Guidance Note

Industrial safety for the Sohar Industrial Port and the Sohar Free Zone

REP-159-11-RMO
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Definitions:

BAT	Best Available Technique
Dangerous substance	a substance or mixture listed in Annex 1 of the Seveso II Directive and present as a raw material, product, by-product, residue or intermediate (including those substances of which it is plausible that they could be generated in the event of an accident). The technical definition of a dangerous substance is the (new) world wide used Globally Harmonized System of Classification and Labeling of Chemicals (GHS) (http://www.unece.org/trans/danger/publi/ghs/ghs_welcome_e.html).
EP	Emergency Plan.
ERP	Emergency Response Planning.
Hazard	the intrinsic property of a dangerous substance or physical situation, with a potential for creating damage to human health or the environment.
GHS	Global Harmonization System
Industrial safety	Safety to prevent major accidents with hazardous substances.
LOC	Loss of Containment.
LOD	Line of Defense.
MAPP	Major Accident Prevention Policy.
Major accident	an occurrence such as a major emission, fire, or explosion resulting from uncontrolled developments, leading to serious danger to human health and/or the environment, immediate or delayed, inside or outside the establishment, and involving one or more dangerous substances.
MCA	Maximum Credible Accident.
MECA	Ministry of Environment and Climate Affairs.
Risk	the likelihood of a specific effect occurring within a specified period or in specified circumstances.
SEU	Sohar Environmental Unit.
SMS	Safety Management System.
SIP	Safety Improvement Plan

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Legal framework

In Oman no legal framework is available for industrial safety. For this reason the Best Available Technique (BAT) of the EU is used: the Seveso II Directive.

Background

Handling dangerous substances could result in unwanted events with consequences for men and environment. The consequence depends on the amount and type of substance. Some substances are already in small quantities dangerous while others becomes more dangerous in larger quantities.

In the European Union, legislation is in force to protect men and environment from major accidents with dangerous substances. This legislation is named by the Italian city were a major accident occurred in 1976. At this moment experts are working on the third edition of the Seveso II Directive. The current directive covers all necessary elements for the prevention of a major accident.

There are two kinds of so called Seveso companies: lower tier and higher tier (also named tier 1 and tier 2). The difference is based on the amount of dangerous substances. The tier 2 companies must provide a *safety report* to demonstrate that the company controls the chance of a major accident and its potential consequences.

Seveso requirements

Companies must demonstrate to the authorities that they have implemented appropriate technical and organizational measures with the following characteristics:

- covering the various activities in the company.
- to prevent major accidents.
- limiting the consequences of major accidents on-site and off-site.
- all submitted reports must adequately reflect the actual conditions in the company.

In order to implement the Seveso II policy in SIP and SFZ, two phases are defined.
The initial phase must result in:

- a Major Accident Prevention Policy (MAPP).
- a Safety Management System (SMS) to implement the MAPP.
- a Hazard Identification and Risk Assessment study.
- an Emergency Response Plan (ERP).
- a list of the hazardous substances in the company (HSL).

The following phase must result in:

- a safety report (if so required) (SR).
- incident investigation report.

The Seveso II classification of companies and the related requirements, will be implemented in SIP and SFZ for existing and new companies.
New companies will be classified during the No Objection stage (together with classification for EIA and IPPC).

Existing companies that are classified as Seveso companies, need to comply with the requirements based on the SMS-gap study by the SEU. This process is ongoing for the SIP companies that are classified as Seveso companies.

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Seveso classification for SIP and SFZ companies

A company is considered a 'Seveso company' when production or storage of dangerous substances exceeds the limits as listed in Annex I of the Seveso II directive. An extract for some common hazardous substances and a more generic list are included in the following tables.

