TABLE (3 / 10)

Checklist Priority Hazardous Substances				Entry point Exposure (FEAT-R) [default choice by expert opinion]			
				First Priority Response		Second Priority Response	
Hazardous Substance	CAS Number	Hazard Classification	Physical State	GHS Hazard	Hazard Classification	GHS Hazard	Hazard Classification
Crotonaldehyde [2-Butenal]	4170-30-3	Aquatic Acute 1, Aquatic Chronic 2, Acute Tox. 1, Acute Tox. 2, Acute Tox. 3, Carc. 2, Eye Dam. 1, Muta. 1B, Muta. 2, Skin Irrit. 2, STOT RE 2, STOT SE 3, Flam. Liq. 2	Liquid	Toxic liquid	Acute Tox. 1	Aquatic Acute	Aquatic Acute 1
Crotonaldehyde, (E)- [2-Butenal, (E)-]	123-73-9	Aquatic Acute 1, Acute Tox. 1, Acute Tox. 2, Acute Tox. 3, Eye Dam. 1, Muta. 2, Skin Irrit. 2, STOT RE 2, STOT SE 3, Flam. Liq. 2	Liquid	Toxic liquid	Acute Tox. 1	Aquatic Acute	Aquatic Acute 1
Cyanogen chloride	506-77-4	Acute Tox. 1, Acute Tox. 2, Skin Corr. 1A, Liq. Gas	Gas	Toxic gas	Acute Tox. 1	-	
Cyclohexylamine [Cyclohexanamine]	108-91-8	Aquatic Chronic 3, Acute Tox. 4, Repr. 2, Skin Corr. 1B, Flam. Liq. 2, Flam. Liq. 3, Met. Corr. 1	Liquid	Corrosive	Skin Corr. 1B	-	
De-icing agents (repre-sentative): propane-1,2 diol (propylene glycol)	57-55-6	Aquatic Chronic 2	Liquid	Aquatic Chronic	Aquatic Chronic 2	-	-
Diborane	19287-45-7	Acute Tox. 1, Acute Tox. 2, Flam. Gas 1, Liq. Gas, Pres. Gas	Gas	Flammable	Flammable Gas 1	-	
Diesel	68334-30-5	Aquatic Chronic 2, Aquatic Chronic 3, Asp. Tox. 1, Carc. 2, STOT RE 2, Flam. Liq. 3	Liquid	Health hazard	Asp. Tox. 1	Aquatic Chronic	Aquatic Chronic 2
Dimethyldichlorosilane [Silane, dichlorodimethyl-]	75-78-5	Eye Irrit. 2, Skin Corr. 1A, Skin Corr. 1B, Skin Irrit. 2, STOT SE 3, Flam. Liq. 2	Liquid	Corrosive	Skin Corr. 1A	-	
Dinickel trioxide	1314-06-3	Aquatic Chronic 4, Carc. 1A, Skin Sens. 1, STOT RE 1	Solid	Health hazard	Carc. 1A	-	
Epichlorohydrin [Oxirane, (chloromethyl)-]	106-89-8	Aquatic Chronic 3, Acute Tox. 2, Acute Tox. 3, Carc. 1A, Carc. 1B, Repr. 2, Skin Corr. 1B, Skin Sens. 1, Flam. Liq. 3	Liquid	Health hazard	Carc. 1A	-	

SUBSTANCE TABLE (4 / 10)

Checklist Priority Hazardous Substances				Entry point Exposure (FEAT-R) [default choice by expert opinion]			
Hazardous Substance	CAS Number	Hazard Classification	Physical State	First Priority Response		Second Priority Response	
				GHS Hazard	Hazard Classification	GHS Hazard	Hazard Classification
Ethylene oxide [Oxirane]	75-21-8	Aquatic Chronic 3, Acute Tox. 2, Acute Tox. 3, Carc. 1B, Eye Irrit. 2, Eye Irrit. 2A, Muta. 1B, Skin Irrit. 2, STOT RE 1, STOT SE 3, Flam. Gas 1, Liq. Gas	**Gas**	Health hazard	Carc. 1B	-	
Ethylenediamine [1,2- Ethanediamine]	107-15-3	Aquatic Chronic 3, Acute Tox. 4, Repr. 1A, Resp. Sens. 1, Resp. Sens. 1B, Skin Corr. 1A, Skin Corr. 1B, Skin Sens. 1, STOT RE 2, Flam. Liq. 3, Met. Corr. 1	**Liquid**	Health hazard	Repr. 1A	-	
Ethyleneimine [Aziridine]	151-56-4	Aquatic Chronic 2, Acute Tox. 1, Acute Tox. 2, Carc. 1B, Muta. 1B, Skin Corr. 1B, Flam. Liq. 2	**Liquid**	Toxic liquid	Acute Tox. 1	Aquatic Chronic	Aquatic Chronic 2
Fluorine	7782-41-4	Acute Tox. 1, Acute Tox. 2, Skin Corr. 1A, Liq. Gas, Ox. Gas 1	**Gas**	Toxic gas	Acute Tox. 1	-	
Formaldehyde (solution)	50-00-0	Acute Tox. 2, Acute Tox. 3, Carc. 1A, Carc. 2, Muta. 2, Resp. Sens. 1, Skin Corr. 1B, Skin Corr. 1C, Skin Sens. 1, STOT RE 1, STOT SE 1, STOT SE 2, Flam. Gas 1, Liq. Gas, Met. Corr. 1	**Liquid**	Health hazard	Carc. 1A	-	
Furan	110-00-9	Aquatic Chronic 3, Acute Tox. 1, Acute Tox. 4, Carc. 1B, Muta. 2, Skin Irrit. 2, STOT RE 2, Flam. Liq. 1	**Liquid**	Toxic liquid	Acute Tox. 1	-	
Gasoline	86290-81-5	Flam.Liq. 2, skin Corr. 2, Muta 1B, Carc. 1B, Repr. 1A, STOT SE 3, STOT RE 1, Asp 1, Aquatic acute 3	**Liquid**	Flammable	Flam.Liq. 2		
Hydrazine	302-01-2	Aquatic Acute 1, Aquatic Chronic 1, Acute Tox. 2, Acute Tox. 3, Carc. 1A, Carc. 1B, Skin Corr. 1B, Skin Sens. 1, Flam. Liq. 3	**Liquid**	Health hazard	Carc. 1A	Aquatic Acute	Aquatic Acute 1

SUBSTANCE TABLE (5 / 10)

Checklist Priority Hazardous Substances				Entry point Exposure (FEAT-R) [default choice by expert opinion]			
				First Priority Response		Second Priority Response	
Hazardous Substance	CAS Number	Hazard Classification	Physical State	GHS Hazard	Hazard Classification	GHS Hazard	Hazard Classification
Hydrochloric acid (conc 37%or greater)	7647-01-0	Acute Tox. 2, Acute Tox. 3, Repr. 1A, Repr. 1B, Resp. Sens. 1, Skin Corr. 1A, Skin Corr. 1B, Skin Corr. 1C, STOT RE 1, STOT RE 2, STOT SE 1, STOT SE 3, Flam. Liq. 2, Liq. Gas, Met. Corr. 1	Liquid	Corrosive	Skin Corr. 1A	-	
Hydrocyanic acid [Hydrogen cyanide]	74-90-8	Aquatic Acute 1, Aquatic Chronic 1, Acute Tox. 1, Acute Tox. 2, STOT RE 1, STOT SE 1, Flam. Liq. 1	Liquid	Toxic liquid	Acute Tox. 1	Aquatic Acute	Aquatic Acute 1
Hydrogen	1333-74-0	Carc. 1A, Muta. 1B, Resp. Sens. 1, Flam. Gas 1, Liq. Gas, Ox. Gas 1, Ref. Liq. Gas	Gas	Flammable	Flammable Gas 1	-	
Hydrogen chloride (anhydrous) [Hydrochloric acid]	7647-01-0	Acute Tox. 2, Acute Tox. 3, Repr. 1A, Repr. 1B, Resp. Sens. 1, Skin Corr. 1A, Skin Corr. 1B, Skin Corr. 1C, STOT RE 1, STOT RE 2, STOT SE 1, STOT SE 3, Flam. Liq. 2, Liq. Gas, Met. Corr. 1	Gas	Corrosive	Skin Corr. 1	-	
Hydrogen fluoride (conc 50%or greater) [Hydrofluoric acid]	7664-39-3	Acute Tox. 1, Acute Tox. 2, Skin Corr. 1A, Met. Corr. 1	Liquid	Toxic liquid	Acute Tox. 1	-	
Hydrogen selenide	7783-07-5	Acute Tox. 2, Flam. Gas 1, Liq. Gas, Pres. Gas	Gas	Flammable	Flam. Gas 1	-	
Hydrogen sulfide	7783-06-4	Aquatic Acute 1, Acute Tox. 1, Acute Tox. 2, Flam. Gas 1, Liq. Gas	Gas	Toxic gas	Acute Tox. 1	-	
Iron, pentacarbonyl [Iron carbonyl (Fe(CO)5), (TB-5-11)-]	13463-40-6	Acute Tox. 1, Acute Tox. 2, STOT RE 1, Flam. Liq. 2	Liquid	Toxic liquid	Acute Tox. 1	-	
Isobutyronitrile [Propanenitrile, 2-methyl-]	78-82-0	Acute Tox. 2, STOT SE 1, STOT SE 2, Flam. Liq. 2	Liquid	Health hazard	STOT SE1	-	

SUBSTANCE TABLE (6 / 10)

