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Mobilizing and coordinating
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Flash Environmental Assessment Tool (FEAT)
Version 2.0

Working Document

To identify acute environmental risks immediately following disasters

United Nations Office for the Coordination of
Humanitarian Affairs (OCHA)
UN Environment Programme (UNEP)
Joint Environment Unit (JEU)

FEAT

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Cover photo: Bulk Ammonia storage facility in Madagascar; affected coastline with nearby industrial facility, Philippines; flooded village in Serbia
Photo credits: 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. 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.

FEAT is intended as guidance material only, and is not to be regarded as binding international regulation or legislation. FEAT does not reflect nor replace nor supersede national, regional or international legislation, regulations or policies. FEAT data has been derived from recognized scientific databanks of international authorities or institutions in good faith and on basis of information available at the date of publication. Resources include amongst others the European Chemicals Agency, UNECE Industrial Accidents Convention Directives and the US Environmental Protection Agency.

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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- Response
FEAT-R	Flash Environmental Assessment Tool- Preparedness
GHS	Globally Harmonized System
HIT	Hazard Identification Tool WHEN
IFC	International Financial Center
JEU	Joint UNEP/OCHA Environment Unit
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
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 (UNEP)/United Nations Office for the Coordination of Humanitarian Affairs (OCHA) Joint Environment Unit (JEU) based on lessons stemming from the 2004 Indian Ocean Earthquake and Tsunami (JEU, 2007) with the aim to provide a standardised, 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 impact 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, which resulted in the revised FEAT 2.0, as presented in this document.

The revised FEAT 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 Coorperation’s (IFC) standards and Emergency Response handbooks, and it is more closely integrated into existing emergency management platforms and guidelines.

FEAT 2.0, as presented in this Handbook, 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 (called the "Handbook") is the result of an international initiative launched by the JEU. With this revised tool, 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 this Handbook is to improve chemical safety in countries where this type of emergency preparedness and response is pertinent. The Handbook builds upon international organizations' and national authorities' experience in addressing chemical accidents, and takes into account international agreements in this area, key national/regional laws and regulations, and materials from other international Handbooks.

To develop this Handbook, the JEU established an Expert Working Group with selected experts working in the area of chemical accident preparedness and response. The Expert Working Group benefited from the expertise of the following organizations:

- Danish Emergency Management Agency
- Emergency Dispatch Centres Rotterdam-Rijnmond and South Holland South Emergency Management Agency
- Federal Agency for Technical Relief, Germany
- Grontmij/Carl Bro
- Italian Civil Protection Department
- Joint UNEP/OCHA Environment Unit (JEU)
- Joint Research Centre (JRC), European Union
- 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)
- Royal HaskoningDHV, The Netherlands
- Swiss Agency for Development and Cooperation
- UN Economic Commission for Europe (UNECE) Convention on Transboundary Effects of Industrial Accidents
- UNECE Transport Division, Dangerous Goods and Special Cargoes 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 modelling. 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 Checklists were updated and expanded with RIVM's novel data compilations and analyses.

1. SECTION I: INTRODUCTION

1.1 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.

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.

Regarding emergency response, the FEAT enables the assessment of the hazards and their potential impact on the environment in the event of an accident, focusing on locations where hazardous substances are being handled, produced, stored or transported (hereafter referred to as “hazardous operations”).

The FEAT focusses 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 focusses on initiating and supporting preparatory work.

1.2 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 mainstreaming the environment, including natechs (natural-hazard triggered technological accidents) into humanitarian assistance.

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

1.3 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.

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 neighbouring 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 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 availablefor free for regional organizations and Member States.

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. 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.

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).

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

1.4 Definitions

Definitions of FEAT Preparedness and Response:

- *Preparedness:* Readyness 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 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]

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

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, drink 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 due to third parties (for example through digging), natural events – landslide, earthquake –, or vandalism and malicious acts.

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 UNISDR Terminology, UNEP Flexible Framework for Addressing Chemical Accident Prevention and Preparedness, International Finance Corporation (IFC) World Bank Group, Report of Workshop on Natech Risk Management (23-25 May 2012, Dresden, Germany) Series on Chemical Accidents No. 25, and the Seveso Directive. Any conflicting or gaps are adapted for the purpose of FEAT. Hazardous Operations (Text Box B) are derived from guidelines from the IFC World Bank Group.[4]

[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.

4 See www.ifc.org/ehsguidelines

TEXT BOX A: Summary of other 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.

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 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: Potential adverse 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., 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 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.

<u>Note</u>: National standards and definitions that exist in countries should be taken into account.

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 Harvasting Pulp and paper mills Saw-milling and wood based products
General manufacturing	Base Metal Melting 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	Drink 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)

2. 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). 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 a four pathways, namelyby air (wind), water or soil and groundwater. Figure 1 visualises the potential triggers of a chemical accident.

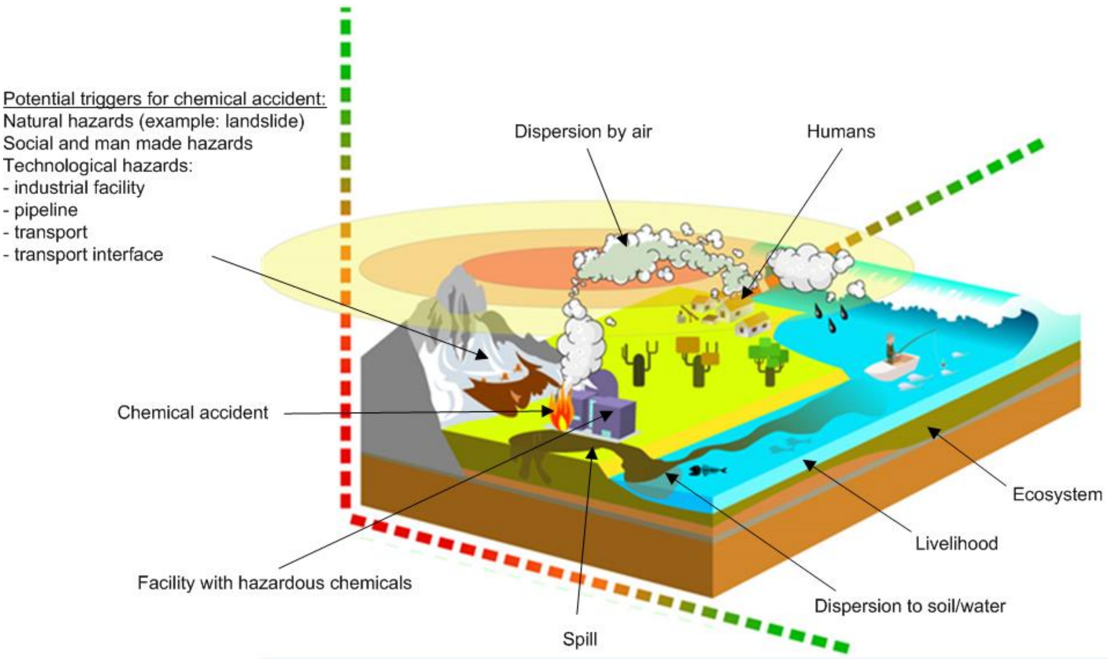

Figure 1. FEAT Infographic: Visualizing the potential triggers of a chemical accident. (Adapted from Posthuma et al (2014))[5]

Estimating Impact: The Value-Added by the FEAT

[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*.

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. The FEAT Handbook provides instructions for activities in the first 72 hours, as more sophisticated equipment may not (yet) be available.

2.1 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 situation. 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]

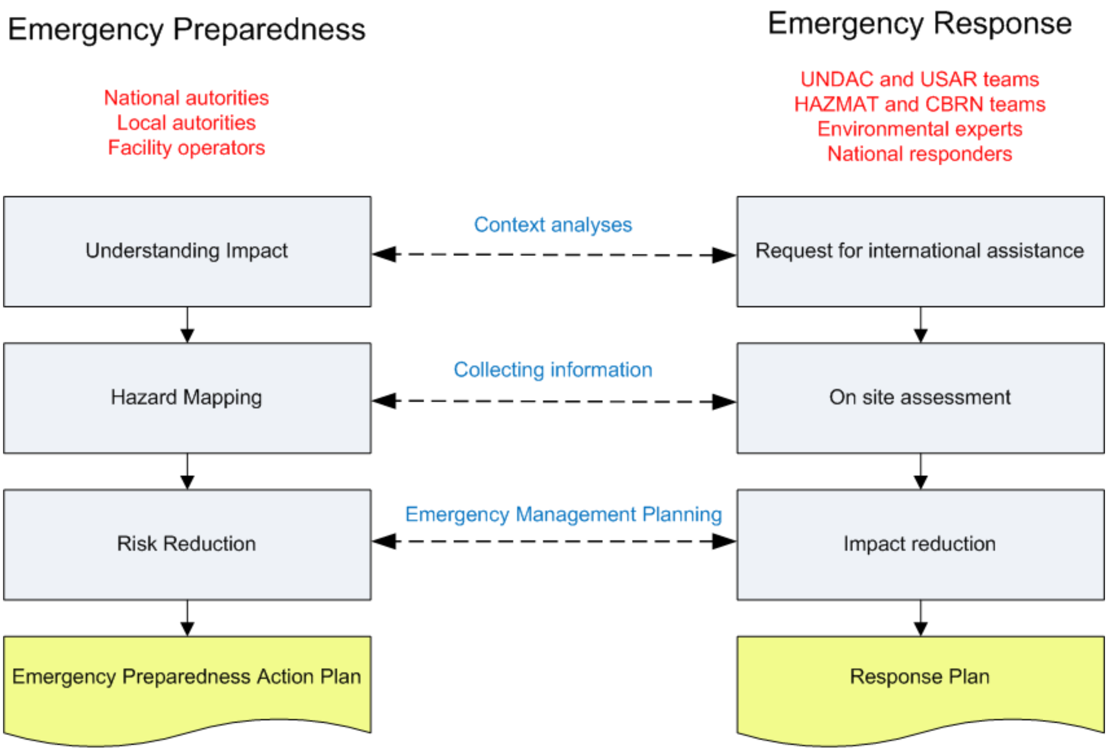

Figure 2 Integrated approach

[6] For prevention several tools and guidelines are available, such as for urban planning, EIA, 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, address specific hazards and for the selection of emergency preparedness action. 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. [7]

Emergency Response

FEAT-R includes instructions for identifying, assessing and mitigating the consequences of a chemical accident by enabling the selection and implementation of (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 plan, including advice for the government on appropriate follow-up actions.