Dangerous substances (extract)	Qualifying quantity (tonnes)	
	Tier 1	**Tier 2**
Ammonium nitrate	350	2500
Bromine	20	100
Chlorine	10	25
Nickel compounds in inhalable powder form (nickel monoxide, nickel dioxide, nickel sulphide, trinickel	-	1
Fluorine	10	20
Formaldehyde (concentration > 90 %)	5	50
Hydrogen	5	50
Hydrogen chloride (liquefied gas)	25	250
Liquefied extremely flammable gases (including LPG) and natural gas	50	200
Acetylene	5	50
Methanol	500	5000
Methylisocyanate	-	0,15
Oxygen	200	2000
Toluene diisocyanate	10	100
Sulphur trioxide	15	75
Automotive petrol and other petroleum spirits	5000	50000

Categories of dangerous substances	Qualifying quantity (tonnes)	
	Tier 1	Tier 2
1. VERY TOXIC	5	20
2. TOXIC	50	200
3. OXIDIZING	50	200
4. EXPLOSIVE	50	200
5. EXPLOSIVE	10	50
6. FLAMMABLE	5000	50000
7 a. HIGHLY FLAMMABLE	50	200
7 b. HIGHLY FLAMMABLE	5000	50000
8. EXTREMELY FLAMMABLE	10	50
9. DANGEROUS FOR THE ENVIRONMENT in combination with risk phrases:	.	.
(i) R50: 'Very toxic to aquatic organisms'	200	500

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(ii) R51: 'Toxic to aquatic organisms'; and R53: 'May cause long term adverse effects in the aquatic environment'	500	2000
10. ANY CLASSIFICATION not covered by those given above in combination with risk phrases:	.	.
(i) R14: 'Reacts violently with water' (including R14/15)	100	500
(ii) R29: 'in contact with water, liberates toxic gas'	50	200

Please note that the full text of the Directive should be consulted when a classification is made.

Safety Action Plan (SAP)

The Safety Action Plan of the SEU is aimed at the introduction of methods for safety management that are standardized and verifiable and are based on the Seveso II Directive.

The 2011 elements of the SAP are:

- conduct SMS-gap studies for existing SIP companies (implemented).
- conduct a safety workshop (implemented).
- organize a Safety Master Class.
- Issue a Guidance Note.
- Request a Safety Improvement Plan (SIP) for port companies.

Major Accident Prevention Policy (MAPP)

The company policy for prevention of major-accidents has the following main characteristics:

- proportionate to the major-accident hazards.
- includes the operator's overall aims and principles of action and the role and responsibility of management.
- addresses the safety culture with respect to the prevention of major-accidents.

The MAPP includes:

- a definition of the companies' own acceptable level of risk.
- tables for likelihood and severity, including a risk matrix.

The MAPP is signed by the CEO of the company to express his approval and to provide all necessary resources for the prevention of major accidents.

The MAPP is yearly reviewed and updated.

Safety Management System (SMS)

For implementing the MAPP a SMS must be implemented. The SMS has the following characteristics:

- Proportionate to the hazards, industrial activities and complexity of the organization.
- Based on the assessment of the risks.
- Is part of the general management system.
- Defines the organizational structure, responsibilities, practices, procedures, processes and resources.
- Procedures and working instruction shall be suitable, documented and implemented.

Suitable: technical, organizational and procedural components are state of the art science and are appropriate for the situation encountered.

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documented: there is a proper and complete description:
- reliable and solid: bright, clear, legible and current;
- complete: all relevant aspects have been appointed.

implemented: the company works as described. There is a well-functioning management course, improvement activities in all components are structurally and inextricably linked to the business.

A useful tool for the SMS is the NTA 8620. This document is available in the SEU and is on request sent by email.

Hazard Identification and Risk Assessment (HIRA)

The identification and evaluation of major hazards is one of the elements of a SMS. The definition is: *'adoption and implementation of procedures for systematically identifying major hazards arising from normal and abnormal operation and the assessment of their likelihood and severity'.* The identification and evaluation should include:

- A detailed description of the possible major-accident scenarios and their probability or the conditions under which they occur including a summary of the events which may play a role in triggering each of these scenarios, the causes being internal or external to the installation; including in particular
  - operational hazard sources;
  - external risks and hazard sources, from domino effects and from other sites, areas and developments that could increase the risk or consequences of a major accident;
  - environmental risks and hazard sources, for example earthquakes or floods;
- Assessment of the extent and severity of the consequences of identified major accidents including maps, images or, as appropriate, equivalent descriptions, showing areas which are liable to be affected by such accidents arising from the establishment;
- A review of past accidents and incidents with the same substances and processes used, consideration of lessons learned from these, and explicit reference to specific measures taken to prevent such accidents;
- A description of technical parameters and equipment used for the safety of installations.

All the taken measures must be presented in scenario's. Purpose of the scenarios is to clarify what measures are taken to prevent major accidents or reduce the impact. Based on the risk assessment a Maximum Credible Accident (MCA) scenario can be identified.