Checklist Priority Hazardous Substances				Entry point Exposure (FEAT-R) [default choice by expert opinion]			
Hazardous Substance	CAS Number	Hazard Classification	Physical State	First Priority Response		Second Priority Response	
				GHS Hazard	Hazard Classification	GHS Hazard	Hazard Classification
Isopropyl chloroformate [Carbonochloridic acid, 1- methylethyl ester]	108-23-6	Acute Tox. 1, Acute Tox. 2, Skin Corr. 1A, Skin Corr. 1B, Flam. Liq. 2	Liquid	Toxic liquid	Acute Tox. 1	-	
Kerosene	8008-20-6	Aquatic Chronic 2, Aquatic Chronic 3, Asp. Tox. 1, Flam. Liq. 3	Liquid	Flammable	Flam. Liq. 3	Aquatic Chronic	Aquatic Chronic 2
Liquefied Petroleum Gas (LPG)	68476-85-7	Flam. Gas 1, Gases under pressure, Compressed gas, Carc. 1B, Muta. 1B	Gas	Flammable	Flam.Gas 1		
Methacrylonitrile [2-Propenenitrile, 2-methyl-]	126-98-7	Acute Tox. 2, Acute Tox. 3, Skin Sens. 1, STOT SE 1, Flam. Liq. 2	Liquid	Health hazard	STOT SE1	-	
Methane	74-82-8	Flam. Gas 1, Liq. Gas, Ref. Liq. Gas	Gas	Flammable	Flam. Gas 1	-	-
Methanol	67-56-1	Acute Tox. 2, Acute Tox. 3, Carc. 2, Repr. 1B, Repr. 2, Skin Corr. 1A, STOT RE 1, STOT RE 2, STOT SE 1, STOT SE 2, Flam. Liq. 2, Ox. Liq. 1	Liquid	Health hazard	STOT SE1	-	
Methyl chloride [Methane, chloro-]	74-87-3	Carc. 2, Repr. 2, Skin Corr. 1A, STOT RE 2, Flam. Gas 1, Flam. Gas 2, Flam. Liq. 1, Liq. Gas	Gas	Flammable	Flam. Gas 1	-	
Methyl chloroformate [Carbonochloridic acid, methylester]	79-22-1	Acute Tox. 1, Acute Tox. 2, Acute Tox. 4, Skin Corr. 1B, Flam. Liq. 2	Liquid	Toxic liquid	Acute Tox. 1	-	
Methyl hydrazine [Hydrazine, methyl-]	60-34-4	Aquatic Chronic 2, Acute Tox. 1, Acute Tox. 2, Carc. 1A, Carc. 1B, Carc. 2, Resp. Sens. 1, Skin Corr. 1B, STOT SE 1, Flam. Liq. 2	Liquid	Health hazard	Carc. 1A	Aquatic Chronic	Aquatic Chronic 2
Methyl isocyanate [Methane, isocyanato-]	624-83-9	Acute Tox. 1, Acute Tox. 2, Acute Tox. 3, Eye Dam. 1, Repr. 2, Resp. Sens. 1, Skin Irrit. 2, Skin Sens. 1, STOT SE 3, Flam. Liq. 2	Liquid	Toxic liquid	Acute Tox. 1	-	
Methyl mercaptan	74-93-1	Aquatic Acute 1, Aquatic Chronic 1, Acute	Gas	Flammable	Flam. Gas 1	-	

SUBSTANCE TABLE (7/10)

Checklist Priority Hazardous Substances				Entry point Exposure (FEAT-R) [default choice by expert opinion]			
Hazardous Substance	CAS Number	Hazard Classification	Physical State	First Priority Response		Second Priority Response	
				GHS Hazard	Hazard Classification	GHS Hazard	Hazard Classification
[Methanethiol]		Tox. 3, Flam. Gas 1, Flam. Liq. 1, Liq. Gas					
Methyl thiocyanate [Thiocyanic acid, methyl ester]	556-64-9	Acute Tox. 2, Flam. Liq. 2, Flam. Liq. 3	Liquid	Toxic liquid	Acute Tox. 2	-	
Methyltrichlorosilane [Silane, trichloromethyl-]	75-79-6	Eye Irrit. 2, Skin Corr. 1A, Skin Irrit. 2, STOT SE 3, Flam. Liq. 2	Liquid	Corrosive	Skin Corr. 1A	-	
Naptha	8030-30-6	Aquatic Chronic 2, Asp. Tox. 1, Carc. 1B, Muta. 1B, Repr. 2, Flam. Liq. 1, Flam. Liq. 2, Flam. Liq. 3	Liquid	Health hazard	Carc. 1B	Aquatic Chronic	Aquatic Chronic 2
Nickel carbonyl	13463-39-3	Aquatic Acute 1, Aquatic Chronic 1, Acute Tox. 2, Carc. 2, Repr. 1B, Flam. Liq. 2	Liquid	Health hazard	Repr. 1B	Aquatic Acute	Aquatic Acute 1
Nickel oxide	1313-99-1	Aquatic Chronic 4, Carc. 1A, Carc. 1B, Resp. Sens. 1, Skin Sens. 1, STOT RE 1, STOT RE 2	Solid	Health hazard	Carc. 1A	-	
Nickel sulphide	16812-54-7	Aquatic Acute 1, Aquatic Chronic 1, Carc. 1A, Muta. 2, Resp. Sens. 1B, Skin Sens. 1, STOT RE 1, STOT RE 2	Solid	Health hazard	Carc. 1A	-	
Nitric acid (conc 80% or greater)	7697-37-2	Acute Tox. 1, Acute Tox. 2, Asp. Tox. 1, Skin Corr. 1A, Skin Corr. 1B, STOT RE 1, STOT SE 1, Met. Corr. 1, Ox. Liq. 1, Ox. Liq. 2, Ox. Liq. 3	Liquid	Toxic liquid	Acute Tox. 1	-	
Nitric oxide [Nitrogen oxide (NO)]	10102-43-9	Acute Tox. 1, Acute Tox. 2, Skin Corr. 1B, STOT RE 2, Ox. Gas 1, Pres. Gas	Gas	Toxic gas	Acute Tox. 1	-	
Oleum (Fuming Sulfuric acid) [Sulfuric acid, mixture with sulfur trioxide] (1)	8014-95-7	Acute Tox. 1, Skin Corr. 1A, Met. Corr. 1	Liquid	Toxic liquid	Acute Tox. 1	-	

SUBSTANCE TABLE (8 / 10)

Checklist Priority Hazardous Substances				Entry point Exposure (FEAT-R) [default choice by expert opinion]			
Hazardous Substance	CAS Number	Hazard Classification	Physical State	First Priority Response		Second Priority Response	
				GHS Hazard	Hazard Classification	GHS Hazard	Hazard Classification
Organosphosphate pesticides (representative): malathion (ISO)	121-75-5	Aquatic Acute 1, Aquatic Chronic 1, Acute Tox. 1, Acute Tox. 4, Skin Sens. 1	**Liquid**	Toxic liquid	Acute Tox. 1	Aquatic Chronic	Aquatic Chronic 1
Organosphosphate pesticides (representative): dichlorvos (ISO)	62-73-7	Aquatic Acute 1, Acute Tox. 1, Acute Tox. 2, Acute Tox. 3, Skin Sens. 1	**Liquid**	Toxic liquid	Acute Tox. 1	Aquatic Acute	Aquatic Acute 1
Oxygen	7782-44-7	Liq. Gas, Ox. Gas 1, Ref. Liq. Gas	**Gas**	Oxidizing	Ox. Gas 1	-	
Peracetic acid [Ethaneperoxoic acid]	79-21-0	Aquatic Acute 1, Acute Tox. 4, Skin Corr. 1A, Skin Corr. 1B, Flam. Liq. 3, Org. Perox. C, Org. Perox. D	**Liquid**	Explosive	Org. Perox. C	Aquatic Acute	Aquatic Acute 1
Perchloromethyl mer-captan [Methanesulfen- yl chloride, trichloro-]	594-42-3	Acute Tox. 1, Skin Corr. 1B, STOT RE 1, STOT SE 1	**Liquid**	Health hazard	STOT SE1	-	
Phosgene [Carbonic dichloride]	75-44-5	Acute Tox. 1, Acute Tox. 2, Repr. 1A, Skin Corr. 1B, STOT RE 1, STOT RE 2, STOT SE 1, Liq. Gas	**Gas**	Toxic gas	Acute Tox. 1	-	
Phosphine [Phosphorous trihydride]	7803-51-2	Aquatic Acute 1, Acute Tox. 1, Acute Tox. 2, Skin Corr. 1B, Flam. Gas 1, Liq. Gas	**Gas**	Toxic gas	Acute Tox. 1	-	
Phosphorus oxychloride [Phosphoryl chloride]	10025-87-3	Acute Tox. 1, Acute Tox. 2, Acute Tox. 4, Skin Corr. 1A, STOT RE 1, Met. Corr. 1	**Liquid**	Toxic liquid	Acute Tox. 1	-	
Phosphorus trichloride	7719-12-2	Acute Tox. 2, Skin Corr. 1A, STOT RE 1, STOT RE 2, STOT SE 1, Water-React. 1	**Liquid**	Reactive with water	Water-React 1	-	
Propionitrile [Propanenitrile]	107-12-0	Acute Tox. 1, Acute Tox. 2, Repr. 1B, Flam. Liq. 2	**Liquid**	Toxic liquid	Acute Tox. 1	-	
Piperidine	110-89-4	Acute Tox. 3, Skin Corr. 1B, Skin Corr. 1C, Flam. Liq. 2	**Liquid**	Corrosive	Skin Corr. 1B	-	

SUBSTANCE TABLE (9/10)

Checklist Priority Hazardous Substances				Entry point Exposure (FEAT-R) [default choice by expert opinion]			
Hazardous Substance	CAS Number	Hazard Classification	Physical State	First Priority Response		Second Priority Response	
				GHS Hazard	Hazard Classification	GHS Hazard	Hazard Classification
Potassium nitrate	7757-79-1	Repr. 2, STOT RE 2, STOT SE 2, Ox. Liq. 1, Ox. Liq. 2, Ox. Liq. 3, Ox. Sol. 1, Ox. Sol. 2, Ox. Sol. 3	Solid	Oxidizing	Ox. Sol. 1	-	
Propyl chloroformate [Carbonochloridic acid, propylester]	109-61-5	Acute Tox. 2, Acute Tox. 3, Skin Corr. 1B, Flam. Liq. 2	Liquid	Toxic liquid	Acute Tox. 2	-	
Propylene oxide [Oxirane, methyl-]	75-56-9	Aquatic Acute 3, Aquatic Chronic 3, Acute Tox. 4, Carc. 1B, Eye Irrit. 2, Muta. 1B, Skin Irrit. 2, STOT SE 3, Flam. Gas 1, Flam. Liq. 1	Liquid	Flammable	Flam. Liq. 1	-	
Propyleneimine [Aziridine, 2-methyl-]	75-55-8	Aquatic Chronic 2, Acute Tox. 1, Acute Tox. 2, Carc. 1B, Eye Dam. 1, Flam. Liq. 2	Liquid	Toxic liquid	Acute Tox. 1	Aquatic Chronic	Aquatic Chronic 2
Sulfur dichloride	10545-99-0	Aquatic Acute 1, Skin Corr. 1B, STOT SE 3	Liquid	Aquatic Acute	Aquatic Acute 1	Corrosive	Skin Corr. 1B
Sulfur dioxide (anhydrous)	7446-09-5	Acute Tox. 2, Acute Tox. 3, Skin Corr. 1B, STOT RE 1, STOT SE 1, Liq. Gas	Gas	Health hazard	STOT SE1	-	
Sulfur tetrafluoride [Sulfur fluoride (SF4), (T-4)-]	7783-60-0	Acute Tox. 1, Acute Tox. 2, Skin Corr. 1A, Skin Corr. 1B, Liq. Gas, Pres. Gas	Gas	Toxic gas	Acute Tox. 1	-	
Sulfur trioxide	7446-11-9	Acute Tox. 1, Acute Tox. 2, Carc. 1B, Skin Corr. 1A, Skin Corr. 1B, Ox. Liq. 1	Gas	Toxic gas	Acute Tox. 1	-	
Tetramethyllead [Plumbane, tetramethyl-]	75-74-1	Acute Tox. 1, Acute Tox. 2, Repr. 1A, STOT RE 2, Flam. Liq. 3	Liquid	Toxic liquid	Acute Tox. 1	-	
Tetranitromethane [Methane, tetranitro-]	509-14-8	Acute Tox. 1, Carc. 2, Ox. Liq. 1	Liquid	Oxidizing	Ox. Liq. 1	-	
Titaniumtetrachloride [Titaniumchloride (TiCl4) (T-4)-]	7550-45-0	Acute Tox. 2, Skin Corr. 1B, STOT RE 1, STOT SE 1	Liquid	Health hazard	STOT SE1	-	