2.2 The FEAT formula

When assessing the release of substances, the potential impact can be expressed by the 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 three hazard types: physical hazards, health hazards and hazards to the aquatic environment. FEAT focusses on “big and obvious” hazardous operations, i.e. operations with relatively large quantities of hazardous chemicals. FEAT does not emphasize on non-chemical accidents, such as occupational incidents, fires, or dust explosions.

The impact type is based on definitions of the GHS system. The GHS is an acronym for The Globally Harmonized System of Classification and Labelling of Chemicals. The GHS is a system for standardizing and harmonizing the classification and labelling of chemicals. It is a logical and comprehensive approach to defining health, physical and environmental hazards of chemicals, creating classification processes that use available data on chemicals for comparison with the defined hazard criteria, and communicating hazard information, as well as protective measures, on labels and Safety Data Sheets (SDS).

Impact type	GHS Hazard type
1. Acute impact on Humans	Physical hazards
2. Long term impact on Humans and Environment	Health hazards
3. Acute impact on Environment	Environmental hazards

[7] The APELL and Flexible Framework for Chemical Accident Prevention and Preparedness can support in the process to reduce risks to an acceptable level and deal with the residual risk.

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 is designed to be consistent and transparent. It draws a clear distinction between classes and categories in order to allow for 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.

The "Impact priority" depends on the hazard classification of the hazardous substance. In Annex 10 the relationship between "GHS hazard classification" and "Impact priority" is defined. Priorities are defined as follows:

1 = high impact
2 = medium impact
3 = low impact
- = no impact

H = Hazard

Hazards result from the release of hazardous substances that can cause loss of life, 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 Figure 3.

Q = Quantity

The quantitity 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 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.

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[8] The Globally Harmonized System of Classification and Labeling of Chemicals (GHS) is an internationally agreed-upon system, created by the UN. It is designed to replace the various classification and labeling standards used in different countries by using consistent criteria for classification and labeling 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.

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.

GHS Hazard Label	GHS Symbol	Acute impact on Human Human Acute	Long term impact on Human and Environment Human and Environment Long term	Acute impact on Environment Environment Acute
Physical hazard				
Explosive		x		
Flammable		x		
Oxidizing		x		
Gas under pressure		x		
Health hazard				
Toxic		x	x	x
Corrosive		x	x	x
Irritant		x	x	x
Health hazard		x	x	x
Environmental hazard				
Hazardous to the Aquatic Environment				x
Reactive with water		x		x
Forms toxic gas in contact with water		x		x

Figure 3: Relation between Impact Type and GHS hazard classification

Example: As you can see in Figure 3, if a hazardous substance is classified as “Toxic” there is potential for:

- Acute impact on Human
- Long-term impact on Human and Environment
- Acute impact on Environment

3. SECTION III: FEAT HANDBOOK

Section III constitutes the FEAT Handbook. The Handbook consists of the following chapters:

- FEAT-P: Emergency Preparedness (Chapter 4)
- FEAT-R: Emergency Response (Chapter 5)

As an introduction, the FEAT Handbook starts with:

1. The steps to be followed for FEAT-P and FEAT-R, demonstrated in the FEAT Logical flowchart.
2. A summary of the FEAT Modules and Checklists.
3. A description of a fictitious case, in order to demomonstrate how to use the FEAT and the results it produces.

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.

FEAT LOGICAL FLOWCHART

The FEAT logical flowchart is presented in
Figure 4. The squares are "activity modules" where the user is expected to perform an activity. See Annex 1 for an overall and detailed overview of the FEAT process, including input and output for each activity.

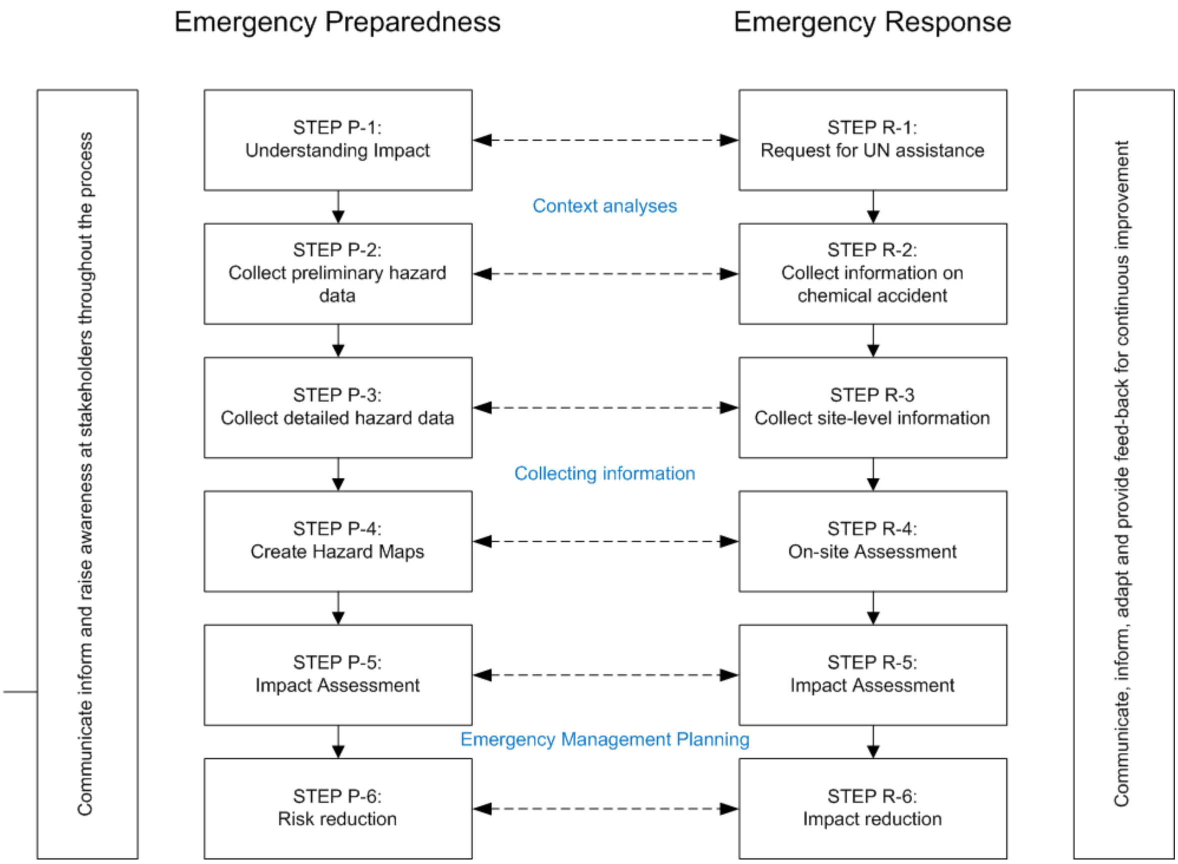

Figure 4. FEAT Logical Flowchart

The FEAT logial flowchart is elaborated upon in the next chapters. Throughout the steps, information resulting from a FEAT assessment shall – first and foremost – be communicated and shared with the appropriate authorities as well as with relevant stakeholders, including providing feedback in order to ensure improvement and to share lessons learned. In the case of response this would be the agency in charge of the coordination of the emergency management.

FEAT MODULES AND CHECKLISTS

The FEAT provides a series of modules and checklists. The modules and checklists allow maximum flexibility in different and evolving accident conditions. Both in preparedness and response, the modules and checklists can be used independently.

ANNEX 1: Elaborated example

In order to demonstrate the output of FEAT an example is elaborated so as to demonstrate the output of both FEAT-P and FEAT-R.

ANNEX 2: Hazardous Operations Module

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

- Facility type (e.g. petroleum based manufacturing)
- Hazardous substance(s) (e.g. hydrocarbons, VCM, ethylbenzene)
- Typical[9] hazardous substance (e.g. ethylbenzene)
- Hazard classification (e.g. aquatic chronic 2, flammable liquid 1)
- Default[10] quantity (in kg)
- Impact priority for three types of receptors: Acute impact on Humans, Long-term impact on Humans and Environment, and Acute impact on Environment

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.