Emergency Response Plan (ERP)

The ERP of a company must be based on a Maximum Credible Accident (MCA) scenario.

Emergency plans have the following objectives:

- containing and controlling incidents (so as to minimize the effects, and to limit damage to human health, the environment and property).
- implementing the measures necessary to protect human health and the environment from the effects of major accidents.
- communicating the necessary information to the public and to the services or authorities concerned providing for the restoration and clean-up of the environment following a major accident.

Emergency plans must be practiced at least 2 times in one year and one of the exercises is with the SIPC. Every exercise must be based on a realistic scenario, must be evaluated.

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Hazardous Substance List (HSL)

An up-to-date list with all hazardous substances must be present at the company to ensure that emergency services have direct access to at least the following current information within an installation of the hazardous substance:

- the chemical name (CAS) or trade name;
- the maximum quantity present and in which facility (installation or storage tank, including a map)
- UN number
- the GHS category

Information sources

Information is also available of consultants, experts and on websites (http://ec.europa.eu/environment/seveso/index.htmin) particularly of the Major Accident Hazardous Bureau of the EU. Other information could also be very useful for example The U.S. Chemical Safety Board (http://www.csb.gov/) and The Health and Safety Executive (http://www.hse.gov.uk/comah/) in the United Kingdom.
It is recommended also to search for information for the type of industry of the company.

Annex I gives some more details of the SMS.

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ANNEX I Extract of NTA 8620

A.0 Introduction

The intention of this NTA is to indicate how the legal requirements for the SMS can be complied with by the introduction or revision of a management system based on the plan-do-check-act cycle. For this reason the legal requirements from BRZO '99 (BRZO '99 is the condensation of the European Seveso II Directive into the Dutch legislative system) form an integral part of the requirements for the SMS described in the main text of this NTA.
In these annex guidelines and examples are given for the application of the requirements. How far these guidelines and examples actually apply for a specific company depends on the risks present there. Some of these guidelines are derived from legal requirements from BRZO'99 and the Regulations on Major Accident Risks 1999 (RRZO'99) that apply for the implementation of parts of the safety management system. Those guidelines are of a normative nature for users who with the application of this NTA wish to comply with all their legal obligations relating to the SMS and the interpretation of parts thereof. In connection with this

A.1 General requirements
Clause 4.1 states that a safety management system shall comply with all the requirements described in Clause 4 of this NTA. Many of these requirements will already be implemented within the organization's overall management system or via specific systems introduced for example for environmental, OH&S or quality management. In those cases the organization may choose to use those system elements already present and ensure that they are also suitable for application for the management of major accident risks. This is in line with the first requirement relating to safety management systems from BRZO'99, in accordance with which the organization shall state how parts of the overall management system are used to carry out the policy to prevent major accidents.

A.2 Policy to prevent major accidents
The principles of the policy should emphasize the importance of:
— the prevention of major accidents;
— ensuring the safety and protection of the health of employees and the public;
— protecting the quality of the environment.

The description of the policy in the Major Action Prevention Policy document (so-called PBZO-document) should in any case contain the following:
— a declaration signed by the top management of the organization in which the overall objectives and principles of the policy to prevent major accidents are set out, showing the commitment with regard to implementation of the policy and clarifying who is responsible for the prevention policy;
— a general description of the nature and extent of the risks of major accidents;
— the criteria or principles applied in assessing the risks of major accidents, where a distinction shall be made between internal OH&S risks and external risks for man and environment. These criteria or principles should take into account both the probability and the consequences of major accidents. Consequences may relate to damage to installations, injuries, deaths, social disruption, environmental damage. Probabilities may be indicated in general terms a few times per year, once per year. One possible way of relating probabilities and consequences with one another is the so-called risk matrix where for each probability/consequence combination it can be indicated how the organization evaluates the relevant risk (see the example below);
— a description of the way in which the policy is implemented within the organization:
    - what the underlying principles of the safety management system are, such that an idea is given of the relationship between the policy and the safety management system;

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- the principles and criteria for selecting preventive, protective and repressive measures, such that an idea is given of the relationship between the measures taken and the risks of major accidents.