SUBSTANCE TABLE (10 / 10)

Checklist Priority Hazardous Substances				Entry point Exposure (FEAT-R) [default choice by expert opinion]			
Hazardous Substance	CAS Number	Hazard Classification	Physical State	First Priority Response		Second Priority Response	
				GHS Hazard	Hazard Classification	GHS Hazard	Hazard Classification
Toluene 2,4-diisocyanate [Benzene, 2,4-diisocyanato-1-methyl-]	584-84-9	Aquatic Chronic 3, Acute Tox. 1, Acute Tox. 2, Carc. 2, Eye Irrit. 2, Eye Irrit. 2A, Resp. Sens. 1, Skin Irrit. 2, Skin Sens. 1, STOT SE 2, STOT SE 3	Liquid	Toxic liquid	Acute Tox. 1	-	
Toluene 2,6-diisocyanate [Benzene, 1,3-diisocyanato-2-methyl-]	91-08-7	Aquatic Chronic 3, Acute Tox. 1, Acute Tox. 2, Carc. 2, Eye Irrit. 2, Muta. 2, Resp. Sens. 1, Skin Irrit. 2, Skin Sens. 1, STOT SE 2, STOT SE 3	Liquid	Toxic liquid	Acute Tox. 1	-	
Toluene diisocyanate (unspecified isomer) [Benzene,1,3-diisocyanatomethyl-]	26471-62-5	Aquatic Chronic 3, Acute Tox. 1, Acute Tox. 2, Carc. 2, Eye Irrit. 2, Eye Irrit. 2A, Resp. Sens. 1, Skin Corr. 1B, Skin Irrit. 2, Skin Sens. 1, STOT RE 1, STOT SE 1, STOT SE 3	Liquid	Toxic liquid	Acute Tox. 1	-	
Trimethylchlorosilane [Silane, chlorotrime- thyl-]	75-77-4	Acute Tox. 1, Acute Tox. 2, Carc. 2, Skin Corr. 1A, Skin Corr. 1B, Skin Corr. 1C, Flam. Liq. 2, Met. Corr. 1	Liquid	Toxic liquid	Acute Tox. 1	-	
Trinickel disulphide	12035-72-2	Aquatic Acute 1, Aquatic Chronic 1, Carc. 1A, Muta. 2, Skin Sens. 1, STOT RE 1	Solid	Aquatic Acute	Aquatic Acute 1	-	
Vinyl acetate monomer [Acetic acid ethenyl ester]	108-05-4	Aquatic Chronic 3, Acute Tox. 4, Carc. 2, STOT SE 2, STOT SE 3, Flam. Liq. 2	Liquid	Health hazard	Carc. 2	-	

PICTOGRAM TABLE (1 / 2)

Hazard Pictograms					Priority Hazard classification [expert opinion]		
GHS Hazard	**GHS Pictogram**	**Example UN Transport pictogram**	**Old Symbols**	**Hazard Classification**	**Physical State** (gas, liquid, solid)	**Hazard Classification**	**Hazard Description**
Physical hazard							
Explosive				Category 1.1, 1.2, 1.5, Unst. Expl Self react. A, B, C Org. Perox. A, B, C	Solid or Liquid	Explosive Category 1.1	Overpressure
Flammable				Flam. Gas 1 Flam. Liq. 1, 2 Flam. Aerosol 1 Pyr. Liq. 1 Water-react. 1	Liquid	Flam. Liq. 1	Heat radiation
Oxidizing				Ox. Gas 1, Ox. Sol. 1 and Ox. Liq. 1	Gas	Ox. Gas 1	Fire propagating
Gas under pressure			no classification	Press. Gas Ref. Liq. Gas	Gas	Gas under pressure	Fragments
Health hazard							
Toxic gas				Acute Tox. 1, 2, 3 Aquatic Toxic gas	Gas	Acute Tox. 1	Intoxication
Toxic liquid				Acute Tox. 1, 2, 3	Liquid	Acute Tox. 1	Intoxication
Corrosive				Skin Corr. 1A, 1B, 1C Eye Dam. 1 Skin Sens. 1	Liquid	Skin Corr. 1A	Corrosive

PICTOGRAM TABLE (2 / 2)

Hazard Pictograms					Priority Hazard classification [expert opinion]		
GHS Hazard	**GHS Pictogram**	**Example UN Transport pictogram**	**Old Symbols**	**Hazard Classification**	**Physical State** (gas, liquid, solid)	**Hazard Classification**	**Hazard Description**
Health hazard							
Irritant				Acute Tox. 4 Skin Irrit. 2; Eye Irrit. 2 STOT SE 2; STOT RE 2	Gas	Skin Irr. 2	Irritant
Health Hazard				Carc. 1A, 1B Muta. 1A, 1B Repr. 1A, 1B Resp. Sens. 1 Asp. Tox. 1 STOT SE 1, STOT RE 1	Gas, Liquid, Solid	Carc. 1A	May cause carcinogenic, mutagenic, repotoxic mutation, induce hypersensitivity of airways, or other severe acute/health effects
Environmental hazard							
Hazardous to the Aquatic Environment				Aquatic Chronic 1, 2, 3 Aquatic Acute 1, 2, 3	Liquid	Aquatic Chronic 1	Significant health effects
Reactive with water (No GHS hazard)	No pictogram			Reactive with water	Liquid	Reactivity	Reacts violently with water
Forms toxic gas in contact with water (No GHS hazard)	No pictogram			Forms toxic gas when in contact with water	Liquid	Acute Tox. Gas 1	Formation and release of toxic gas

The UN Transport pictograms provided are examples of those that fit the organization of FEAT.
Note: not all of the UN Transport pictograms are provided here.

DEFINITIONS OF GHS HAZARD CLASSIFICATIONS (1/4)

GHS Hazard	Hazard Classification	Definition
Physical hazard		
Explosive	**Expl. 1.1**	An explosive is a reactive substance that contains a great amount of potential energy that can produce an explosion if released suddenly, usually accompanied by the production of light, heat, sound, and pressure. Pyrotechnic substances are included even when they do not evolve gases. A pyrotechnic substance (or mixture) is designed to produce an effect by heat, light, sound, gas or smoke or a combination of these as the result of non-detonative, self-sustaining, exothermic chemical reactions.
	Expl. 1.2	
	Expl. 1.3	
	Expl. 1.4	
	Expl. 1.5	
	Expl. 1.6	
	Unst. Expl	
Flammable gas	**Flam. Gas 1**	Flammable gas means a gas having a flammable range in air at 20°C and a standard (ambient) pressure of 101.3 kPa. Substances and mixtures of this hazard class are assigned in two hazard categories.
	Flam. Gas 2	
Flammable aerosol	**Flam. Aerosol 1**	An aerosol is a colloid of fine solid particles or liquid droplets, in air or another gas. An aerosol often is a compressed gas, liquefied or dissolved under pressure within a non-refillable container made of metal, glass or plastic, with or without a liquid, paste or powder. The container is fitted with a release device allowing the contents to be ejected as solid or liquid particles in suspension in a gas, as a foam, paste or powder or in a liquid or gaseous state. Aerosols should be considered for classification as either a Category 1 or Category 2 Flammable Aerosol if they contain any component classified as flammable according to the GHS criteria for flammable liquids, flammable gases, or flammable solids.
	Flam. Aerosol 2	
Oxidizing gas	**Ox. Gas 1**	An oxidizing gas is any gas which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does. Substances and mixtures of this hazard class are assigned to a single hazard category on the basis that, generally by providing oxygen, they cause or contribute to the combustion of other material more than air does.

GHS Hazard	Hazard Classification	Definition
Physical hazard		
Gas under pressure	**Press. Gas**	A gas under pressure is a gas contained in a containment at a pressure not less than 200 kPa at 20°C or as a refrigerated liquid. This endpoint covers four types of gases or gaseous mixtures to address the effects of sudden release of pressure or freezing which may lead to serious damage to people, property, or the environment independent of other hazards the gases may pose.
	Ref. Liq. Gas	
Flammable liquid	**Flam. Liq. 1**	A flammable liquid means a liquid having a flash point of not more than 93°C. Substances and mixtures of this hazard class are assigned to one of four hazard categories on the basis of the flash point and boiling point.
	Flam. Liq. 2	
	Flam. Liq. 3	
	Flam. Liq. 4	
Flammable solid	**Flam. Sol. 1**	A flammable is readily combustible, or may cause or contribute to fire through friction. Readily combustible solids are powdered, granular, or pasty substances which are dangerous if they can be easily ignited by brief contact with an ignition source, such as a burning match, and if the flame spreads rapidly.
	Flam. Sol. 2	
Self-reactive substance	**Self-react. A**	A self-reactive substance is an unstable liquid or solid liable to undergo a strong reaction (such as exothermic thermal decomposition), even without participation of oxygen (air). This definition excludes materials classified under the GHS as explosive, organic peroxides or as oxidizing. These materials may have similar properties, but such hazards are addressed in their specific endpoints.
	Self-react. B	
	Self-react. C	
	Self-react. D	
	Self-react. E	
	Self-react. F	
	Self-react. G	
Self-heating substance	**Self-heat. 1**	A self-heating substance is a solid or liquid, other than a pyrophoric substance, which, by reaction with air and without energy supply, is liable to self-heat. This endpoint differs from a pyrophoric substance in that it will ignite only when in large amounts (kilograms) and after long periods of time (hours or days). Substances and mixtures of this hazard class are assigned to one of two hazard categories.
	Self-heat. 2	

DEFINITIONS OF GHS HAZARD CLASSIFICATIONS (2/4)

GHS Hazard	Hazard Classification	Definition
Physical hazard		
Oxidizing liquid	**Ox. Liq. 1**	An oxidizing liquid is a liquid which, while in itself not necessarily combustible, may, generally by yielding oxygen, cause or contribute to the combustion of other material. Substances and mixtures of this hazard class are assigned to one of three hazard categories.
	Ox. Liq. 2	
	Ox. Liq. 3	
Oxidizing solid	**Ox. Sol. 1**	An oxidizing solid is a solid which, while in itself not necessarily combustible, may, generally by yielding oxygen, cause or contribute to the combustion of other material. Substances and mixtures of this hazard class are assigned to one of three hazard categories.
	Ox. Sol. 2	
	Ox. Sol. 3	
Organic peroxide	**Org. Perox. A**	An organic peroxide can cause fire and explosion. An organic peroxide may also be toxic or corrosive. Depending on the material, route of exposure (inhalation, eye or skin contact, or swallowing) and dose or amount of exposure, they could harm the body. Corrosive organic peroxides can also attack and destroy metals. Organic peroxides are available as solids (usually fine powders), liquids or pastes.
	Org. Perox. B	
	Org. Perox. C	
	Org. Perox. D	
	Org. Perox. E	
	Org. Perox. F	
	Org. Perox. G	
Substance corrosive to metal	**Met. Corr. 1**	A substance is termed 'corrosive to metal' if it can - by oxidation or dissolution - attack metals. These substances or mixtures are classified in a single hazard category.