ANNEX 3: Exposure Distance Module

With this annex 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 selecton 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]

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

[10] The term “Default” means: a preset setting or value that will be used if no actual information is available

[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 indication and priorization purposes only. For determining or calculation of exact or exposure distances, dedicated models and specialists should be consulted.

ANNEX 4: Checklist Typical Unit Sizing (transport and storage units)

This annex 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.

ANNEX 5: Checklist for Emergency Preparedness and Response Interventions

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

ANNEX 6: Checklist Hazardous Substances

This annex contains a summary of the most commonly utilized hazardous substances, ranked either by chemical name (alphabetical) or by CAS number. 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)[12]

ANNEX 7: Checklist Triggering Events and Failure Types

This annex provides the user a checklist for:

- 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 ncluded as a failure type

ANNEX 8: Checklist on How to Prepare a HIT Report

This annex provides instructions for preparing a Hazard Identification Tool (HIT) report. A HIT report contains generic information on hazardous operations for a particular area or country. If a HIT report is available on the Virtual OSOCC (http://vosocc.unocha.org/), it can be downloaded and used as a starting point. The HIT report also serves as a matrix for capturing key issues and findings in order to identify hazardous operations that can have a major impact on humans and the environment in the case of a chemical accident.

ANNEX 9 Relation GHS Hazard Classification and Impact Priority

This annex contains a cross reference table demonstrating the relation between "GHS hazard classification" and "Impact priority".

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

EXAMPLE

The steps of FEAT-P and FEAT-R are “building blocks” that allow for the collation and assessment of the information collected. Step-by-step, the information is collected, reviewed and assessed. Please note that the example is for demonstration purposes only so as to to explain the FEAT. The example is not to be regarded as complete nor fully detailed.

The case is called “Farland,” as displayed in Figure 5.

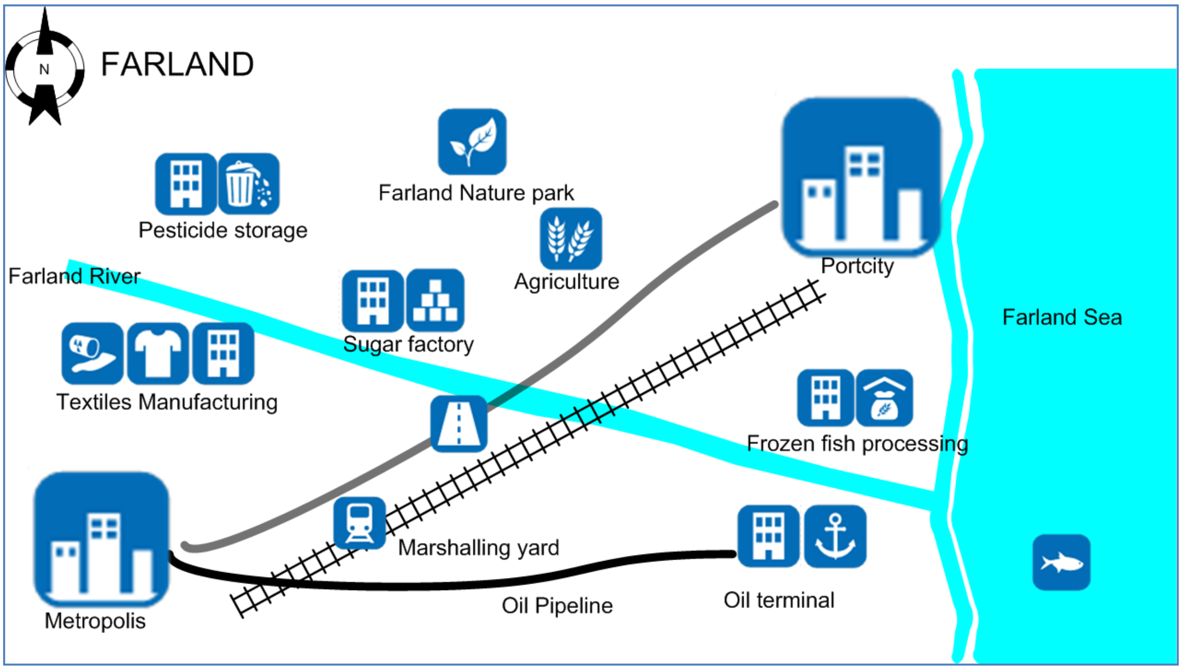

Figure 5. Case "Farland"

Introduction

Farland is a developing country with approx. 2 million inhabitants. Farland has two big cities: Portcity (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 Portcity. An oil pipeline is running from Portcity 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 Portcity 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.

FEAT-P: The Preparedness example elaborates four potential accident scenarios; at a pesticide storage, a textile manufacturing plant, a marshalling yard and an oil pipeline.

FEAT-R: The Response example elaborates a chemical accident at a textile manufacturing plant.

4. EMERGENCY PREPAREDNESS

The user instructions for FEAT-P are summarized in Checklist 1 (next page). However, before starting FEAT-P, there are some important introductory points.

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.

Commitment

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

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 minimise 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 organised, 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.

Checklist 1: User Instructions for FEAT-P				
Step number **Step Title**	**Status information:** default information (yellow) actual information (green)	**Actions**	**Input**	**Output**
Step P-1 **Understand impact**	I = H ; E ; Q	1. Select/Define area or country 2. Identify triggers and failure types 3. Describe hazards and exposure	Checklist 2: Understanding Impact Annex 8 Checklist Triggering events	Management summary, including: - Triggering events - Potential impact *Example 1 in paragraph 4.1*
Step P-2 **Collect preliminary hazard data**	I = H ; E ; Q	1. Identify hazardous operations 2. Identify hazardous substances	Annex 2 Hazardous Operations Module Annex 7 Checklist Hazardous Substances	Chemical accident scenario's: - Hazardous operations - Hazards - Exposure - Quantities - Potential Impact *Example 4 FEAT-P Accident scenarios) in Annex 1* - Hazard Map
Step P-3 **Collect detailed hazard data**	I = H ; E ; Q	1. Verify and update hazard information 2. Collect chemical and physical properties of each hazardous substance 3. Determine exposure distance	Annex 3 Exposure Distance Module Annex 5 Checklist Typical unit sizing	
Step P-4 **Create Hazard Map**	I = H ; E ; Q	1. Select mapping tool 2. Create hazard map	Mapping instrument	
Step P-5 **Perform Impact assessment**	I = H ; E ; Q	1. Determine presence of receptors 2. Assess potential impact 3. Propose risk reduction measures	Annex 6 Emergency Interventions Module	
Step P-6 **Start Risk reduction**	↓ Risk ↓	1. Identify and initiate emergency preparedness actions 2. Define risk reduction strategy 3. Define priorities 4. Prepare emergency preparedness action plan.		Emergency Preparedness Action Plan *Checklist 3 (see paragraph 4.5)*

Checklist 1: User Instructions for FEAT-P.

4.1 STEP P-1: Understanding Impact

I = H ; E ; Q

- **OBJECTIVE:** To determine the potential impact of chemical accidents.

The activities to undertake in this step are as follows:

1. Select/define scope of area or country
2. Identify triggers and failure causes
3. Describe hazards and exposure

- **ACTION: Firstly, select an area or country**

Select an area that is practical, to keep a good overview and to keep control over the data collected.

Tip: 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.

- **ACTION: Secondly, identify triggering events and failure causes**

Use Checklist 5 Triggering Events and Failure Types (in Annex 7) 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.

- **ACTION: Thirdly, describe hazards and exposure**

Use
Checklist 2: Understanding Impact to describe:

- 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

Tip: Desribe 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 impact of chemical accidents.

Checklist 2:Understanding Impact										
Hazard	**Exposure**									
	Pathway				Receptor					
GHS Hazard label	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	

Checklist 2: Understanding Impact.

Example: A pesticide storage contains large quantities of not-volatile toxic liquids.
From checklist 2 it can be derived that:

- Potential pathways are: soil and groundwater, lake and river
- Potential receptors are: humans, fishing areas, soil and groundwater, agricultural areas and nature reserves

An example of a Management Summary is displayed on the next page (Example 1 Management Summary Understanding Impact).

Management Summary - Understanding Impact	
Case	Farland
Country baseline information	Farland is a developing country with approx. 2 million inhabitants. Farland has two big cities: Portcity (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 Portcity, Farlands's capital. An oil pipeline is running from Portcity 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 Portcity 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 Portcity could be heavily affected. It is assumed that the industrial zones around Metropolis would be less affected. The coastal population of Portcity 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 Portcity. The garments industry is using several (highly) toxic liquids. A chemical accident could pollute Falrand 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.

Example 1 Management Summary Understanding Impact

4.2 STEP P-2: Collect Preliminary Hazard Data

I = H ; E ; Q

- **OBJECTIVE:** To summarize the hazardous operations in the selected area including hazardous substances involved.

