Netherlands Commission for
Environmental Assessment

HAZARDOUS SUBSTANCES RISK ASSESSMENT IN EIA

In 2020, a new requirement was introduced in the Jordan EIA regulation. A risk assessment can now be necessary as part of the EIA for projects that involve hazardous substances. This handout gives some pointers for such an assessment. It is based on a series of webinars that was jointly organized by the Jordan Ministry for Environment, and the Netherlands Commission for Environmental Assessment.

What is risk assessment?

Risk assessment is required according to both international agreements (such as the UNECE Industrial Accident Convention and the European Union's Seveso III Directive) as well as by financing institutions such as the World Bank. A risk assessment helps to answer key questions such as:

- What can go wrong and why? (scenarios)
- How likely is the occurrence of certain incidents? (probability)
- What are the effects and how serious are they? (impact)
- What can we do about it? (mitigation)

In this hand-out we focus on the risks associated with projects that use, store or handle hazardous materials. We look specifically at the management of major hazards (industrial accidents) which are usually associated with larger quantities of hazardous material.

AT THE START OF THE EIA PROCESS:

- ☐ Check if there is sufficient information on the types and amounts of hazardous substances involved in the project.
- ☐ Ensure that it is clear if a risk assessment is needed.
- ☐ Determine what the objectives of the risk assessment is. Will it inform location or design choices? Should it deliver a Safety Management Plan for the site? Will it provide information to meet other hazardous substance requirements? Etc.
- ☐ Determine what benchmarks, guidance or sectoral good practice applies to this risk assessment.

Definition of Risk

Risk = Hazard x Exposure (probability of damage due to a hazard)

Hazard = potential damage (related to the hazardous characteristics of a substance)

Exposure = probability event will occur

Seveso III Directive

The Seveso directive is the EU framework for the control of industrial risks. The directive provides a methodology to assess risks based on hazardous properties of a substance and the quantity present on a location.

Example criteria for deciding if a risk assessment is needed:

- Project involves substances that are categorized as 'hazardous'
- Maximum quantities of the substances present are above a threshold value.

- ☐ Plan how to integrate the risk assessment into the EIA process as much as possible. Avoid a stand alone risk assessment.
- ☐ Ensure adequate risk assessment expertise in the EIA team.

SELECTION CRITERIA FOR THE RISK ASSESSMENT EXPERTS:

- ☐ Experience in similar projects and similar industrial sectors or similar infrastructure development.
- ☐ Track record in EIAs.
- ☐ Adequate seniority in the team, at least 5 years experience.
- ☐ Familiarity with applicable rules and regulations.
- ☐ Knowledge of relevant risk models and software, if needed.

Important outputs of the risk assessment

The risk assessment may be reported in separate documents, or as part of the EIA report. The following issues need to be reported in sufficient detail:

IDENTIFICATION AND ANALYSIS OF RISKS

- ☐ Details of the project including (if applicable) the different technical installations.
- ☐ Details of the immediate surroundings of the project (spatial planning) including nearby industrial activities and residential areas.
- ☐ Details on the substances stored and processed, including the quantities and hazardous characteristics.
- ☐ Details of the relevant requirements and standards that apply.
- ☐ Identification of risks (can be done in terms of environmental, physical or toxic risks).
- ☐ Ranking of risks (can be done in terms of probability of occurrence and severity of impact).

MITIGATION AND MANAGING RISKS

- ☐ Description of mitigating measures that are proposed/required to bring risk within acceptable levels and in compliance with applicable standards.
- ☐ Technical safety arrangements e.g. alarm management, preventive maintenance, operational controls.
- ☐ Safety management arrangements, including appropriate organization staffing (including training), operational controls and Management of Change arrangements.
- ☐ Emergency planning (firefighting equipment, trained staff for use gasmasks, etc.).
- ☐ Arrangements for performance monitoring and auditing.
- ☐ Identification of any residual risk that cannot be mitigated, or any compliance gaps.

Risk Assessment Methodologies

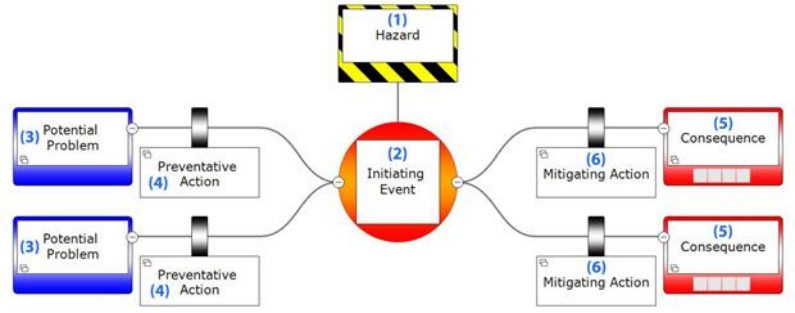
There are different risk assessment methodology. Which type of risk assessment is most suitable will depend on country requirements and on the type of project and the nature of the risks.

Risk assessment can get quite technical, and will often require specialist expertise.