GHS Hazard	Hazard Classification	Definition
Health Hazard		
Acute Toxic	**Acute Tox. 1**	Five GHS categories have been included in the GHS Acute Toxicity scheme from which the appropriate elements relevant to transport, consumer, worker and environment protection can be selected.
	Acute Tox. 2	
	Acute Tox. 3	
	Acute Tox. 4	
	Acute Tox. 5	
Skin Corrosion Skin Irritation	**Skin Corr. 1A**	Skin corrosion means the production of irreversible damage to the skin following the application of a test substance for up to 4 hours. Substances and mixtures in this hazard class are assigned to a single harmonized corrosion category. Skin irritation means the production of reversible damage to the skin following the application of a test substance for up to 4 hours. Substances and mixtures in this hazard class are assigned to a single irritant category. For those authorities, such as pesticide regulators, wanting more than one designation for skin irritation, an additional mild irritant category is provided.
	Skin Corr. 1B	
	Skin Corr. 1C	
	Skin Irrit. 2	
	Skin Mild Irrit. 3	
Serious Eye Damage / **Eye Irritation**	**Eye Dam. 1**	Serious eye damage means the production of tissue damage in the eye, or serious physical decay of vision, following application of a test substance to the front surface of the eye, which is not fully reversible within 21 days of application. Substances and mixtures in this hazard class are assigned to a single harmonized category. Eye irritation means changes in the eye following the application of a test substance to the front surface of the eye, which are fully reversible within 21 days of application. Substances and mixtures in this hazard class are assigned to a single harmonized hazard category. For authorities, such as pesticide regulators, wanting more than one designation for eye irritation, one of two subcategories can be selected, depending on whether the effects are reversible in 21 or 7 days.
	Eye Irrit. 2	
	Eye Irrit. 2A	
	Eye Irrit. 2B	

DEFINITIONS OF GHS HAZARD CLASSIFICATIONS (3/4)

GHS Hazard	Hazard Classification	Definition
	Health Hazard	
Respiratory Sensitization	**Resp. Sens. 1**	Respiratory sensitizer means a substance that induces hypersensitivity of the airways following inhalation of the substance. Substances and mixtures in this hazard class are assigned to one hazard category.
	Resp. Sens. 1A	
	Resp. Sens. 1B	
Skin Sensitization	**Skin Sens. 1**	Skin sensitizer means a substance that will induce an allergic response following skin contact. The definition for "skin sensitizer" is equivalent to "contact sensitizer". Substances and mixtures in this hazard class are assigned to one hazard category. Consideration should be given to classifying substances which cause immunological contact urticaria (an allergic disorder) as contact sensitizers.
	Skin Sens. 2	
	Skin Sens. 3	
Germ Cell Mutagenicity	**Muta. 1A**	Mutagen means an agent giving rise to an increased occurrence of mutations in populations of cells and/or organisms. Substances and mixtures in this hazard class are assigned to one of two hazard categories.
	Muta. 1B	
	Muta. 2	
Carcinogenicity	**Carc. 1A**	Carcinogen means a chemical substance or a mixture of chemical substances which induce cancer or increase its incidence. Substances and mixtures in this hazard class are assigned to one of two hazard categories.
	Carc. 1B	
	Carc. 2	
Reproductive Toxicology	**Repr. 1A**	Reproductive toxicity includes adverse effects on sexual function and fertility in adult males and females, as well as developmental toxicity in offspring. Substances and mixtures with reproductive and/or developmental effects are assigned to one of two hazard categories, 'known or presumed' and 'suspected'.
	Repr. 1B	
	Repr. 2	
	Lact.	

GHS Hazard	Hazard Classification	Definition
	Health Hazard	
System Target Organ Toxicity Single Exposure	**STOT SE 1**	The GHS distinguishes between single and repeat exposure for Target Organ Effects. Some existing systems distinguish between single and repeat exposure for these effects and some do not. All significant health effects, not otherwise specifically included in the GHS, that can impair function, both reversible and irreversible, immediate and/or delayed are included in the non-lethal Systemic Target Organ Toxicity class (STOT). Narcotic effects and respiratory tract irritation are considered to be target organ systemic effects following a single exposure.
	STOT SE 2	
	STOT SE 3	
System Target Organ Toxicity Repeated Exposure	**STOT RE 1**	
	STOT RE 2	
Aspiration Toxicity	**Asp. Tox. 1**	Aspiration toxicity includes severe acute effects such as chemical pneumonia, varying degrees of pulmonary injury or death following aspiration. Aspiration is the entry of a liquid or solid directly through the oral or nasal cavity, or indirectly from vomiting, into the trachea and lower respiratory system.
	Asp. Tox. 2	

DEFINITIONS OF GHS HAZARD CLASSIFICATIONS (4/4)

GHS Hazard	Hazard Classification	Definition
Environmental Hazard		
Hazardous to the aquatic environment: Acute aquatic toxicity	**Aquatic Acute 1**	Acute aquatic toxicity means the intrinsic property of a material to cause injury to an aquatic organism in a short-term exposure. Substances and mixtures of this hazard class are assigned to one of three toxicity categories.
	Aquatic Acute 2	
	Aquatic Acute 3	
Hazardous to the aquatic environment: Chronic aquatic toxicity	**Aquatic Chronic 1**	Chronic aquatic toxicity means the potential or actual properties of a material to cause adverse effects to aquatic organisms during exposures that are determined in relation to the lifecycle of the organism. Substances and mixtures in this hazard class are assigned to one of four toxicity categories on the basis of acute data and environmental fate data.
	Aquatic Chronic 2	
	Aquatic Chronic 3	
	Aquatic Chronic 4	
Reactive with water	**Water Reactive 1,2**	Substances and mixtures which react violently with water, such as acetyl chloride, titanium tetrachloride.
Forms toxic gas when in contact with water	**Aquatic Toxic gas**	Substances and mixtures which in contact with water liberate toxic gas (substances and mixtures which in contact with water or damp air evolve gases classified for acute toxicity in category 1, 2 or 3, such as aluminium phosphide or phosphorus pentasulphide).

QUANTITY TABLE

Modality	Default		Unit Conversions
	Instantaneous Release (Typical Quantity) [kg]	Continuous Release [kg/s]	
INDUSTRY			**Weight**
Default: large storage tank	100,000,000	100	1 kilogram (kg) = 2.2 pounds (lbs)
Intermediate Bulk Container (IBC)	1,000	1	1 pound (lb) = 454 grams (g) = 0.454 kilograms (kg)
Drum	200	1	1 metric tonne = 1,000 kilograms (kg)
Gas bottle	50	1	1 metric tonne = 1.1023 short tons
Storage hazardous substances (mixed)	20,000	0.5	1 short ton = 0.907 metric tonnes
Ship (un)loading	100,000,000	100	1 short ton = 2,000 pounds
Storage tank- large	100,000,000	100	
Storage tank – medium	10,000,000	10	**Distance**
Storage tank – small	1,000,000	1	1 kilometer (km) = 0.621 miles
Process installation - large: e.g. vessels	500,000	10	1 mile = 1.61 kilometers (km)
Process installation - small: e.g. flanges	10,000	1	1 meter (m) = 3.281 feet (ft)
TRANSPORT RAIL/ROAD			1 meter (m) = 1.094 yards (yd)
Default: tank truck	25,000	100	1 yard (yd) = 0.914 meters (m)
Tank truck (default)	25,000	100	1 yard (yd) = 3 feet (ft)
Instantaneous	25,000	100	1 foot (ft) = 0.305 meters (m)
Large leak	5,000	100	
Small leak	1,000	10	
Rail wagon (default)	60,000	100	
Packed unit	10,000		
Container (default)	50,000	100	
Container small	25,000	100	
Container large	50,000	100	
Tank container	50,000	100	
Truck (toppled)	20,000	10	
Estimate for airplanes is the quantity of the kerosene refueling tankwagon	50,000	100	

EXPOSURE DISTANCE TABLE (1 / 5)

Hazard			Quantity	Priority Hazard [expert opinion]				
				Human		Environment		
GHS Hazard	Hazard Classification	Explanation	kg	Lethal	Health	Soil	Lake	River
				km	km	km	km	km
Physical hazard								
Explosive	Category 1.1, 1.2, 1.5, Unst. Expl	Mass explosion, fragments	1,000	**0.2 km**	**0.4 km**			
	Self react. A, B, C	Explosive when heated	10,000	**0.3 km**	**0.7 km**			
	Org. Perox. A, B, C	Explosive when heated	100,000	**0.6 km**	**1.5 km**			
			1,000,000	**1.3 km**	**3.2 km**			
Flammable	Flam. Gas 1	Extremely flammable	1,000,000	**0.2 km**	**0.3 km**			
	Flam. Liq. 1, 2, 3	Flashpoint < 23 °C	10,000,000	**0.4 km**	**0.6 km**			
	Flam. Aerosol 1	Extremely flammable	100,000,000	**1.2 km**	**1.8 km**			
	Pyr. Liq. 1	Ignites < 5 minutes						
	Water-react. 1	Reactive, spontaneous ignition, formation gas						
Oxidizing	Ox. Gas 1	Fire propagating	1,000	**< 0.1 km**	**0 km**			
	Ox. Liq. 1	Fire propagating	10,000	**< 0.1 km**	**0 km**			
	Ox. Sol. 1	Explosive solid	100,000	**0.2 km**	**0 km**			
Gas under pressure	Press. Gas	Pressurized, liquified	1,000	**< 0.1 km**	**< 0.1 km**			
	Ref. Liq. Gas (Liq Gas)	Refridgerated, pressurized, liquified	10,000	**0.2 km**	**0.3 km**			
			50,000	**0.4 km**	**0.6 km**			

EXPOSURE DISTANCE TABLE (2 / 5)