The activities to do in this step are:

1. Identify hazardous operations
2. Identify hazardous substances

- **ACTION: Firstly, identify hazardous operations**

Use Annex 2 (Hazardous Operations and Impact priority) to identify hazardous operations in the area. This annex provides the user with default information, in case actual data is not available. If data is available, this information is preferred above the use of default hazard data.

Tip: Information that can be helpful includes 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.

- **ACTION: Secondly, identify hazardous substances**

Use Annex 2 (Hazardous Operations and Impact priority) to identify hazardous substances for each hazardous operation:

- Identify hazardous substances (for each hazardous operation)
- Look up hazard classification for each substance (see Annex 6)
- Look up the default quantity of each hazardous substance

An example of results of step P-2 is included in Annex 1.

I = H ; E ; Q

4.3 STEP P-3: Collect Detailed Hazard Data

- **OBJECTIVE:** To collect, verify and update information on hazards and the quantity of hazardous substances.

The activities to do in this step are as follows:

1. Verify and update hazard information.
2. Collect chemical and physical properties of each hazardous substance.
3. Determine exposure distance.

- **ACTION: Firstly, verify and update hazard information**

Verify and update hazard information: check if the hazardous substances are actually present at all hazardous operations, as identified in Step P-2. Replace default data with actual data, where available. Check in particular the name of hazardous substance, the hazard classification and the actual quantity.

Tip: The best way to do this is to ask the industry operator. However, site visits or acquiring missing detailed information may not always be feasible or practicable. If a notification procedure is in place in the country, the competent authority would be the best source of information. It may not be feasible to get detailed information from industry associations or NGOs.

Tip: If you do not know the actual quantity, but you do know the type of containment system in which the hazardous substance is stored (e.g. a large storage tank, tank container or tank truck), use the “Checklist Typical Unit Sizing” (Annex 4) to estimate the quantity.

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.

- **ACTION: Secondly, collect chemical and physical properties**

Collect for each hazardous substance its chemical and physical properties, in particular:

- Chemical name (product name or trade name is not sufficient)
- CAS number[13]
- Aggregation (gas, liquid, solid)
- Hazard and precautionary statements

Tip: Use Safety Data Sheets, chemical handbooks or on internet websites.[14] 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.

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[13] Every hazardous substance has a so called “CAS Registry Number”. A CAS number is an unique numerical identifier assigned by Chemical Abstracts Service (CAS)

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

- **ACTION: Thirdly, determine exposure distance**

Use Annex 3 (Exposure Distance Module) to determine the exposure distance for each hazardous substance. Because hazardous substances may have multiple hazard classifications, the exposure distance shall be determined for each hazard classification.

An example of results of step P-3 is included in Annex 1.

I = H ; E ; Q

STEP P-4: Create Hazard Map

- **OBJECTIVE:** To prepare an industrial hazard map.

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

The activities to do in this step are as follows:

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 (see example in Figure 6)
   - Prepare Layer 3: Plot exposure distances for each hazard (see example in Figure 7)

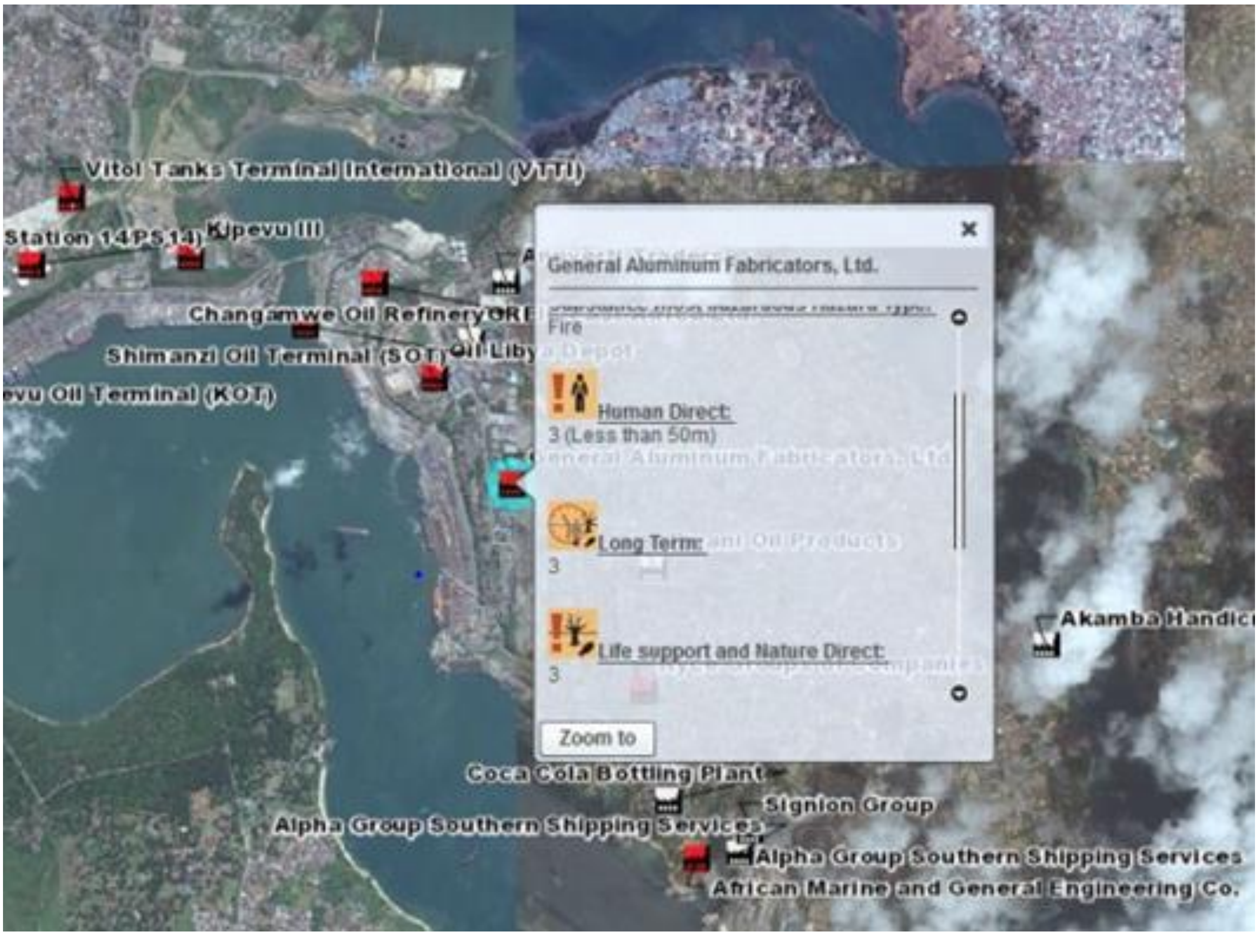

Figure 6 Layer 2: Mapping hazardous facilities in Mombasa, Kenya [Source: NDOC/JEU (2013)].

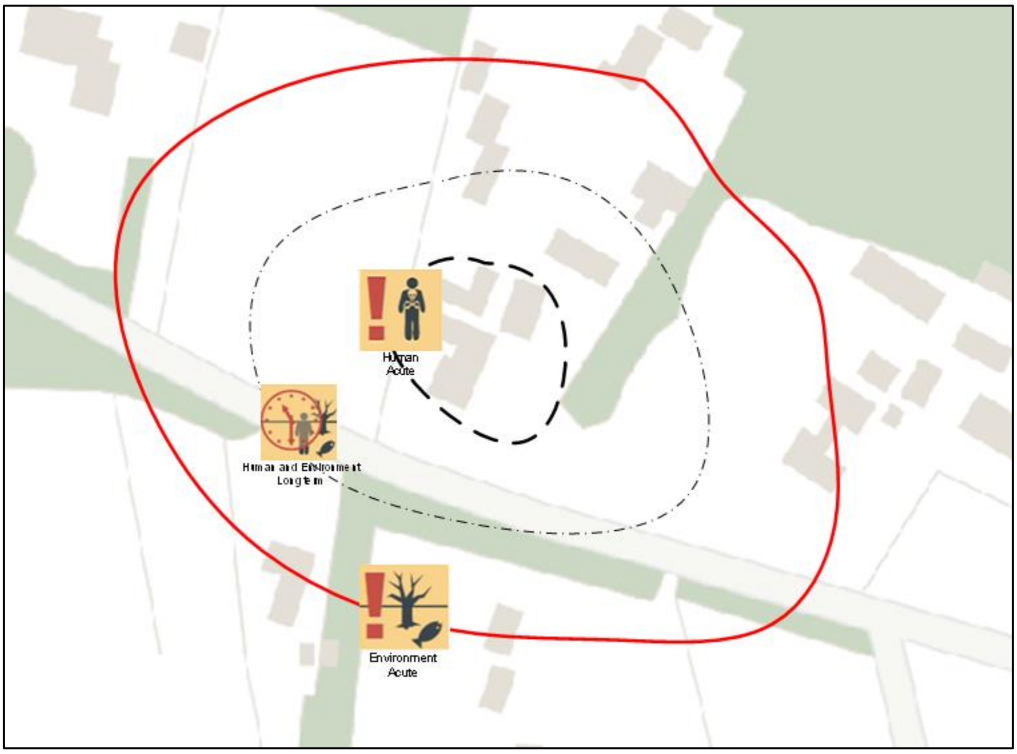

Figure 7 Layer 3: Exposure distance on hazard map.