Example – Criteria for the assessment of risks of major accidents using a risk matrix

A risk matrix consists of two axes. Along one axis the probabilities of major accidents are shown and along the other axis the severity of the consequences. In both cases the organization shall choose a (qualitative) classification. A sub-classification into 5 levels is often chosen. Tables A.1 and A.2 give examples of the classification of probabilities and consequences.

Table A.1 Possible classifications for the probability of a (major) accident

Example 1	Example 2	
- very low (very improbable) - low (not probable but possible) - average (rarely occurs) - high (occurs from time to time) - very high (occurs with some regularity)	- never heard of in our industry sector - heard of in our industry sector - has occurred in our company - occurs a few times per year in our company - occurs a few times per year on our site	

Table A.2 Possible classifications for the severity of the consequences of a (major) accident

Example 1 (combined 'man and 'environment')	Example 2 ('people')	Example 3
- negligible - slight - considerable - great - very great	- no injury or damage to health - slight injury or damage to health - severe injury - deadly injury	- slight - considerable - serious - very serious - catastrophic

These classifications provide a matrix with a number of cells in which each cell contains a combination of a certain probability of a major accident and the severity of its consequences. In the matrix the company can indicate for each cell how the risk in this cell is evaluated and what consequences are associated with it. Possible classifications are indicated in table A.3

Table A.3 Possible classification of risks of (major) accidents

Example 1	Example 2	Example 3
- very high risk; risk-reducing action is necessary - high risk; ALARA (As Low As Reasonably Achievable) should be applied - tolerable risk; no further	- high risk; unacceptable; alternatives should be examined - risk; implement risk reducing action and then apply ALARP (As Low As Reasonably Practicable) - tolerable risk; continually	- intolerable; direct action required - serious risk; urgent action desired (< 3 months) - moderate risk; plan

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action necessary	improve performance	action (within 1 year) - limited risk; action depending on costs/benefits - tolerable risk; no adjustment required

The result is for example a matrix as given in Table A.4 or Table A.5

Table A.4 Example of a risk matrix

	Very improbable	Not probable	Rarely occurring	From time to time	Fairly regularly
No effect					
Negligible effect					
Slight effect					
Considerable effect					
Great effect					
Very great effect					

Table A.5 Example of a risk matrix

	Very improbable	Not probable	Rarely occurring	From time to time	Fairly regularly
No effect					
Negligible effect					
Slight effect					
Considerable effect					
Great effect					
Very great effect					

NOTE to Table A.4 and A.5
grey: Tolerable risk
white: High risk (application of ALARA)
black: Very high (unacceptable) risk, risk-reducing action is necessary

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A.3 Planning

A.3.1 Identification of hazards and risk assessment

The figures below indicate which aspects of managing risks of major accidents are covered by the various parts of the NTA.

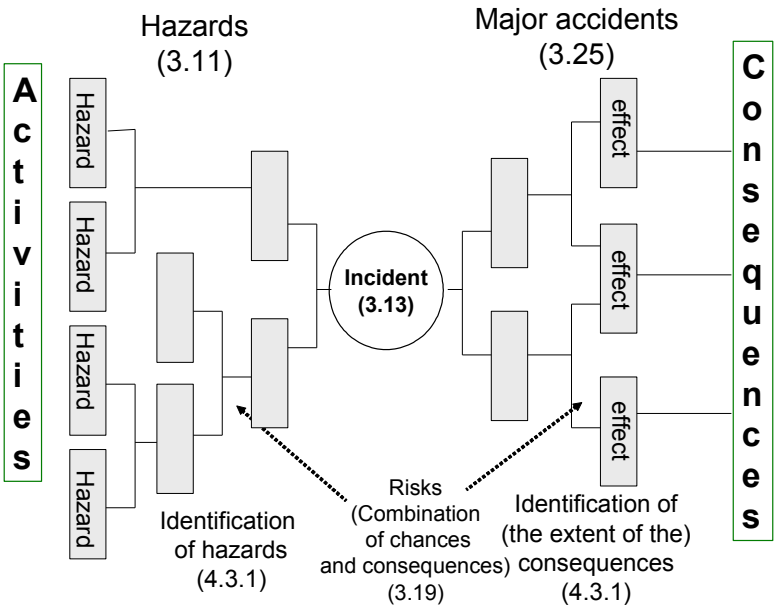

Figure A.1 - Bow-tie model for approaching risk

Figure A.1 shows how certain terms relating to major accident risks are related to one another. The activities (production, storage, transport) of an organization are associated with all sorts of hazards that may lead to an incident (loss of containment) with the consequence of the release of hazardous substances) which may possibly have serious consequences for man and the environment. When assessing risks the combination of the probability of an incident occurring as a result of hazards becoming manifest, and the extent of the possible consequences of this are looked at.