Hazard			Quantity	Priority Hazard [expert opinion]				
				Human		Environment		
GHS Hazard	Hazard Classification	Explanation	kg	Lethal	Health	Soil	Lake	River
				km	km	km	km	km
Health hazard								
Toxic gas	Acute Tox. 1	Fatal when inhaled	10,000	**0.4 km**	**2 km**			
			100,000	**0.5 km**	**3 km**			
			1,000,000	**0.8 km**	**4 km**			
			> 1,000,000	**1.3 km**	**5 km**			
	Acute Tox. 2	Fatal/toxic when inhaled	10,000	**< 0.1 km**	**0.8 km**			
			100,000	**< 0.1 km**	**1 km**			
			1,000,000	**0.1 km**	**2 km**			
			> 1,000,000	**0.2 km**	**3 km**			
	Acute Tox. 3	Toxic when inhaled	10,000	**< 0.1 km**	**0.5 km**			
			100,000	**0.1 km**	**0.7 km**			
			1,000,000	**0.1 km**	**1 km**			
			> 1,000,000	**0.2 km**	**1.7 km**			
Toxic liquid	Acute Tox. 1	Fatal when swallowed	20	**1 km**	**> 5 km**	2 km (0.1 - 4.1)	0.3 km (0 - 0.6)	5 km (0 - >10)
			100	**1.6 km**	**> 5 km**	4.5 km (0.1 - 9.2)	0.6 km (0 - 1.3)	>10 km (0 - >10)
			1,000	**5 km**	**> 5 km**	>1 km (0.4 - >10)	2 km (0.1 - 4.1)	>10 km (0.2 - >10)
			5,000	**> 5 km**	**> 5 km**	>10 km (0.9 - >10)	4.5 km (0.1 - 9.2)	>10 km (1 - >10)
	Acute Tox. 2	Fatal/toxic when swallowed	100	**0.3 km**	**2 km**	4.3 km (0.2 - >10)	0.6 km (0 - 2.2)	>10 km (0 - >10)
			1,000	**0.4 km**	**3 km**	10 km (0.5 - >10)	1.9 km (0.1 - 6.8)	>10 km (0.3 - >10)
			5,000	**> 5 km**	**> 5 km**	10 km (1.2 - >10)	4.3 km (0.2 - >10)	>10 km (1.7 - >10)

EXPOSURE DISTANCE TABLE (3 / 5)

Hazard			Quantity	Priority Hazard [expert opinion]				
GHS Hazard	Hazard Classification	Explanation	kg	Human		Environment		
				Lethal	Health	Soil	Lake	River
				km	km	km	km	km
	Acute Tox. 3	Toxic when swallowed	1,000	**0.5 km**	**1.5 km**	0.3 km (0.2 - 0.3)	0 km (0 - 0)	0.1 km (0 - 0.1)
			10,000	**0.8 km**	**2 km**	0.8 km (0.5 - 0.9)	0.1 km (0.1 - 0.1)	0.8 km (0.4 - 1.1)
			50,000	**5 km**	**> 5 km**	1.8 km (1.2 - 2.1)	0.3 km (0.2 - 0.3)	4.1 km (1.8 - 5.6)
Corrosive	Skin Corr. 1A, 1B, 1C	Corrosive for skin	1,000	**contact**	**contact**	1.3 km (1 - 1.5)	0.2 km (0.2 - 0.2)	2 km (1.3 - 2.7)
	Eye Dam. 1	Eye damaging	10,000	**contact**	**contact**	4 km (3.3 - 4.6)	0.6 km (0.5 - 0.7)	>10 km
	Skin Sens. 1	Irreversible damage to skin	100,000	**contact**	**contact**	>10 km	1.8 km (1.5 - 2.1)	>10 km
Irritant	Acute Tox. 4	Slightly toxic	1,000	**< 0.1 km**	**0.1 km**	0.1 km (0.1 - 7.3)	0 km (0 - 1)	0 km (0 - >10)
	Skin Irrit. 2; Eye Irrit. 2	Irritating	10,000	**< 0.1 km**	**0.2 km**	0.3 km (0.3 - >10)	0 km (0 - 3.3)	0.1 km (0.1 - >10)
	STOT SE 2; STOT RE 2	Temporary adverse effect	50,000	**< 0.1 km**	**0.3 km**	0.7 km (0.6 - >10)	0.1 km (0.1 - 7.3)	0.6 km (0.5 - >10)
Health hazard	Carc. 1A, 1B Muta. 1A, 1B Repr. 1A, 1B	May cause carcinogenic, muta-genic, repotoxic mutation	No threshold. Any quantity has impact potential.	**> 5 km**	**> 5 km**	> 10 km	> 4.5 km	> 10 km
	Resp. Sens. 1	Induces hypersensitivity of the airways		**> 5 km**	**> 5 km**	> 10 km	> 4.5 km	> 10 km
	Asp. Tox. 1	Severe acute effects		**> 5 km**	**> 5 km**	> 10 km	> 4.5 km	> 10 km
	STOT SE 1, STOT RE 1	Significant health effects		**> 5 km**	**> 5 km**	> 10 km	> 4.5 km	> 10 km

EXPOSURE DISTANCE TABLE (4 / 5)

Hazard			Quantity	Priority Hazard [expert opinion]				
				Human		Environment		
GHS Hazard	Hazard Classification	Explanation	kg	Lethal	Health	Soil	Lake	River
				km	km	km	km	km
Environmental hazard								
Aquatic chronic	Aquatic Chronic 1	Extremely acute adverse effects to aquatic organisms	1,000			>10 km (2 - >10)	3.6 km (0.3 - >10)	>10 km
			10,000			>10 km (6.3 - >10)	>10 km (0.9 - 10)	>10 km
			50,000			>10 km	>10 km (2 - >10)	>10 km
Aquatic acute	Aquatic Acute 1	Causes serious injury to an aquatic organism in short period of time	100			2.8 km (0.1 - 11)	0.4 km (0 - 1.5)	10 km (0 - >10)
			1,000			8.9 km (0.4 - >10)	1.3 km (0.1 - 4.8)	>10 km (0.2 - >10)
			5,000			>10 km (0.8 - >10)	2.8 km (0.1 - 10)	>10 km (0.8 - >10)
Aquatic chronic	Aquatic Chronic 2	Acute adverse effects to aqua- tic organisms	1,000			1 km (0.6 - >10)	0.1 km (0.1 - 5.8)	1.3 km (0.4 - >10)
			10,000			3.3 km (1.8 - >10)	0.5 km (0.3 - >10)	>10 km
			50,000			7.3 km (4 - >10)	1 km (0.6 - >10)	>10 km
Aquatic acute	Aquatic Acute 2	Causes serious injury to an aquatic organism in short period of time	100			0.3 km (0.2 - >10)	0 km (0 - 1.8)	0.1 km (0 - >10)
			1,000			1 km (0.0 - >10)	0.1 km (0.1 - 5.8)	1.3 km (0.4 - >10)
			5,000			2.3 km (1.2 - >10)	0.3 km (0.2 - >10)	6.7 km (2 - >10)
Aquatic chronic	Aquatic Chronic 3	Reversible adverse effects to aquatic organisms	1,000			0.5 km (0.3 - >10)	0.1 km (0 - 3.3)	0.1 km (0 - >10)
			10,000			1.5 km (0.9 - >10)	0.2 km (0.1 - 10)	2.7 km (1.1 - >10)
			50,000			3.3 km (2.1 - >10)	0.5 km (0.3 - >10)	>10 km

EXPOSURE DISTANCE TABLE (5 / 5)

Hazard			Quantity	Priority Hazard [expert opinion]				
				Human		Environment		
GHS Hazard	Hazard Classification	Explanation	kg	Lethal	Health	Soil	Lake	River
				km	km	km	km	km
Aquatic acute	Aquatic Acute 3	Causes injury to an aquatic organism in short period of time	100			0.2 km (0.1 - 1)	0 km (0 - 0.1)	0 km (0 - 1.2)
			1,000			0.5 km (0.2 - 3.1)	0.1 km (0 - 0.4)	0.3 km (0 - 12)
			5,000			1.1 km (0.4 - 6.8)	0.2 km (0.1 - 1)	1.5 km (0.2 - >10)
Reactive with water (no GHS Hazard)	Water reactive 1, water reactive 2	Reacts violently with water	1,000			0	0	0
			10,000			0	0	0
			50,000			0	0	0
Forms toxic gas when in contact with water (no GHS Hazard)	Aquatic Toxic gas	Formation and release of toxic gas Fatal when inhaled	1,000	Estimate human impact distances using acute toxic 1		1.3 km (0.2 - >10)	0.2 km (0 - 2.2)	2 km (0 - >10)
			10,000			4 km (0.5 - >10)	0.6 km (0.1 - 6.8)	>10 km (0.3 - >10)
			50,000			8.9 km (1.2 - >10)	1.3 km (0.2 - >10)	>10 km (1.7 - >10)

CHECKLIST: UNDERSTANDING IMPACT

Hazard	Exposure				Exposure					
	Pathway				Receptor					
GHS Hazard	Air	Soil, Groundwater	Lake	River	Human	Fishing Area	Soil, Groundwater	Agricultural Area	Nature Reserve	(Critical) Infrastructure
Physical hazard										
Explosive	X				X					X
Flammable	X				X					X
Oxidizing	X				X					X
Gases under pressure	X				X					X
Health hazard										
Toxic gas	X				X				X	
Toxic liquid (volatile)	X	X	X	X	X	X	X	X	X	
Toxic liquid (not volatile)		X	X	X		X	X	X	X	
Corrosive	X				X					X
Irritant	X				X					
Health hazard	X	X	X	X	X	X	X	X	X	
Environmental hazard										
Hazards for aquatic environment		X	X	X		X	X	X	X	

Note: Volatile liquids produce hazardous vapors which can affect human health by air exposure. Assume a toxic liquid is volatile if unsure.

CHECKLIST: SECONDARY DATA SOURCES

Some background data may be necessary for the FEAT process. Data sources will vary depending on the context of the country or region, and the type of data required. Depending on how established humanitarian actors are in the area, there may be pre-existing information management capacity which can provide standardized common operational datasets (CODs) or recently-reported fundamental operational datasets (FODs) – the country-level OCHA office would be the first avenue of contact. OCHA also maintains the humanitarian data exchange (https://data.humdata.org/) which is an online platform for sharing humanitarian data globally.

In the absence of collated datasets, the following checklist provides a non-exhaustive list of potential secondary data sources which could be consulted to supplement the execution of a FEAT.