4.4 STEP P-5: Impact Assessment

I = H ; E ; Q

- **OBJECTIVE:** To gain an understanding of the extent of the impact on humans and the environment.

The (potential) impact forms the basis of the preparedness planning and the commitment to reduce risks.

The activities to do in this step are:

1. Determine presence of receptors within exposure distance
2. Assess potential impact
3. Propose potential risk reduction measures

- **ACTION: Firstly, determine the presence of receptors within exposure distance**

Assess the presence of receptors within the exposure distance for each facility and each hazard. Use the hazard map, or information from local parties: compare the exposure distance on one hand (results of Step P-3) and check if any receptors are present within the exposure distance (result of Step P-4). If there are receptors witin the exposure distance, continue with the hazard assessment (perform activity 2 and 3 of this step). If there are no receptors within the exposure distance, there are no further actions required.

Tip: In case the impact exceeds the local or region level, that is, there may be impact at the national level or there is a potential transboundary impact, the key stakeholders shall be invited to complete the hazard assessment process.

- **ACTION: Secondly, assess potential impact**

Assess the potential on basis of your expertise and discretion. If you are lacking information, collect information from the authorities or any other local parties. Next, conclude whether there is a potential impact by answering the following three impact-determining questions:

a. Are hazardous substances actually unintentionally released into the environment?
b. Are there any realistic pathways by which hazardous substances can be spread into the environment?
c. Are there any vulnerable receptors in the vicinity (humans and/or vulnerable environment) that could be exposed?

If the answer to all three questions is positive then there is a potential impact. Describe the impact on the basis of local findings, observations, interviews and other data collected.

- **ACTION: Thirdly, propose potential risk reduction measures**

Use Annex 5 to identify and propose potential risk reduction measures in order to avoid or to reduce the risk of chemical accidents. When proposing risk reduction measures the frequency or likelihood of a chemical accident shall be taken into account.

Tip: When proposing measures, keep in mind that there are different types of risk reduction measures, such as:

- Prevention measures: to reduce the risk i.e. probability of occurrence on an accident
- Preparedness measures: to avoid or to minimize the potential impact of an accident

An example of the results of step P-5 is included in Annex 1.

4.5 STEP P-6: Risk Reduction

↓ Risk ↓

- **OBJECTIVE:** To prepare an Emergency Preparedness Action Plan and to start on risk reduction.

The plan shall be prepared in cooperation with key stakeholders – as preparedness planning is a joint responsibility of government authoritiesand 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.

- **ACTION: Firstly, identify and initiate emergency preparedness actions**

Identify and initiate adequate preparedness planning actions and develop testing of emergency prepraredness 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.

- **ACTION: Secondly, define risk reduction strategy**

Identify a risk reduction on strategic level – i.e. a long term risk reduction action plann. 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).[15]

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

- **ACTION: Thirdly, define priorities**

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[15] 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.

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: Priorization can help to identify which elements of the preparedness activities should be further developed and implemented first, recognising 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.

- **ACTION: Forthly, prepare emergency preparedness action plan**

The final step is to draw up the 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 prioritising 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.[16]

<u>Note: Actions for authorities</u>

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 which 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.

<u>Note: Actions for operators</u>

A checklist for actions by operators of hazardous operations (see Checklist 3: Emergency Preparedness Action Plan) includes actions in order to meet obligations and operating installations safely as specified.

[16] 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 www.capp.eecentre.org

Note: Information and participation of the public

The public shall be informed and the public 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.[17]

[17] 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).

Checklist 3: 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; minimise 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 organisational 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. • Utilise "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.

Checklist 3: 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.

Checklist 3: Emergency Preparedness Action Plan

5. EMERGENCY RESPONSE

FEAT-R is for use in the case of a chemical accident.

Emergency response teams face the difficult task of 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 a response is crucial and important decisions have to be made as soon as possible after occurrence of the accident.

FEAT-R helps the user to collect information on the chemical accident, to assess the impact of the chemical accident (by assessing hazard, exposure and quantity) and to initiate emergency response actions.

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

User Instructions: FEAT-R

Step number Step Title	Status information: default information (yellow) actual information (green)	Actions	Input	Output
Step R-1 **Request for UN assistance**	Accident	1. Provide Country base line information 2. Describe triggering event(s) and area 3. Describe immediate and acute needs	Checklist 5 Triggering Events and Failure Types	Nature and extend of chemical accident
Step R-2: **Collect info on chemical accident**	I = H ; E ; Q	1. Identify key stakeholders 2. Identify hazardous operations 3. Identify hazardous substances	Annex 2 Hazardous Operations Module Annex 3 Exposure Distance Module	Chemical accident information: - Hazardous operations - Hazards - Exposure - Quantity - Actual Impact - Interventions - Knowledge gaps *Example 5 FEAT-R – Impact Assessment in Annex 1*
Step R-3: **Collect site-level information**	I = H ; E ; Q	1. Determine if and which chemical substances are present 2. Look up chemical and physical properties 3. Identify Loss of Containment details	Annex 4 Checklist Typical unit sizing Annex 6 Checklist Hazardous Substances	
Step R-4: **On site assessment(s)**	I = H ; E ; Q	1. Mark local observations 2. Review monitoring reports 3. Identify additional hazards		
Step R-5: **Impact assessment**	I = H ; E ; Q	1. Determine humans/environment exposure. 2. Determine actual impact. 3. Identify major gaps. 4. Prepare time line, conclusions and recommendations.	Annex 5 Checlist Emergency Interventions	
Step R-6: **Impact reduction**	↓ Impact ↓	1. Prepare situation analyses. 2. Determine emergency response strategy. 3. Select potential interventions. 4. Request additional assistance (if required). 5. Prepare Emergency Response Plan.		Emergency Response Plan: - Case description - Situation analyses - Response strategy - Recommendations *Example 3 Emergency Response Plan*

5.1 STEP R-1: Request for international assistance

Accident

- **OBJECTIVE:** 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 mobilises 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. Estblish contact with the UN and provide accident baseline information.
2. Descibe 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 Guidelines for Environmental Emergencies (https://ochanet.unocha.org/p/Documents/Guidelines%20for%20Environmental%20Emergencies%20Version%201.pdf)

In extreme urgent and acute situations, assistance can be requested by contacting OCHA's Emergency Duty Officer: +41 22 917 2010.

5.2 STEP R-2: Collect information on Chemical Accident

I = H ; E ; Q

- **OBJECTIVE:** To collect information on the chemical accident.

The information shall be collected as quickly as possible after the occurrence of the accident. The result of this step is a summary of the chemical accident and hazardous substances involved. On the basis of this information the responder can decide on what do first and where to go first.

The activities to do in this step are as follows:

1. Identify key stakeholders.
2. Identify hazardous operations in the affected area.
3. Identify hazardous substances

- **ACTION: Firstly, identify key stakeholders**

Team up with key stakeholders, such as representatives from national, regional and local authorities, agencies and operators. Request stakeholders to assist in:

- Providing a situation overview and detailed information on sites of interest.
- Identifying relevant stakeholders.
- Understanding local requirements, means of communication, customs, culture and practices.
- Providing logistical support.
- Initiating follow-ups – i.e. enabling a proper mission "handover".

- **ACTION: Secondly, identify hazardous operations in the affected area**

Check if a HIT report is available.[18] A HIT contains generic information on facilities and hazard data for a particular area or country. If it is available, download it and select relevant hazardous operations.[19] If a HIT is not available, use Annex 2 (Hazardous Operations Module) to identify hazardous operations in the area.

Tip: An example of (how to prepare) a HIT is provided in Annex 8.

- **ACTION: Thirdly, identify hazardous substances**

Identify, verify and update information on hazardous substances with the operators of facilities, either by phone contact, or by conducting a site visit. Operators may have information on the hazardous substances on-site and hazard classification, assuming this information is accessible and operators are willing and able to provide it.

Summarize the hazard data for each facility, in particular:

- Hazardous substances.
- Hazard classification for each substance.
- Quantity of each substance.

[18] HIT's are available from the Virtual OSOCC (http://vosocc.unocha.org/)

[19] Upon finalisation of this step it is recommended to provide feedback to the originator of the HIT and to share updates and information by uploading updated results

5.3 STEP R-3: Collect Site-level Information

I = H ; E ; Q

- **OBJECTIVE:** To collect detailed information on site-level and determine exposure distance.

The activities to do in this step are:

1. Determine if and which chemical substances are present.
2. Look up chemical and physical properties.
3. Identify Loss of Containment details.
4. Determine exposure distance.

- **ACTION: Firstly, collect information**

Verify whether the hazardous substances data is actually present at the facility, in particular the names of the hazardous substances and the quantities. The best way do do this is to collect the information (on hazardous substances) from the industry operators, however site visits or acquiring missing detailed information may not be always feasible. If a notification procedure is in place in the country, the competent authority would be the best source of information. Please note it may not always be feasible to get detailed information from industry associations or NGOs.

- **ACTION: Secondly, look up chemical and physical properties**

Use Annex 6 (Checklist Hazardous Substances) to look up the CAS number and the hazard classification. Then collect, for each hazardous substance of relevance, the chemical and physical properties, in particular:

- The chemical name ("product name" or "name" is not sufficient).
- The form (gas, liquid, solid).
- It's potential for evaporation (i.e. formation of gas from liquids).
- The hazard and precautionary statements.

