

Shell Chemicals Prioritization, Risk Characterization and Management Process Summary

INTRODUCTION

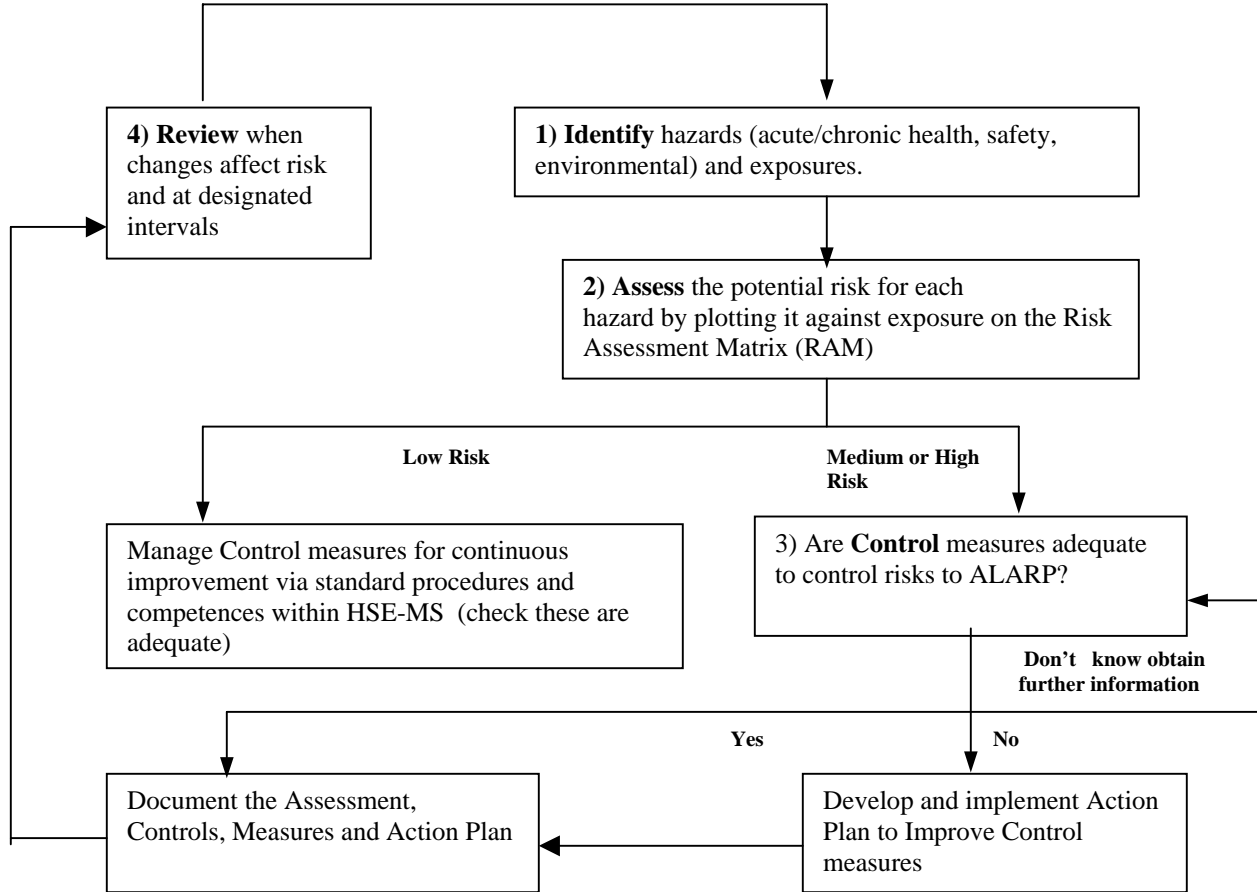
Shell chemicals companies have a strong commitment to Product Stewardship, a program to ensure that all health, safety and environmental aspects of products are managed responsibly and ethically. Shell chemicals companies assess the products they produce to determine their potential harmful effects to persons, property and the environment based on their intended uses and reasonably foreseeable misuses. Chemicals and Products are prioritized based on a Hazard Banding Process. This tool is used to differentiate and rank chemical products based on hazards. Each product is rated on physical, health effects, environmental toxicity and security issues, and then classified into an overall hazard band (very high, high, medium, or low) according to the level of danger presented. Uses and potential exposures are then reviewed and the risk characterized for each. Management practices are implemented to reduce those risks to levels that are as low as reasonably practicable (ALARP), recognizing that no chemical product can be made totally risk free.