Common Operational Datasets

Category	Type/Resolution of Data	Description	Web Link	Other Sources
Administrative boundaries	Admin levels and boundaries	Data on administrative units or areas defined for the purpose of administration by a (local) government	https://index.okfn.org/dataset/boundaries/	Available online or from interior/urban planning/housing ministries
Transportation Network	Roads, Rails, Airports, Seaports	Transportation networks and ports	https://www.openstreetmap.org/	Available online or from transport ministries
Populated places / Settlements (Villages, towns, cities)	Buildings, locations and geocoded addresses (if available)	Urban and rural settlements in country	https://www.openstreetmap.org/	Available online, via QGIS OpenLayers plugin or from interior ministries
Population Statistics	Population census	Systematic acquisition and record of information about the members of a given population. It is a regularly occurring and official count of a particular population.	N/A	On request from national statistic departments
	UN-Adjusted Population Density, v4 (2000, 2005, 2010, 2015, 2020)	Estimates of population density for the years 2000, 2005, 2010, 2015, and 2020, based on counts consistent with national censuses and population registers with respect to relative spatial distribution, but adjusted to match United Nations country totals	http://sedac.ciesin.columbia.edu/data/set/gpw-v4-population-density-adjusted-to-2015-unwpp-country-totals	Available online and can be view spatially with QGIS or commercial GIS software

	UN-Adjusted Population Count, v4 (2000, 2005, 2010, 2015, 2020)	Estimates of population count for the years 2000, 2005, 2010, 2015, and 2020, consistent with national censuses and population registers with respect to relative spatial distribution, but adjusted to match United Nations country totals.	http://sedac.ciesin.columbia.edu/data/set/gpw-v4-population-count-adjusted-to-2015-unwpp-country-totals	
	Population Density Grid, v1 (1990, 1995, 2000)	Provide a time series of raster population density data for data integration.	http://sedac.ciesin.columbia.edu/data/set/grump-v1-population-density	
Land use / Land cover / Vegetation indices	Landsat data products	Provide land imaging from moderate-resolution Earth-observing satellites, which offers critical and irreplaceable capability to observe land use and land use change	https://earthexplorer.usgs.gov/	Processing of satellite imagery data (Landsat and Sentinel)
	SENTINEL-1	Provide data routinely and systematically for maritime and land monitoring, emergency response, climate change and security	https://scihub.copernicus.eu/dhus/#/home	
	SENTINEL-2	Provides data for land cover/change classification, atmospheric correction and cloud/snow separation	https://scihub.copernicus.eu/dhus/#/home	
Surface temperatures / Hydrography / Hydrology / Hydrological	Readings and Recordings	Temperature readings (daily, monthly) Precipitation patterns (total rainfall) Humidity Prevailing wind patterns	N/A	On request from meteorological offices or environmental agencies
	MODIS data products	Describe features of the land, oceans and the atmosphere that can be used for studies of processes and trends on local to global scales	https://search.earthdata.nasa.gov/	Processing remotely sensed data with free and available datasets
	AIRS data products	Records and measures atmospheric temperature and humidity profiles, cloud amount and height, and the spectral outgoing infrared radiation	https://search.earthdata.nasa.gov/	
	TRMM data products	Observes rainfall rates over the tropics and subtropics, where two-thirds of the world's rainfall occurs. Data supports operational applications such as flood and drought monitoring and weather forecasting	https://search.earthdata.nasa.gov/	
	WINDSAT data	Measures the ocean surface wind vector from	https://podaac-tools.jpl.nasa.gov/soto/	

	products	space		
	AQUASTAT (FAO's global water information system)	Information related to water resources, water uses and agricultural water management	http://www.fao.org/nr/water/aquastat/maps/	
Hypsography	Shuttle Radar Topography Mission (30m)	Provides topographic (elevation) data of Earth's surface	https://earthexplorer.usgs.gov/	
Humanitarian Profile	Humanitarian data and indicators	1) Data about the context in which a humanitarian crisis is occurring (e.g., baseline/development data, damage assessments, geospatial data) 2) Data about the people affected by the crisis and their needs 3) Data about the response by organizations and people seeking to help those who need assistance.	https://data.humdata.org/	Varying available datasets
		InfoRM index - global, open-source risk assessment for humanitarian crises and disasters. It can support decisions about prevention, preparedness and response.	http://www.inform-index.org/	
		United Nations database - containing data from other UN agencies	http://data.un.org/DataMartInfo.aspx	

Fundamental Operational Datasets

Category	Type/Resolution of Data	Description	Web Link	Other Sources
Protection	United Nations Refugee Agency	Information about the legal and physical safety of displaced persons, particularly those most vulnerable	http://reporting.unhcr.org/operations	Available online or by request from in-country UNHCR personnel. Subjected to confidentiality and document sensitivity
Security	United Nations Peacekeeping Missions	Situation about peace and security of the region, and key stakeholders involved in the process	http://www.un.org/en/peacekeeping/operations/current.shtml	On request from Department of Peacekeeping Operations. Subjected to confidentiality and document sensitivity
Other	Geological surveys	Porosity of surface/sedimentary rocks (if available)	Online on the official government website (if available)	On request from educational institutions or government agencies with geological experts (if available)
		Soil surface runoff data sets and potential seepage modelling (if available)		
		Geomorphological characteristics (if available)		
	Climate change	Climate change scenarios (if available) - possible regional climate changes during the 21st century is presented, followed by discussions of stabilization scenarios and changes in climate variability and extreme events	http://sres.ciesin.org/final_data.html http://www.ipcc.ch/ipccreports/tar/wg2/index.php?idp=154	Online database with ready data available in varying formats for analysis
Food security	Food and Agricultural Organization	Decentralized statistical system and statistical activities cover the areas of agriculture, forestry and fisheries, land and water resources and use, climate, environment, population, gender, nutrition, poverty, rural development, education and health as well as many others	http://www.fao.org/faostat/en/	Online database with ready data available in varying formats for analysis
Health	Date of onsets for cases	First appearance of the signs or symptoms of an illness in patients/identified cases	Online on the official government website (if available)	On request from ministries or health or agencies responsible for environmental health (depending on nature and transmission of disease)
	Geo-coded addresses of cases (suspected /confirmed)	Postal codes or exact location of the confirmed/suspected case without name and identifiers	Medical confidentiality as it will trace to the household/individual - should be available only on official request	

	Additional epidemiological data	Additional data surrounding the likely exposure to source of illness (chemical, radiological, biological, toxicological source)	Laboratory results would have to supplement this data and further epidemiological investigations are required to pinpoint the likely source	
	Public health education programmes / awareness campaigns	Campaigns and programmes to raise awareness towards public health efforts	Online on the official government website (if available)	
	Health facilities	Location of health facilities, health outpost, community health centers etc.	Online on the official government website (if available)	
	Laboratory results (if available)	Laboratory results and confirmation on the suspected cases / affected patients	Medical confidentiality as it will trace to the household/individual - should be available only on official request	On request from laboratories in ministries of health or environment, or other regional or foreign laboratories depending on testing capacity
Vector control	House indexes	Percentage of houses infested with larvae and/or pupae.	N/A	On request from ministries or health or agencies responsible for environmental health
	Breteau indexes	Number of positive containers per 100 houses inspected.		
	Container indexes	Percentage of water-holding containers infested with larvae or pupae		
	Ovitrap/gravitrap findings (if available)	Estimating adult population density using ovitraps, sticky traps, human landing collections or any similar traps		
	Rodent findings and classification	Identification of rodent species via examination of droppings/fecal matter and tracks; state of infestation in the community		
	Awareness programmes or campaigns	Campaigns and programmes to raise awareness towards vector control and environmental health efforts	Online on the official government website (if available)	
Crisis management and business continuity	Crisis management plans (revision version, history and engagement with local community)	Crisis management plans for various industries and prioritized emergencies (natural and technological hazards)	Online on the official government website (if available)	On request from ministries of industry or internal/home affairs

	Hazard mitigation resources and activation procedures	Plans and standard operating procedures to mitigate and prepare for identified and risk assessed hazards		On request from ministries of industry or internal/home affairs
	Crisis communications plans	Communications channels, procedures and outreach to the various communities (general public, authorities and responders, humanitarians and political leaders)		On request from ministries of internal/home affairs
	Business continuity plans (government, educational institutions, local businesses)	Continuity and recovery plans for various institutions to regain and recover public's/investor's confidence. Ensuring that local business can operate to regain normalcy after an emergency		On request from ministries of trade, industry or internal/home affairs
	Evacuations centers and shelters	Temporary shelters and/or hardened structures for displaced population as a result of an emergency		On request from ministries of internal/home affairs or housing and urban development
	Licenses approved for industry and infrastructure	Licenses to operate and work with hazardous substances as well as operating procedures to ensure that waste disposal is taken care of.		On request from ministries of industry or trade
	Types of hazardous materials, storage facilities and locations	Storage conditions and security situation of the storage facilities for these hazardous substances		On request from ministries of industry or environment, or from fire brigade
	Regulatory compliance reports (if available)	Compliance reports on the operation and work with hazardous substances as well as operating procedures to ensure that waste disposal is taken care of.		On request from ministries of industry or environment, or from fire brigade
Potential impact assessment	United Nations Environment Programme (UN Environment)	Works with scientists and policy makers worldwide to place biodiversity at the heart of environment and development decision-making to enable enlightened choices for people and the planet.	https://www.unep-wcmc.org/	Online database with ready data available in varying formats for analysis
	Centre for Research on Epidemiology of Disasters (CRED)	Promotes research, training and technical expertise on humanitarian emergencies, particularly in public health and epidemiology	http://www.cred.be/	Data available online in table formats and downloadable in various formats for analysis
	United Nations Office for Disaster Risk Reduction (UNISDR)	Support countries to develop disaster loss databases	https://www.unisdr.org/we/inform/disaster-statistics	Web service allows tables and charts to be built depending on user input/selected data

	UNITAR's Operational Satellite Applications Programme	Technology-intensive programme delivering imagery analysis and satellite solutions to relief and development organizations within and outside the UN system to help make a difference in critical areas such as humanitarian relief, human security, strategic territorial and development planning	https://unitar.org/unosat/maps	Data will only be available upon request and it is mission specific
	Protected planet	Complete source of information on protected areas, updated monthly with submissions from governments, non-governmental organizations, landowners and communities. It is managed by the United Nations Environment World Conservation Monitoring Centre (UNEP-WCMC) with support from IUCN and its World Commission on Protected Areas	https://www.protectedplanet.net/#thematic-areas	Data available online in various formats for download: 1) .csv - viewed on Excel 2) .kml - viewed on Google Earth 3) .shp - viewable on GIS software (QGIS) 4) File Geodatabase - GIS software 5) ESRI webservice - on ArcGIS and web service

CHECKLIST: TRIGGERING EVENTS AND FAILURE TYPES

Triggering events	Failure types
<u>Natural hazards:</u> • Avalanche • Earthquake • Flood, tsunami • Landslide, mud stream • Typhoon, storm, hurricane, cyclone, drought, tornado • Wildfire • Volcanic eruption	• Natural origin • Hydrological • Meteorological • Climate change • Side effects of human actions (e.g. deforestation)
<u>Social and man-made hazards</u> • Crime • Arson • Civil disorder • Terrorism • War	• Deliberate acts
<u>Hazardous operations:</u> • Chemicals production • Forestry • Agriculture and food production • Oil and Gas Exploration and Production • General manufacturing • Mining • Transport and infrastructure • Transport interfaces • Pipelines • Small and medium enterprises	• General: Human error, inadequate operational control, lack of maintenance, lacking safety culture • Industrial facilities: corrosion, erosion, high level (overfilling), high pressure (overpressure, vacuum), high temperature, chemical reactions, mechanical, damage, failure of components, external impact (extreme weather conditions, collapse of structure) • Transport: accidents, (in) loading, overfilling • Pipelines: corrosion, overloading from above (e.g., heavy vehicles, building works), damage during excavation, sabotage, vandalism, theft, impact with vehicles or moving objects, natural hazards (earthquakes, flooding,.), subsidence, (seasonal) melting of the permafrost

CHECKLIST: EMERGENCY INTERVENTIONS

This Annex entails a (non limitative) checklist on potential interventions. The objective of this checklist is to help the user of the FEAT Handbook to identify potential interventions in order to prepare or respond to chemical accidents effectively. This checklist entails interventions for both Emergency Preparedness and Emergency Response, including elements such as Safety Management Systems, Planning, Land Use Planning, Infrastructure and Communication.