Tip: This information can be found in the Safety Data Sheets (SDS), chemical handbooks or on internet websites. The SDS provides the user with more detailed information, such as particular risks, emergency and first aid procedures, or fire and explosion hazard data.

- **ACTION: Thirdly, identify loss of containment details**

In order to respond effectively it is required to gather details of the chemical accident. Answer the following questions:

1. Hazards: Was it a "one-time-spill" that has already been stopped, or is the spill still ongoing? What is the quantity of hazardous substances released? Is the spill in control and/or contained (e.g. in an enclosed area)? Use the "Checklist Typical Unit Sizing" (Annex 4) to estimate the quantity of hazardous substances released.

2. Pathways: How are hazardous substances released into the environment? Determine the actual pathway(s) that the spill is being (or has been) released into the environment: by air, on soil (groundwater) or into surface water (e.g. lake or river).

   Tip: Make notes on (ambient air/water) temperature, wind force and wind direction and any other details. These details are of relevance (for experts) in order to calculate or predict the potential impact on humans or environment.
3. Exposure: Check the presence of people, the vulnerability of the environment, or vital assets in the vicinity of the release location.

- **Fourthly, determine exposure distance**

Use Annex 3 (Exposure Distance Module) to determine the relevant hazard classifications and the actual exposure distance. Repeat this action for each hazardous substance. Because hazardous substances may have multiple hazard classifications, the exposure distance shall be determined for each hazard classification.

Activities to do are:

- Select the hazardous substanceform (e.g. liquid, solid, gas) and hazard classification.
- Determine and summarize exposure distances for all hazard classifications.
- Select “hazard classifications of most relevance”, thse are those hazard classifications that have:
    - the greatest impact distance, and
    - those that are classified as “any” (in Annex 3).

An example is displayed at the next page (Example 2).

The results of this step are included in the example in Annex 1.

Example: How to determine the Exposure Distance for 5.000 kg of MIC?

Actions and results:

1. Use Annex 6 to look up hazard classifications:
   - MIC is a toxic liquid with several hazardous classifications
2. Use Annex 3 to rank all hazard classifications according the GHS hazard type:
   - Physical hazards are: flammable liquid 2
   - Health hazards are: acute toxic (1, 2 and 3), eye damaging 1, skin sensitive 1, reprotoxic 2, resp. sens. 1, skin irritating 1 and STOT SE 3
   - Hazards for the environment: no hazards
3. Use Annex 3 to look up the the corresponding exposure distance for each hazard classification:
   - Exposure distances are summarized in Example 2
4. Determine the "hazard classification of most relevance".
   - Marked yellow are:
     - Hazard classifications with highest exposure distance, ánd
     - Hazard classifications marked as "any"

In this case: the "hazard classifications of most relevance" are:

- Physical Hazards: Flammable liquid (category 2)
- Health hazards: Acute Toxic (category 1) and Respiratory Sensitive (category 1)
- Environmental hazards: no hazards

Hazardous substance	Methyl Isocyanate (MIC) Liquid, 5.000 kg				
GHS Hazard label (ref. Annex 6)	**Exposure distance** (Average distance, see Annex 3)				
	Human		**Environment**		
	Lethal	Health	Soil	Lake	River
Physical hazard					
Flam. Liq. 2	< 0,1 km	< 0,1 km	-	-	-
Health hazard					
Acute Tox. 1	> 5 km	> 5 km	> 10 km	4,5 km	> 10 km
Acute Tox. 2	-	-	-	-	-
Acute Tox. 3	-	-	-	-	-
Eye Dam. 1 (10.000 kg)	Contact	contact	4 km	0,6 km	> 10 km
Skin Sens. 1 (10.000 kg)	Contact	contact	4 km	0,6 km	> 10 km
Repr. 2	-	-	-	-	-
Resp. Sens. 1	any	any	any	any	any
Skin Irrit. 2 (10.000 kg)	< 0,1 km	0,2 km	0,3 km	0 km	0,1 km
STOT SE 3	-	-	-	-	-
Environmental hazard					
(no hazards)	-	-	-	-	-

Example 2 Results example "Exposure Distance 5.000 kg MIC"

5.4 STEP R-4: On-site Assessment

I = H ; E ; Q

- **OBJECTIVE:** To identify all factors relevant to the emergency response, such as the nature and extend of the chemical accident.

The result of this step is an overview of observations, hazards and recommendations.

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, do not perform the on-site assessment.

The activities of this step are as follows:

1. Note local observations.
2. Review monitoring reports.
3. Identify additional hazards.

- **ACTION: Firstly, note local observations**

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.

Tip: When possible, conduct the on-site assessment in cooperation with other teams, such as local authorities, disaster responders, environmental experts or NGOs.

- **ACTION: Secondly, review monitoring reports**

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

- **ACTION: Thirdly, identify additional hazards**

Ensure that no hazards have been overlooked. If you have checked this, start to ascertain observations and to prepare recommendations for emergency response activities.

I = H ; E ; Q

5.5 STEP R-5: Impact Assessment

- **OBJECTIVE:** Assess the impact of the accident.

This step provides a starting point for impact reduction as well as a basis for evaluating and prioritising needs.

The activities of this step are as follows:

1. Determine the exposure of humans and the environment.
2. Determine the actual impact.
3. Identify major gaps.
4. Prepare a timeline, conclusions and recommendations.

- **ACTION: Firstly, determine the exposure of humans and the environment exposed**

Determine whether humans and the environment are exposed:

- The number, vulnerability and self-sufficiency of humans.
- The size of the area, vulnerability and any details of relevance for the environment.
- If required, critical infrastructure or other objects, such as hydro dams, telephone or drinking-water facilities.

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

- **ACTION: Secondly, determine the actual impact**

Conclude whether there is actual impact by answering the following three impact-determining questions:

1. Have hazardous substances been released at the facility?
2. Have pathways, by which hazardous substances are transported into the environment, been confirmed? (e.g. by air or water)
3. Have receptors (humans and/or the environment) actually exposed?

If the answer to all three questions is “Yes” then there is a potential impact. Describe the actual impact on the basis of the observations, the confirmed data, the interview results and other data collected.

- **ACTION: Thirdly, identify major gaps**

If you do not have complete information, summarize the major gaps. All items (as deemed required) can be mentioned here, for example gaps regarding:

- Hazarous operations (see Step R-2).
- Hazards: Hazardous substances released, quantity, physical or chemical properties, or Loss of Containment details (see Step R-3).
- 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

- **ACTION: Fourthly, prepare timeline, conclusions and recommendations**

Prepare a timeline displaying the list of events in chronological order. Draw up conclusions and recommendations in order of priority.

Tip: A timeline can be drawn up by using a graphic design tool (e.g. Google for a template) showing a long bar labelled with dates and events along it.

↓ Impact ↓

5.6 STEP R-6: Impact reduction

- **OBJECTIVE:** To prepare response plan(s) in order to reduce the impact of the chemical accident.

The response 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.

The activities to do in this step are as follows:

1. Determine emergency response strategy.
2. Draw up recommendations.
3. Prepare Emergency Response Plan.

- **ACTION: Firstly, determine the emergency response strategy**

Prepare the emergency response strategy according to the following elements:

a. Situation analysis.
b. Goals and strategies.
    - Needs assessment.
    - Action plan.
    - Mobilising resources.
    - Conclusions and recommendations.
c. (Preliminary) interventions 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 or use Annex 8. Use the ERG (or GHS database on internet) to select interventions for particular hazardous substances.

- **ACTION: Secondly, draw up recommendations**

Assess the results of the “FEAT-R Impact Assessment” (see step R-5), 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 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 mobilise such international assistance. Discuss options for moving people from the affected area and humanitarian needs.

- **ACTION: Thirdly, prepare the Emergency Response 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.

An example of an Emergency Response Plan is demonstrated on the next page (Example 3).

FEAT-R Emergency Response 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 of 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 drifted 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 system (approx. 5 to 10 m^3) labeled with “MIC”. This tank maybe filled with Methyl Isocyanate and it may 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. In addition, there is need for 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 drink 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.

FEAT-R Emergency Response Plan		
	Mobilising Resources	Resources to: 1) build dikes and repair the tank(s), including equipment such as shovels; 2) (drink) 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.
Follow up	Preliminary interventions	In according the Emergency Response Guidebook[20] the following preliminary interventions are executed fot benzene (ref. ERG, number 1114). Immediate precautionary measures taken are: • Spill is isolated for at least 50 meters in all directions • Unauthorized personnel is kept away. • Instructions given: to stay upwind, keep out of low areas and to ventilate closed spaces before entering. Potective 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.

[20] 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 hazardous materials.It is produced by the United States Department of Transportation, Transport Canada, and the Secretariat of Communications and Transportation (Mexico).

FEAT-R Emergency Response Plan		
		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. • 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 vapors. • 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.
Recommendations	Interventions	Continue and evaluate effectiveness of interventions mentioned above. In addition, a) Start air and (drink) 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 drink 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 Portcity.