Shell chemicals companies follow a management system approach as provided in the Royal Dutch/Shell Group Health, Safety and Environment – Management System (HSE-MS) guidance for risk characterization and management.

The following steps and flow chart (Figure 1) demonstrate the process used to characterize and manage risk:

- 1) **Identify** – information is gathered and documented on products and components, their hazards and exposures.
- 2) **Assess** – risks are evaluated, documented and prioritized based on the identified hazards and exposures.
- 3) **Control** – management practices are implemented and documented to reduce exposures to as low as reasonably practicable.
- 4) **Review** – at designated intervals or when new information becomes available the risk assessment and continued effectiveness of the control measures are reviewed.

Figure 1. Risk Assessment Flow Chart



PROCESS STEPS

1) Identify

Identify Product

- 1) Business identifiers such as products name and codes.
- 2) Composition including chemical identity (name, CAS number, etc.) of components and the relative amounts of each.
- 3) Physical/chemical properties such as:
 - a. Physical state,
 - b. Appearance and odor,
 - c. Relative density,
 - d. Vapor density,
 - e. Flammability (flash point, flammable limits in air),
 - f. Boiling point or distillation range,
 - g. Melting/Freezing point,
 - h. Water solubility,
 - i. Octanol/water partition coefficient,

- j. Other specific properties relevant to a given material (pH, viscosity, electrical conductivity, etc.).

Identify Product Safety Hazards

Safety hazards are determined by evaluating the physical/chemical properties of the product and other available information [published literature, company literature, competent authority classifications/standards (EU Classification and Labeling Directive, OSHA Standards, etc.)]. Safety hazards include:

- flammability,
- reactivity,
- corrosivity to material,
- explosivity,
- oxidizing potential.
- handled as gases.

Identify Product Health Hazards

Health hazards are determined by gathering and reviewing available data on health related effects. Sources of information include published literature, competent authority evaluations (EPA IRIS, EU Risk Assessments), and classifications/standards, and company sponsored studies (HPV, VCCEP, etc.). Health hazards include:

- carcinogenicity,
- mutagenicity,
- effects on reproduction/development,
- corrosivity to tissue,
- acute toxicity,
- irritancy (skin and eye),
- sensitizing potential,
- target organ effects (nervous system, liver, kidney, etc.).

Identify Product Environmental Hazards

Environmental hazards are determined by gathering and reviewing available data on environmental effects. Sources of information include published literature, competent authority evaluations and classifications/standards, and company sponsored studies. Environmental hazards include:

- toxicity to non-human organisms,
- biodegradation,
- abiotic degradation (photodegradation, hydrolysis, etc.)
- bioaccumulation.

Identify Product Exposure Potentials

Potential exposures are evaluated by considering:
Prioritization and Risk Characterization Summary, 2008.

- intended product uses and foreseen misuses,
- populations potentially exposed (workers, community, consumers),
- potential routes of exposure (ingestion, skin contact, inhalation),
- magnitude, frequency and duration of exposure,
- likelihood of an increase in exposure due to changes in physical form during use,
- applicable exposure limits,
- releases to the environment,
- modes of transport.

Guidance documents and tools provided by the Alliance for Chemical Awareness (<http://chemicalawareness.org>) are utilized in assessing exposure potential where applicable.

2) Assess

Risk is a function of Hazard and Exposure ($\text{Risk} = \text{Hazard} \times \text{Exposure}$). Shell chemicals companies use a Risk Assessment Matrix (RAM) approach to characterize and prioritize risks. Using the information obtained, the risk is evaluated by making a judgment on:

- the severity of the possible effects and assigning a hazard rating,
- the potential for exposure and assigning an exposure rating.

Hazard ratings are then plotted against exposure ratings in a matrix format. Product risk assessments that are high hazard/high exposure are considered the highest priority and control measures must be investigated and implemented.

3) Control

Once the RAM analysis is complete, systematic reviews of all existing control measures are made to identify necessary additional controls to reduce exposures to ALARP. Possible control measures include:

- engineering measures (i.e., implementation of vapor recovery systems, specialized storage and transport containers),
- procedural measures (i.e., modifications of work practices, customer reviews, restricted uses, loading/unloading procedures, limited modes of transport),
- personal protective equipment (i.e., recommendations for respirators, gloves, goggles).
- substitution of the hazard (i.e., develop a suitable less hazardous substitute),
- elimination of the hazard (i.e., remove from market).

Action plans are developed, implemented and documented.

4) Review

At designated **Review** intervals or when new information becomes available, the process of **Identify, Assess, and Control** is repeated. Additional control measures are evaluated and implemented as necessary.

All aspects of the process are documented.