EMERGENCY PREPAREDNESS INTERVENTIONS

Industrial facility elements:

- ☐ Leadership and administration
- ☐ Safety Management System
- ☐ Management and training
- ☐ Planned inspections
- ☐ Job analyses and procedures
- ☐ Accident investigation
- ☐ Emergency preparedness
- ☐ Organizational Rules and regulations
- ☐ Personal Protective equipment
- ☐ Mutual aid agreements
- ☐ Records and reports, industrial facility plans
    - ✓ Safety Report, Quantitative Risk Analyses, Environmental Impact Assessment Fire protection plan, Evacuation plan, Oil Spill Response Plan
    - ✓ Plant emergency organization
    - ✓ Area risk evaluation or Hazardous area classification
    - ✓ Notification procedures and communication systems
    - ✓ Emergency equipment and facilities
    - ✓ Procedure for returning to normal operations
    - ✓ Training and drills
    - ✓ Tests of emergency organization/procedures
    - ✓ Plan updates
    - ✓ Operating manuals

Organizational elements:

- ☐ Coordination of all (emergency) organizations involved
- ☐ Authorities and responsibilities (per authority, local, regional or national level)
- ☐ Command and control responsibilities
- ☐ Chain of command
- ☐ Authority/responsibility interfaces between government/industry
- ☐ Mutual aid agreements
- ☐ Organizations outside community (assistance)
- ☐ Key participants, roles
- ☐ Resources:
    - ✓ Capacity building
    - ✓ Personnel
    - ✓ Training
    - ✓ Equipment

- Records and reports, industrial facility plans:
  - ✓ Incident Command System
  - ✓ Crisis Management Plan, Corporate Crisis Plan, Risk management plan
  - ✓ Security procedures
  - ✓ Insurance programs
  - ✓ Plant closing policy
  - ✓ Persons in charge
  - ✓ Relationships among key participants

Communication elements:

- Coordination
- Information exchange
- Information dissemination
- Information sources and data base sharing
- Notification procedures
- Clearing house functions
- Crisis communication

Planning elements:

- Organizational responsibilities
- Risk evaluations
- Notification procedures and communication systems
- Emergency equipment and facilities
- Assessment capabilities
- Protective action procedures
- Public education and information
- Post emergency procedures
- Training and drills

Land use planning elements:

- Spatial planning, Restrictions for developments near hazardous installations
- Change land use
- (Re) Location of hazardous facilities
- Hazard mapping
- Buffering areas, Safety distances

Emergency Response interventions

Organizational elements:

- Coordination of all (emergency) organizations involved
- Authorities and responsibilities
- Command and control responsibilities
- Chain of command
- Authority/responsibility interfaces between government/industry
- Mutual aid agreements
- Organizations outside community (assistance)
- Key participants, roles

Communication elements:

- Coordination, roles and responsibilities
- Information exchange
- Information dissemination
- Information sources and data base sharing
- Notification procedures
- Clearing house functions

Resources:

- Incident Management Team
- Crisis Management Team
- Corporate Crisis Team
- Evacuation and internal rescue teams, medical assistance.
- Capabilities of assessment teams
- Experienced personnel resources

Notification and early warning elements:

- Early warning systems
- 24 hour notification to first responders, 24 hour notification to officials
- Communication systems
- Mutually agreed format and content initial notification
- Means for notifying additional assistance/responders
- Means for notifying public
- Standard, pre-planned message formats/signals for notifying public
- Ensure public understands and responds to signals
- Early warning and evacuation plans and shelters

Emergency Equipment and Facilities:

- Command posts
- Backup systems
- Crisis Management Facility

- ☐ Infrastructural emergency response access routes
- ☐ Fire brigade/station, incl. equipment (trucks, fire fighting, spill control, first aid,)
- ☐ Monitoring equipment
- ☐ Medical centre
- ☐ Access roads and assembly area's for public services
- ☐ Evacuation equipment
- ☐ Special facilities (schools, nursing homes, handicapped,)
- ☐ Personal Protective Equipment
- ☐ Reception centres / shelters
- ☐ Off/Near shore response vessels
- ☐ Marine support equipment
- ☐ Refuge and muster area's
- ☐ Temporary storage

Logistic services:

- ☐ Logistic equipment
- ☐ Means of transportation
- ☐ Means for communication
- ☐ Housing
- ☐ Computer hardware and software
- ☐ Personal protective equipment
- ☐ Medical supplies
- ☐ Specialized response and decontamination equipment
- ☐ HAZMAT equipment

Infrastructure:

- ☐ Computer systems (data banks and national or state inventories)
- ☐ Emergency response equipment:
    - ✓ first-aid and rescue material
    - ✓ fire-fighting equipment
    - ✓ spill containment and control equipment
    - ✓ personal protective equipment for rescue personnel
    - ✓ measuring instruments for various toxic substances
    - ✓ antidotes for the treatment of people

ANNEX 3: SUPPLEMENTAL FORMS

Hazardous Substance Data Sheet	
Chemical Name:	
CAS #:	UN #:
ERG Guide Number:	
Sources of Information:	
Chemical and Physical Properties	
Normal Physical State: ☐ Solid ☐ Liquid ☐ Gas	
Molecular Weight:	Density (gm/ml):
Specific Gravity:	Vapor Density:
Boiling Point (C^0):	Melting Point (C^0):
Vapor Pressure (mm/hg):	Polymerization:
Solubility (Water): ☐ % ☐ ppm	
Corrosive: ☐ Yes ☐ No ☐ Acid ☐ Base	
Radioactive: ☐ Yes ☐ No ☐ Alpha ☐ Beta ☐ Gamma	
Ionization Potential (eV):	
Physical Description:	
Incompatibilities/Reactivities:	
Health Hazards	
Inhalation: ☐ Yes ☐ No	Ingestion: ☐ Yes ☐ No
Absorption: ☐ Yes ☐ No	Teratogenic: ☐ Yes ☐ No
Skin/Eye Contact: ☐ Yes ☐ No	Carcinogenic: ☐ Yes ☐ No
Mutagenic: ☐ Yes ☐ No	Aquatic: ☐ Yes ☐ No
IDLH:	STEL:

TWA/REL:	TWA/PEL:
PPE: ☐ Level A ☐ Level B ☐ LevelC	
Respirator: HEPA ☐ APR ☐ SCBA / Supplied Air	
Target Organs:	
Symptoms:	
First Aid:	
Fire Hazard	
Flammable/Combustible: ☐ Yes ☐ No	Flash Point (C^0):
LEL/LFL (%):	UEL/UFL (%):
Toxic Byproducts:	
Fire Control Considerations:	
Other Incident Related	
Quantity Released:	Air Temp (C^0):
Water Temp (C^0):	Wind Direction /Speed:
Recommended Monitoring/Sampling:	
Recommended Decontamination:	
Evacuation Distance:	
Other:	

ANNEX 4: KOBO FIELD DATA COLLECTION TOOL

As an alternative to filling out an Excel FEAT Impact Table, FEAT assessment data may also be collected using the FEAT KoBo data collection tool. This data collection tool was developed using KoBoToolbox software. It allows FEAT assessment data to be entered on a laptop or smartphone and submitted directly to the JEU for compilation and posting to the VOSOCC. The following describes the actions needed to deploy a KoBo form for an event, collect data with the form, and manage output.

➢ Request the JEU deploy a KoBo FEAT form

If not already done so, send an email request to the JEU at ochaunep@un.org requesting that a KoBo FEAT form be deployed for your event. Information to provide in the email request includes:

1. A unique name for the form that links it to your incident (e.g. Anytown City Flood 2017).
2. The email addresses of all persons who will be entering data in the deployed form.

The JEU will then deploy the form and send a hyperlink to to all email addresses provided allowing the recipients to open the form and collect data.

➢ Collect data

The following describes how a data collector accesses and submits data in a deployed KoBo FEAT form.

1. Click on the hyperlink the JEU sent by e-mail to open the form.
2. Enter the FEAT data into the form as prompted.
3. When finished entering data for a particular site, click the "Submit" button at the bottom of the form.
    a. If you are not connected to a network, records are stored inside your browser. Once connected to a network, stored records are automatically submitted in the background every 5 minutes.
    b. If you want to force a data submission between the 5 minutes, you submit your data by clicking the "bracket" icon on the right of the screen and then click upload.
4. After submitting a form for a location, a new blank form automatically appears for data collection on the next site.

Note: You will only be asked a limited amount of FEAT Questions. The rest of the FEAT assessment will be conducted remotely from your responses.

Note: Although KoBo forms can work in all browsers, it works best in Google Chrome. If you have problems using the data collection tool in your browser, copy the link sent by e-mail and open it in Google Chrome.

Note: KoBo forms may not work correctly if opened in Lotus Notes. If you have problems using the collection form in a browser opened by Lotus Notes, copy the link sent by e-mail and open it in a browser you accessed outside of Lotus Notes, preferably Google Chrome.

➢ Compile Data in FEAT Impact Table

1. Log into the KoBo website (username: jeu password: feat).
2. Click on the Projects (Globe) icon on the left of the screen.
3. Click on the deployed form of interest.
4. Under the "Submissions" section, click on the "Download data" tab.
5. Choose the XLS option.