Example 3 Emergency Response Plan

ANNEX 1 Elaborated example

The FEAT Preparedness example elaborates four potential accident scenarios

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

One of the first steps is to summarize hazardous substances, hazard classifications and exposure distances. The summary is demonstrated in de next tables.

GHS Hazard label (ref. Annex 6)	**Exposure distance** (Average distance, see Annex 3)				
	Human		**Environment**		
	Lethal	Health	Soil	Lake	River
Hazardous operation Hazardous substance Form, quantity	1. Textile manufacturing plant Benzene Liquid, 10.000 kg				
Physical hazard					
Flam. Liq. 2	< 0,1 km	< 0,1 km	-	-	-
Press. Gas	0,2 km	0,3 km	-	-	-
Health hazard					
Asp. Tox. 1	any	any	any	any	any
Carc. 1A	any	any	any	any	any
Muta. 1B	any	any	any	any	any
Eye Irr. 2	< 0,1 km	0,2 km	0,3 km	0 km	0,1 km
Skin Irrit. 2	< 0,1 km	0,2 km	0,3 km	0 km	0,1 km
STOT RE 1	any	any	any	any	any
Environmental hazard					
Aquatic Chronic 3	-	-	1,5 km	0,2 km	2,7 km
Hazardous operation Hazardous substance Form, quantity	2. Pesticide storage Carbamate pesticide Solid, 10.000 kg				
Physical hazard					
(no hazards)	-	-	-	-	-
Health hazard					
Carc. 2	-	-	-	-	-
Acute Tox. 4	-	-	-	-	-
Environmental hazard					
Aquatic Acute 1 (*5.000 kg)	-	-	0,8 km	0,1 km	0,8 km

Example (continued)

GHS Hazard label (ref. Annex 6)	Exposure distance (Average distance, see Annex 3)				
	Human		**Environment**		
	Lethal	Health	Soil	Lake	River
Hazardous operation Hazardous substance Form, quantity	3. Marshalling yard Acrylonitrile Liquid, 50.000 kg				
Physical hazard					
Flam. Liq. 2	< 0,1 km	< 0,1 km	-	-	-
Health hazard					
Acute Tox. 2 (*5.000 kg)	> 5 km	> 5 km	> 10 km	4,3 km	> 10 km
Carc. 1B	any	any	any	any	any
Eye Dam. 1 (*100.000 kg)	contact	contact	> 10 km	1,8 km	> 10 km
Repr. 2					
Skin Irr. 2	< 0,1 km	0,3 km	0,7 km	0,1 km	0,6 km
Skin Sens. 1 (*100.000 kg)	contact	contact	> 10 km	1,8 km	> 10 km
STOT SE 3	-	-	-	-	-
Environmental hazard					
Aquatic Chronic 2	-	-	7,3 km	1 km	> 10 km
Hazardous operation Hazardous substance Form, quantity	4. Oil pipeline Petroleum (crude oil) Liquid, 200.000 kg				
Physical hazard					
Flam. Liq. 1 (*1.000.000 kg)	0,2 km	0,3 km	-	-	-
Health hazard					
Asp. Tox. 1	any	any	any	any	any
Environmental hazard					
Aquatic Chronic 3 (*50.000 kg)	-	-	3,3 km	0,5 km	> 10 km

The results above, as well as results form other steps in FEAT-P, are summarized in the FEAT Preparedness – Accident Scenarios overview (see next page).

FEAT Preparedness – Accident Scenarios

Case: Farland

Accident scenario	Facility	Hazard					Quantity	Exposure							Impact	
Number	**Name Adress GPS [WGS84]**	**Hazardous Substance**	**Form**	**Hazard Classification**	**Hazard Classification of most relevance**		**[kg]**	**Pathway**	**Receptor**	Human Acute		Human and Environment Long term	Environment Acute		**Priority**	**Preparedness Interventions**
										Lethal	**Health**	**Soil**	**Lake**	**River**		
1	**Textiles manufacturing "Wear out"** Main road 10, Smallville 22°.34.56' S, 078°.91.11.E	Benzene	liquid	Flam. Liq. 2 Pres. Gas Asp. Tox. 1 Carc. 1A Muta. 1B STOT RE 1 Eye Irrit. 2 Skin Irrit. 2 Aquatic Chronic 3	Human Acute	Pres. Gas	10.000	Air Farland river Soil/grou nd water	People in area Farland River (household, irrigation, drinking water production) Nature reserve (Farland Nature Park) Agricultural fields with crops (sugar, wheat, rice, maize)	0,2 km	0,3 km	-	-	-	1	Beneze appears not to be pressurized, flammable only. Consider fire figting arrangements
					Human and Environment Long term	Asp. Tox. 1 Carc. 1A Muta. 1B STOT RE 1				any	any	any	any	any	1	Personal protective equipment Detailed Risk assessment First aiders at facility
					Environment Acute	Aquatic Chronic 3				-	-	1,5 km	0,2 km	2,7 km	-	Notification procedure Provisions to stop liquid flow to river
2	**Pesticide production and warehousing** Road nr. 5, Mountains 12°.34.56' S, 077°.91.11.E	carbamate pesticide	Solid	Carc. 2 Acute Tox. 4 Aquatic Acute 1	Human Acute	-	10.000	Assuming solids are solved in water: Farland river Soil/ground water Agricultural fields	People in area Farland River (household, irrigation, drinking water production) Nature reserve (Farland Nature Park)	-	-	-	-	-	3	Proper design of pesticide storage system
					Human and Environment Long term	-				-	-	-	-	-	2	Second containment system pesticide storage Gas detection and alarm system
					Environment Acute	Aquatic Acute 1				-	-	0,8 km	0,1 km	0,8 km	1	Provisions to stop loss of containment Dedicated risk assessment
3	**Marshalling yard "The Corner"** Sub road 16, Metropolis 10°.34.56' S, 58°.91.11.E	acrylonitrile	liquid	Flam. Liq. 2 Acute Tox. 2 Carc. 1B Eye Dam. 1 Repr. 2 Skin Irrit. 2 Skin Sens. 1 STOT SE 3 Aquatic Chronic 2	Human Acute	Flam. Liq. 2	50.000	Air Soil/ground water	Inhabitants of Metropolis Agricultural fields with crops (sugar, wheat, rice, maize)	< 0,1 km	< 0,1 km	-	-	-	1	Set up emergency and evacuation system Medical care facilities at Metropolis City
					Human and Environment Long term	Acute Tox. 2				> 5 km	> 5 km	> 10 km	4,3 km	> 10 km	1	Spatial planning Restrict land use around marshalling yard
						Carc. 1B				any	any	any	any	any		
					Environment Acute	Aquatic Chronic 2				-	-	7,3 km	1 km	> 10 km	-	
4	**Oil pipeline "Big pipe"** From Portcity to Metropolis	Petroleum (crude oil)	liquid	Flam. Liq. 1 Asp. Tox. 1 Aquatic Chronic 3	Human Acute	Flam. Liq. 1	200.000	Air Soil/ground water	People in rural areas Agricultural fields with crops (sugar, wheat, rice, maize)	0,2 km	0,3 km				1	Maintenance Management system Regular inspections
					Human and Environment Long term	Asp. Tox. 1				any	any	any	any	any	2	Warning signs Safety distance Fencing off at critical locations
					Environment Acute	Aquatic Chronic 3				-	-	3,3 km	0,5 km	> 10 km	-	

Example 4 FEAT-P Accident scenarios

FEAT Response – Impact Assessment

Case: Textiles manufacturing plant "Wear out" at Farland

April 24th 2013

Accident scenario	**Facility**	**Hazard**						**Quantity**	**Exposure**				
Number	**Name** **Adress** **GPS [WGS84]**	**Hazardous Substance**	**Form**	**Hazard Classification**	**Hazard Classification of most relevance**	**Physical and chemical properties**	**Loss of Containment details**	**[kg]**	Human Acute		Human and Environment Long term / Environment Acute		
									Lethal	**Health**	**Soil**	**Lake**	**River**
1	**Textiles manufacturing "Wear out"** Main road 10, Smallville 22°.34.56' S, 078°.91.11.E	Benzene	liquid	Flam. Liq. 2 Pres. Gas Asp. Tox. 1 Carc. 1A Eye Irrit. 2 Muta. 1B Skin Irrit. 2 STOT RE 1 Aquatic Chronic 3	Pres. Gas	• Those substances designated with a (P) may polymerize explosively when heated in a fire. • Runoff to sewer may create fire or explosion. • Containers may explode when heated. • Highly flammable, will be easily ignited by heat, sparks or flames. • Vapors may form explosive mixtures with air. • Vapors may travel to source of ignition, flash back. • Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks). • Vapor explosion hazard indoors, outdoors, sewers. • Many liquids are lighter than water.	Leaking from tank and some smaller containers	10.000	0,2 km	0,3 km	-	-	-
					Asp. Tox. 1 Carc. 1A Muta. 1B STOT RE 1	• May cause toxic effects if inhaled or absorbed through skin. • Inhalation or contact with material may irritate or burn skin and eyes. • Fire will produce irritating, corrosive and/or toxic gases. • Vapors may cause dizziness or suffocation. • Runoff from fire control or dilution water may cause pollution.	Leaking from tank and some smaller containers		any	any	any	any	any
					Aquatic Chronic 3	To be checked out	Leaking from tank and some smaller containers		-	-	1,5 km	0,2 km	2,7 km