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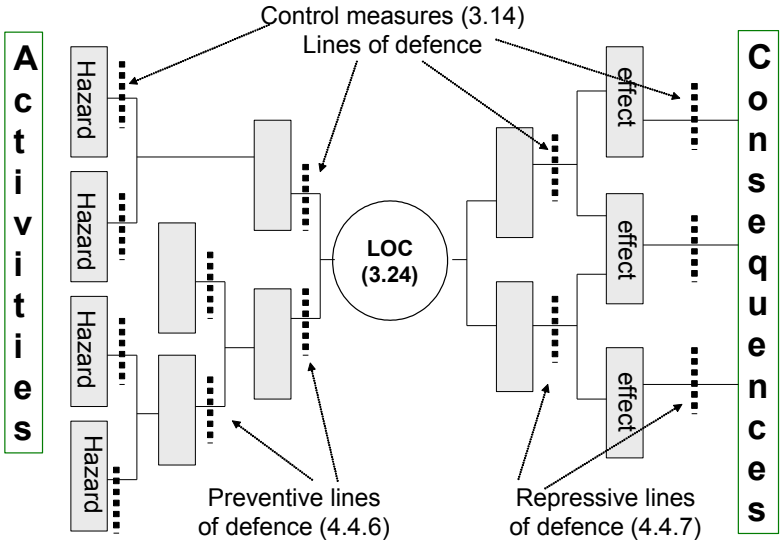

Figure A.2 – Bow-tie model for risk management

Figure A.2 shows where the different points of application are for managing and minimizing risks. An organization will take technical and organisational measures (lines of defence) to prevent incidents (potential or actual loss of containment), the so-called preventive measures. In this NTA, that comes under the 'operational control' (4.4.6). An organization will also take technical and organisational measures as far as possible to mitigate the consequences of an incident, in which dangerous substances are actually released (an emergency situation), so-called repressive measures. In this NTA, that comes under 'major accident preparedness and response' (4.4.7).
In the risk assessment in 4.3.1 when determining the probability and consequences of major accidents, the present preventive and repressive technical control measures (lines of defence)are taken into account. Based on the results of this assessment an organization will establish which risks can or must be further reduced. For this the organization establishes objectives (4.3.3) and a programme to develop and introduce either additional preventive or additional repressive control measures (lines of defence). The organisational measures that are necessary to carry out the operations such that processes are controlled and implemented technical Control measures function effectively are part of 4.4.6. The emergency plans in accordance with 4.4.7 are included in the organisational measure for optimal operation of the repressive (mitigating) technical control measures.

The procedures for identifying hazards and assessing risks should include the following:
— methods for the systematic identification of scenarios that may result in major accidents (for this the accident history should be used (case history)) ;
— criteria for the application of these methods (safety studies such as HAZOP, fault tree analysis, FMEA, process safety analysis, QRA) for the different phases in the life cycle of installations (design/change, construction, normal operation (including commissioning and shutdown) and maintenance (during normal operation and during so-called 'stops');
— the criteria for applying these methods (when, for what situations);
— identification of the hazards that may lead to so-called Loss of Containment (LOC) and under what conditions these hazards manifest themselves; a check shall be made here as to whether the following

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direct causes possibly play a part in the unintentional release of hazardous substances: corrosion, erosion, impact, external load, vibration, high/low pressure, high/low temperature and human error
— methods to determine the probability of a certain LOC and determination of its consequences
— the criteria or principles (that are also included in the prevention policy) to assess the risks (based on probabilities and effects) on the basis of which priorities can be set and preventive, protective and repressive (mitigating) measures can be selected;
— documentation of the results of the safety studies used;
— the organisational requirements laid down for carrying out safety studies (team composition; expertise);
— the evaluation of the effectiveness of preventive, protective and repressive (mitigating) control measures (lines of defence);
— the way in which future actions on studies and recommendations should be given.
— the way in which results of analyses of near-misses lead to and are taken into account in revised identification of hazards and assessment of risks.

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