One specific type of risk assessment is QRA (quantitative risk assessment). QRA is based on detailed computer calculations of likelihood using statistical failure frequencies. It requires specialized resources and expertise. Sector specific proprietary software exists, for example to undertake QRAs of oil and gas pipelines.

Bow tie model

Consider the "bow-tie" model for mitigation measures: a risk assessment needs to address both the ways in which hazardous events can be avoided, and ways in which the impacts can be managed when an event does take place. Ineffective *preventive controls* will result in the event. Insufficient *responsive control* will have consequences for people, environment and assets.



Source image: http://umich.edu/~safeche/bowtie.html

ALWAYS CHECK THAT THE RISKS ASSESSMENT:

- ☐ Is transparent and clear.
- ☐ Has been addressed in the stakeholder engagement that is part of the EIA process. Has the risk assessment information been shared, and does it address the concerns that stakeholders have?
- ☐ Has influenced early design and siting decisions within the project. Have opportunities been taken to avoid or minimize the risk? For example by siting a facility further away from vulnerable locations or substituting hazardous material for non-hazardous material.
- ☐ Does not just describe the risks, but also delivers a convincing approach for managing the risks. This could be part of the Environmental and Social Management Plan, or a in the form of a separate Safety Management System, Emergency Plan, etc.
- ☐ Considers how hazards may change over time, for example if maintenance is lacking, if equipment ages, or if the surroundings of the project change.

DECISION-MAKING ON THE RISK ASSESSMENT

- ☐ Consider the risks associated with the hazardous substances involved under regular operating conditions.
- ☐ Consider the cumulative risk of having relatively small amounts of different hazardous substances on-site (e.g. in warehouses or laboratories).
- ☐ Consider amounts temporarily present in e.g. in parked trucks.
- ☐ Consider how hazards may change over time, for example if maintenance is lacking, if equipment ages, or if the surroundings of the project change.
- ☐ Ensure that any measure for mitigation and management are addressed in approval conditions so that the compliance can be verified and the proponent can be held accountable.
- ☐ Specify the maximum amounts of the hazardous substances that may be on-site in the approval conditions.

What risks are acceptable?

This will depend on the context. Sectoral standards can be helpful here, or any relevant government policies on acceptable risks, such as spatial plans for the area or hazardous substance requirements. Sometimes a company policy will also include certain limitation on acceptable risks. Stakeholder concerns can also be a factor in deciding acceptability of risks.

In risk assessments that include a QRA, the risk will be shown in 10^{-6} risk contours. A policy reference is then needed to determine which activities or structures are permitted inside the risk contours.

Zero risk does not really exist. Some residual risk will always remain.

What information is addressed in a risk assessment?

Key information that is needed for a risk assessment

- Properties and quantities of hazardous substances in the project, consider:
  - raw materials and products (also throughput and stored quantities);
  - intermediates and by-products that will be handled;
  - hazardous waste and emissions, including waste water;
  - provisions for off-spec materials (these are batches of material that are not according to requirement, and need to be disposed of);
  - release of hazardous substances in OTNOC (other than normal operational conditions) such as start-up and shut-down, power-outages, etc.
- Location details such as the facility lay-out.
- Details on immediate surroundings of the project to identify areas sensitive to risk, consider:
  - the location and distribution of the population in the vicinity;
  - the mobility and susceptibility of that population;
  - future plans related to industrial developments or residential expansions, for example;

Analysis of this information

- Identification of hazards and risks and ranking of risks in a systematic way (according to the Seveso approach, for example).
- Selection of hazards and risks subject to more detailed risk analysis.
- Identification of the need for specific requirements (if following the Seveso approach, these would be: lower tier/upper tier; MAPP, SMS, Safety Report; QRA).
- Identification of relevant scenarios, in the basis of representative samples of industrial accidents.
- Analysis of each scenario, including:
  - the severity of harm potentially affecting people and environment;
  - the distance at which the harmful effects on people and environment may occur.
- Identification and description of the mitigating measures that are proposed.
- Review of any remaining risks, that cannot be mitigated.

Sources consulted:

- UNECE, 2016, Guidance on Hazard Classification
- IFC, 2007, EHS guideline, Hazardous Materials Management
- World Bank Environmental and Social Framework
- Presentations in the webinar by Dick Jansen
- Presentation in the webinar by Alshahar Engineering

Further reading

- https://unece.org/fileadmin/DAM/env/documents/2013/TEIA/MAHB_nov_2013/Session_7-_Risk_Assessment.pdf
  https://www.epa.gov/risk/about-risk-assessment#whatisrisk
- https://safeti.com/
- https://unece.org/about-ghs
- https://www.nfpa.org/Codes-and-Standards/All-Codes-and-Standards/List-of-Codes-and-Standards
- https://www.osha.gov/chemical-hazards/hazards

Handout accompanying a webinar series organized by the Jordan Ministry for Environment and the NCEA, February 2021

For more information see: https://www.eia.nl/en/projects/7285-02