FEAT Response – Impact Assessment Case: Textiles manufacturing plant "Wear out" at Farland 24th April 2013				
Impact Assessment				
Actual impact	**Action item**	**Emergency Response interventions**	**Knowledge gaps**	**Remarks**
General	1	The leak in tank has been (provisionally) repaired, however repairs are instable. Provisionary Dikes are built the stop liquid flow towards river. Soil and groundwater remediation (not yet started)	Responders have discovered a tank (approx. 5-10 m^3) with "MIC", leaking as well. Potential leak and emission of MIC to be checked out by experts. Resources to to repair the storage tank adequately.	
Personal injuries and casualties	1	Appr. 20 people with respiratory problems, they are hospitalized Medics have treated casualties Downwind evacuation of all people with 300 meters radius. Because tank is involved in a fire, isolated for 800 meters in all directions	Find out source of penetrating smell is coming from. Air quality monitoring is recommendad. Additional specialized doctors and medics for treating casualties with respiratory problems are required.	
Pollution of Farland River: • Decolourization of water • Dead fish	2	Drinking water production is stopped. Provisionary containment units and dikes provided in order to stop flow to Farland River Spill control units not yet available	The extent of soil and ground water pollution is not known. The extent of the water pollution of Farland River is not known. Additional sampling and monitoring of water quality is required The drinking water quality shall be checked before restart of supply to households.	
Agricultural fields with crops (sugar, wheat, rice, maize)	2	Farmers witin 5 km radius are informed to stop waster irrigation of fields with crops	None	
Impoact on Farland Nature Park	3	Access of nature park is closed, people in the park are evacuated.		

Example 5 FEAT-R – Impact Assessment

ANNEX 2 Hazardous Operations Module

SEE SPREADSHEET

ANNEX 3 Impact Assessment Module

SEE SPREADSHEET

ANNEX 4 Checklist Typical Unit Sizing (transport and storage units)

Checklist Typical sizing transport and storage units			
		Default	
Modality		Instantaneous release (Typical quantity) [kg]	Continues release [kg/s]
INDUSTRY			
	Default: large storage tank	100.000.000	100
	Intermediate Bulk Container (IBC)	1.000	1
	Drum	200	1
	Gas bottle	50	1
	Storage hazardous substances (mixed)	20.000	0,5
	Ship (un)loading	100.000.000	100
	Storage tank– large	100.000.000	100
	Storage tank – medium	10.000.000	10
	Storage tank – small	1.000.000	1
	Process installation - large: e.g. vessels	500.000	10
	Process installation - small: e.g. flanges	10.000	1
TRANSPORT RAIL/ROAD			
	Default: tank truck	25.000	100
	Tank truck (default)	25.000	100
	• Instantaneous failure	25.000	100
	• Large leak	5.000	100
	• Small leak	1.000	10
	Rail wagon (default)	25.000	100
	Packed unit	10.000	-
	Container (default):	50.000	100
	• Container – small	25.000	100
	• Container – large	50.000	100
	• Tankcontainer	50.000	100
	• Truck (toppled)	20.000	10
	• Reservoir truck	25.000	100
	• Battery wagon (rail)	50.000	100
	• Transporttank	50.000	100
TRANSPORT WATER			
	Default: tanker ship	500.000	100
	Tanker (barges)	500.000	100
	• Gas tanker – large hole	500.000	100
	• Gastanker –small hole	100.000	50
	• Single-wall liquid tanker	500.000	50
	• Double-wall liquid tanker	250.000	50
	Container	50.000	100
PIPE LINES			
	Pipe line (gas)	200.000	20
	Pipe line (liquid)	200.000	100

Checklist 4 Typical unit sizing transport and storage units

Examples

Case 1: Rupture of a pipeline (transporting liquids). It can be assumed that:

- In case of instantaneous release: liquid pool formation with a surface of 2.000 m^2
- In case of continuous release (leaking): leak rate is 100 kg/s

Case 2: Rupture of a ‘medium size storage’ tank. It can be assumed that:

- In case of instantaneous release: 10.000 tons of hazardous substances is released
- In case of continuous release (leaking): leak rate is 10 kg/s

This - of course - is a rough assessment, but it does provide a first idea of what one could potentially expect. For preparing a more detailed assessment it is required to take other site specific factors into account, such as presence of secondary containment or drainage systems, pressure or suction system (e.g in pipelines), viscosity of liquids or nature of the surface.

ANNEX 5 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 organisation/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 affected by toxic substances

ANNEX 6 Checklist Hazardous Substances

SEE SPREADSHEET

ANNEX 7 Checklist Triggering Events and Failure Types

Triggering events and Failure types	
Triggering events	**Failure types**
Natural hazards: • Avalanche • Earthquake • Flood, tsunami • Landslide, mud stream • Typhoon, storm, hurricane, cyclone, drought, tornado • Wildfire • Vulcanic eruption	• Natural origin • Hydrological • Meteorological • Climate change • Side effects of human actions (e.g. deforestation)
Social and man made hazards • Crime • Arson • Civil disorder • Terrorism • War	• Deliberate acts
Hazardous operations: • 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 5 Triggering Events and Failure Types

ANNEX 8 Checklist How to Prepare a HIT Report

The objective of the HIT report is to preliminarily identify facilities with hazardous substances that may have major impact to humans and the environment in case of a chemical accident. Please note the HIT report is equivalent to activities as performed in FEAT step P-2.

Activities:

1. Identify hazardous operations.
2. Identify hazards:
    - Hazardous substances.
    - Hazard classification.
    - Highest hazard classification
3. Identify exposure:
    - Pathways.
    - Receptors.
4. Identify quantity.
5. Determine impact priority.

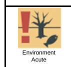
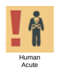
These activities shall be repeated to account for other hazardous substancess.[21] Availability of detailed data plays a crucial role, in particular when collecting data is limited by human resources, time and access constraints. Hazardous operations data is derived from country authoritries or own (UN) resources.

Additional activities in preparing a HIT report may include (optional):

1. Collect contact and location (GPS using WGS 84 or clearly specify if using another referential) details.
2. Review of implemented "contingency plans" – if any.
3. Collect additional data, such as a list of hazardous substances (name, CAS number, etc) and quantities.
4. Review (detailed) risk assessments including pathways (e.g. wastewater discharge and drainage systems).
5. Compare the importance of the impact-determining factors and evaluate them based on your common sense understanding of the collected information. This is the definitive result of the assessment of this case.
6. Verify HIT results with on site assessment (if available). Feed-back from on-site assessments ideally is used to improve the quality of data. In the regional HIT the types of facilities - and hazards they pose – are being gone through in more detail (on facility level), while also considering the pathways and receptors.
7. Prepare a full list of hazardous substances.
8. Finalize HIT report.

[21] Determine whether the assessment must be repeated for other hazard aspects of the same case or substance. If substances pose more than one type of hazard, such as toxic liquids with substantial volatility (e.g. with the potential hazard of the liquid itself, and the gas evaporating from the liquid), both types of hazard must be considered and both types of expected impacts must be taken into account. If this is the case: go through previous steps as many times as necessary for each type of hazard.

HIT Report **Case: Farland, April 24th 2013**

Facility	**Hazard**					**Exposure**		**Q**	**Impact**
Name, Adress GPS [WGS84]	**Hazardous Substance**	**Form**	**Hazard Classification**	**Hazard Classification of most relevance**		**Pathway**	**Receptor**	**[kg]**	**Priority**
Textiles manufacturing "Wear out" Main road 10, Smallville 22°.34.56' S, 078°.91.11.E	Benzene	liquid	Flam. Liq. 2 Pres. Gas Asp. Tox. 1 Carc. 1A Muta. 1B STOT RE 1 Eye Irrit. 2 Skin Irrit. 2 Aquatic Chronic 3		Pres. Gas	Air Farland river Soil/ground water	People in area Farland River (household, irrigation, drinking water production) Nature reserve (Farland Nature Park) Agricultural fields with crops (sugar, wheat, rice, maize)	10.000	1
					Asp. Tox. 1 Carc. 1A Muta. 1B STOT RE 1				1
					Aquatic Chronic 3				-
Pesticide production and warehousing Road nr. 5, Mountains 12°.34.56' S, 077°.91.11.E	carbamate pesticide	Solid	Carc. 2 Acute Tox. 4 Aquatic Acute 1		-	Assuming solids are solved in water: Farland river Soil/ground water Agricultural fields	People in area Farland River (household, irrigation, drinking water production) Nature reserve (Farland Nature Park)	10.000	3
					-				2
					Aquatic Acute 1				1
Oil pipeline "Big pipe" From Portcity to Metropolis	Petroleum (crude oil)	liquid	Flam. Liq. 1 Asp. Tox. 1 Aquatic Chronic 3		Flam. Liq. 1	Air (if volatile) Soil/ground water	People in rural areas Agricultural fields with crops (sugar, wheat, rice, maize)	200.000	1
					Asp. Tox. 1				2
					Aquatic Chronic 3				-

Example 6 HIT Report

APPENDIX 9 Checklist Relation GHS Hazard Classification – Impact Priority

SEE SPREADSHEET