6. Click on the generated Excel report to export.
7. Open the downloaded Excel report.
8. Summarize Excel data for all submissions in a FEAT Impact Table.
    a. The first Excel sheet (found at bottom of report) contains information on:
        i. Hazardous operations and type
        ii. GPS coordinates
        iii. Comments
        iv. Contacts
        v. Date and Time
    b. The second Excel sheet named "Substance" (found at bottom of report) contains information on:
        i. Hazardous Substances at each location. The "parent index" column references the row number of the facility in the first Excel sheet that the substance was recorded for.
        ii. Substance Quantity
        iii. Receptors/Pathways
    c. The photo group sheet lists the photos and " parent index" number which provides the row of the facility in the first Excel sheet that the photo was taken for.
    d. The video group sheet lists the videos and the "parent index" number which provides the row of the facility in the first Excel sheet that the video was taken for.
9. Provide the completed FEAT Impact Table and other assessment data on the Environmental Risks section of the VOSOCC.
    a. To provide a map of GPS points which links to photos and videos follow these steps:
        i. Once in the deployed project, click on the "View on map" option under "GPS points."
        ii. Copy the URL of the map.
        iii. Paste the URL in the "Environmental Risk" section of VOSOCC.
    b. To view view photos or videos associated with a facility location:
        i. Click on the URL link that was copied onto VOSOCC
        ii. Click on the GPS point on the map.
        iii. Scroll down to photos or videos
        iv. Click on the "Child" tabs to view submitted photos and/or videos.

Note: The KoBo software is limited in the amount of data it provides in the GPS map and in it's formatting. The map is most useful for a FEAT assessment for a visualization of the locations of hazardous facilities and for providing associated photos and videos taken at those sites.
For clarity, it is also not currently possible to provide tabs that say "Photo" or "Video." KoBo simply provides tabs with the label "Child" for this type of submitted data.

ANNEX 5: FEAT QUESTIONS AND ANSWERS

MAIN CHANGES IN FEAT 2.0

1. What is new in FEAT 2.0?

The revised FEAT 2.0 is comprised of two parts: FEAT Preparedness (FEAT-P) and FEAT Response (FEAT-R). While the FEAT formula and scientific rigor remained the same, the revised FEAT 2.0 is easier to use, it reflects the latest international guidelines, such as United Nations guidelines, the International Finance Cooperation's (IFC) standards and Emergency Response handbooks. In addition, it is more closely integrated into existing emergency management platforms and guidelines.

Emergency Preparedness is added because experience in using FEAT 1.1 in the field has shown that practitioners use this tool also for preparedness activities, such as hazard mapping and risk assessments. Therefore, the FEAT 2.0 developer team decided to include a methodology to guide practitioners in this work and to have a strong link to FEAT response activities through inclusion in the same tool. Further, the data in FEAT 2.0 is updated according to the latest scientific insights.

2. May there be a difference in exposure distance when using FEAT 1.1 and FEAT 2.0?

Yes, this is possible. The pre-calculated exposure distances in FEAT 2.0 are revised according to new scientific developments and revised calculation formulas.

Therefore, the exposure distances of FEAT 2.0 are to be preferred over the exposure distances of FEAT 1.1.

3. Why does FEAT 2.0 provide a list with only approximately 100 hazardous substances, whilst FEAT 1.1 included an extended list of about 1800 hazardous substances?

For improved usability and feasibility in the field, the list of hazardous substances in the FEAT 2.0 tables was reduced to priority substances only. The list in Annex 6 is derived from priority substances as mentioned in Annex I of the UNECE Convention on Transboundary Effects of Industrial Accidents, Annex I of Seveso III Directive (i.e. the "named" substances) and the priority substances as used by United States Environmental Protection Agency (EPA).

3.1. Are you planning to add an extended list of chemicals later on?

In the future, the list of hazardous chemicals may be extended. This will be decided following the evaluation of FEAT 2.0.

HAZARD CLASSIFICATION

4. Is there a difference in hazard classification between FEAT 1.1 and FEAT 2.0?

Yes. FEAT 2.0 is based on GHS hazard classification.

The "lowest number" (for example Acute Tox 1) is the "most hazardous" substance. Please note this is opposite of FEAT 1.1.

5. Some chemicals, such as Chlorine, are classified with seemingly indistinguishably hazard categories for someone that only knows FEAT 1.1, For example, both "Acute Tox 1", "Acute Tox 2" and "Acute Tox 3". Are those different types of toxicity? Or only different degrees of toxicity (perhaps attributed to different concentrations of the chemical in a mixture)? In the latter case, could I be right to propose that perhaps the lesser degree could be disregarded?

In case multiple hazards are mentioned within the same hazard classification (such as "Acute toxic 1", "Acute toxic 2" and "Acute toxic 3") then apply the 'worst case' hazard classification given the classification number (in this case: select Acute Tox 1).

FEAT 2.0 follows the opposite prioritization as FEAT 1.1.

6. Why do several chemicals have more than 10 GHS hazard classifications? Are all classifications relevant for the subsequent assessment process? If not, could some of them be disregarded or downplayed?

When piloting FEAT 2.0 in the field, it appeared that every hazard classification may be of relevance. Disregarding any classification implies the risk of quality loss and removal of relevant information for decision-making. Development of an electronic FEAT would solve this issue and is under consideration.

7. Do GHS and the "Classification, Labeling and Packaging (CLP)" EU Regulation from 2008 have different classifications for the same substance? (Example: Chlorine has seven hazard classifications based on the CLP EU Regulation Annex VI table 3.1, whereas on the FEAT 2.0 Annex 6 table, chlorine has ten GHS hazard classifications.)

Yes, there can be different hazard classifications for one hazardous substance. The reason is that manufacturers of chemicals may have different methods and opinions on hazard classification. As a consequence, different data is provided between CLP EU regulations and FEAT 2.0 (i.e. ECHA database). This is a general problem and ECHA is working continuously on harmonization and uniform labeling.

In this case, if the user of FEAT 2.0 has different data it is advised to:

a) Initially, select the worst case hazard classifications and use those as default;

b) To update (default) data as soon as possible with actual information, e.g. from the original manufacturer or with data from the permit of the operator.

8. If a substance is not listed in the FEAT 2.0 tables, which database/classification should the FEAT user choose?

If a substance is not listed in the FEAT tables, it is advised to derive actual data, e.g. from the manufacturer or from the operator of the hazardous operation. In addition, data may be found on container labeling and information in Safety Data Sheets. If actual information is not available, the website of ECHA can be consulted, providing default information (http://echa.europa.eu/information-on-chemicals).

EXPOSURE DISTANCE

9. How do I determine the exposure distance in case the quantity is outside the range of the exposure distance stated in the shortlist?

In this case you have to apply a "multiplication factor". This factor is merely a "rule of thumb" and NOT to be considered accurate! You can use the following conversion factors:

Quantity factor	Multiplication factor for Exposure Distance
2	1,4
5	2,2
10	3,2
20	4,5
50	7,1
100	10
200	14
500	22
1.000	32
2.000	45

Explanation:

If the quantity is 10x more: multiply with factor 3,2
If the quantity is 1.000x less: divide with factor 32

Example:

The actual quantity of a product (a toxic gas, classified as Acute Tox 1) is 10.000.000 kg.

The highest default value provided for "Toxic Gas, Acute Tox 1" in FEAT 2.0, however, is 1.000.000 kg, for which impact distances are tabulated as 0,8 and 4 km for "human lethal" and "human health", respectively. Since the actual quantity is 10x higher than the information provided in FEAT 2.0, the user should use a factor of 3,2.

Multiply the exposure distance stated in FEAT 2.0 with factor 3,2 as follows:

Exposure distance in FEAT 2.0 for "Human lethal" is 0,8 km x 3,2 = 2,6 km
Exposure distance in FEAT 2.0 for "Human Health" is 4 km x 3,2 = 12,8 km

Subsequently, the actual exposure distance for the quantity 10.000.000 kg is 2,6 km for human lethal impacts and 12,8 km for impacts on human health.

10. Is there a risk of underestimating or overvaluing, when applying FEAT 2.0 default data?

Yes, that is possible. There are thousands of hazardous substances, multiple hazard classifications and various pathways and weather conditions. Many assumptions have been made in FEAT 2.0 to determine a swift indication of the exposure distance for prioritization of management. Therefore it is crucial to use the default data from the FEAT table, to combine it with actual data and to take local weather, environmental and geological conditions into account. The results of FEAT 2.0 therefore can only be applied as "First Aid" i.e. for priority purposes and decision-making. Detailed analyses shall be done by experts with actual data and on the basis of deterministic models.

11. FEAT 2.0 Quantity Table states figures with the term "Continues release [kg/s]". Is that to be used with FEAT-R or FEAT-P? Do field assessment teams usually manage to determine the duration of release that has occurred? Or is it a step forward, as a rough input to dispersion modeling?

The "kg/s" can be used by responders in particular in two ways: before an incident happens (FEAT-P) or post incident (FEAT-R). An example for using those figures for post -incident would be: responders are at the location observing a spill and liquids are spilling from a containment unit. As it is hard to estimate a spill rate, FEAT 2.0 provides typical (default) spill rates. The responder can use the "kg/s" to estimate the spill rate and the total quantity of liquids spilled. Here, responders need to inquire on the hours the liquid has already spilled.

For example:

- A pipeline (liquid filled) has been leaking for 24 hours.
- See Annex 4 (Pipeline, liquid): spill rate is 100 kg/s
  - Estimation: quantity spilled for 24 hours
  - 60 Seconds * 60 minutes * 24 hours = 86,400 seconds
  - Calculation: 86,400 seconds*100 kg/s = 8,640,000 kg.

The final action is to apply this quantity and look up the exposure distance.

12. According to the Exposure Distance Table, some exposure distances to determine the direct impact on human health are larger for 'toxic liquid when <u>swallowed'</u> than for 'toxic gases when <u>inhaled'</u>. This seems, at a first glance, counter-intuitive. How can this be explained?

The exposure distance is determined on the basis of a particular scenario, i.e. the combination of hazard classification (e.g. "Acute Tox 1"), pathway (e.g. air, water or soil) and the 'type' of receptor

(e.g. Human). For "Human" the toxic gas is assumed to be transported by air and inhaled directly by humans. Any variation in exposure distances can be explained by the different type of impact on the receptor (ref. column "Explanation" in Annex 3):

- Hazard classification 1: *Fatal* when swallowed
- Hazard classification 2: *Fatal/toxic* when swallowed
- Hazard classification 3: *Toxic* when swallowed

Variations in exposure distances (as mentioned in the Exposure Distance Table) can furthermore be explained by differences in the pathway. See the Checklist: Understanding Impact for further explanation. In case a toxic liquid is spilled into a river, the toxic liquid is assumed to be transported as a 'package' or 'lump' by the water flowing through the river. In that case the exposure distance is determined by the transport duration and velocity of the water in the river.

13. What is the source of the Globally Harmonized System of Classification and Labeling of Chemicals that FEAT is currently based on?

Regulation (EC) No 1272/2008 Of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006