

## 14.2 CONTACT WITH HAZARDOUS SUBSTANCE WITHOUT CONTAINMENT FAILURE

171 REPORTABLE OCCUPATIONAL ACCIDENTS WITH 226 VICTIMS IN THE NETHERLANDS FROM 1998-2009 INCLUSIVE (12 YEAR PERIOD)

*Table 1 Accident consequences*

HAZARD	AVERAGE NUMBER OF VICTIMS PER YEAR				RATIOS <sup>1</sup>		
	Deaths	Permanent injuries	Recoverable injuries	Unknown injury type	Deaths	Permanent injuries	Recoverable injuries
14.2 Contact with hazardous substance without containment failure	<1	4	12.5	2.5	1	17	57

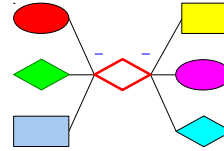
*Table 2 Activity of person near or related to hazardous substance<sup>2</sup>*

Activity	Accidents 1998-2009	Accidents per year	Victims per year	% Accidents
Application of (cleaning) agents	47	4	4	27%
Tasks on/ nearby open/ closed containment(s)	38	3	5	22%
Other activity nearby hazardous substance	31	3	3	18%
Spill removal/ treatment	20	2	3	12%
Handling of (potentially) contaminated objects	19	2	2	11%
Passive exposure	9	1	1	5%
Unknown activity <sup>3</sup>	3	<1	<1	2%

<sup>1</sup> Calculated with unknowns reallocated proportionally to permanent and recoverable injuries

<sup>2</sup> Due to space restrictions activities with smaller values not reported here

<sup>3</sup> Unknown means that the accident report did not give enough data to categorise the accident

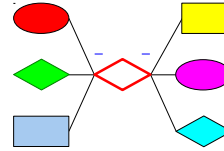


**Table 3 Barrier failure modes for contact with a hazardous substance without LOC. Where did it go wrong?<sup>45</sup>**

BARRIER FAILURE MODE	Description	Accidents 1998-2009	Accidents per year	Victims per year	% Accidents
<b>Before contact</b>	<b>Release of, and contact with, hazardous substance</b>				
Personal Protective Equipment failure	If PPE would have mitigated the consequences of the contact.	65	5	6	38%
Hazardous substance detection failure	The hazardous substance is not detected by person/automatic detection	46	4	6	27%
Cleaning failure (not product free)	Equipment/ work area not or inadequately cleaned after use/ spillage	32	3	3	19%
Wrong type of substance for the job/ process	Incompatible, unsuitable and/or substandard substance.	26	2	3	15%
Physical barrier failure	Access to hazardous substance not prevented by screen, railing, cover, lid, etc.	25	2	2	15%
Ventilation failure	Hazardous fume present in work area due to absent/ ineffective natural or mechanical ventilation or due to inlet/ ingress of polluted air	25	2	3	15%
Personal exposure limitation failure (distance/ duration)	i.e. person detects warning signals or other indications, but does not/ incorrectly responds to them e.g. not immediately stopping work and leaving the area	23	2	2	13%
Separation of incompatible substances failure	Not keeping apart incompatible substances or using the wrong substances or in the wrong order or amount, leading to unintended chemical reaction during activity.	17	1	4	10%
Labelling/ indication failure	No, unclear or wrong labelling or indication of hazardous substance.	17	1	2	10%
Access prevention failure	No/ ineffective prevention of access/ entry to hazardous area	16	1	1	9%
Protective measure at source failure	i.e. person detects warning signals or other indications, but does not/ incorrectly close off source e.g. no closing-off of valve, no removal of reactant, etc.	12	1	2	7%
Storage failure of hazardous substances	This refers to substandard storage conditions (e.g. if water gets into contact with the stored substances and reacts)	10	1	3	6%
Lock(out) failure	Includes equipment that should have been disabled from operation, i.e. locked-out, and put into a safe state	3	<1	<1	2%
Protective measure at transfer path failure	i.e. person detects warning signals or other indications, but does not/ incorrectly respond to them e.g. not initiating a water screen, not closing a gas-tight door, etc.	2	<1	<1	1%
<b>After contact</b>					
Late, no or inadequate provision of first aid	i.e. Delayed or no response of first-aider OR Wrong diagnosis is made OR Ambulance does not arrive or is delayed	70	6	7	41%
Access prevention failure	No/ ineffective prevention of access/ entry to hazardous area	5	<1	2	3%
No/ Ineffective evacuation	Failure to evacuate in time from hazardous area to prevent contact with hazardous substance	3	<1	<1	2%
No/ Ineffective fire-fighting (source/ transmission)	i.e. limitation of release and/or transmission route	1	<1	<1	1%

<sup>4</sup> Note: there can be more than one barrier failure per accident

<sup>5</sup> Excluding unknown barrier failure modes



**Table 4 The most common underlying causes: barrier tasks and management delivery system failures. How and why did it go wrong?<sup>6</sup>**

<b>UNDERLYING FAILURES<sup>7</sup></b>	<b>Description</b>	<b>Accidents 1998-2009</b>	<b>Accidents per year</b>	<b>Victims per year</b>	<b>% Accidents</b>
<b>Task failures</b>	<b>The failure of the tasks which are required for the adequate functioning of the safety barriers.</b>				
Use of: Rapid and adequate provision of first aid	Rapid and adequate provision of first aid is provided, but the way in which the provided barrier is used or operated is incorrect, is only partially used, or is not used at all.	37	3	4	22%
Use of: Detection of hazardous substance	Detection of hazardous substance is provided, but the way in which the provided barrier is used or operated is incorrect, is only partially used, or is not used at all.	33	3	4	19%
Provide: Rapid and adequate provision of first aid	Rapid and adequate provision of first aid does not exist, has not been well designed, or it is not provided and / or sufficiently/easily available when required.	30	3	3	18%
Provide: Adequate personal protective equipment	Adequate personal protective equipment does not exist, has not been well designed, or it is not provided and / or sufficiently/easily available when required.	30	3	3	18%
<b>Management delivery system failures</b>	<b>The failure of the necessary resources which should have been delivered by the management system for the execution of the tasks.</b>				
Competence for: Rapid and adequate provision of first aid	The management system must provide for the knowledge, skills and abilities of the workers who are selected and trained for the carrying out of the tasks for achieving: Rapid and adequate provision of first aid	32	3	4	19%
Motivation/Awareness for: Rapid and adequate provision of first aid	The management system must provide for the motivation, alertness and risk awareness of workers for carrying out their tasks for achieving: Rapid and adequate provision of first aid	30	3	4	18%
Plans and procedures for: Adequate personal protective equipment	The management system must provide for specific performance criteria which specify in detail, usually in written form, a formalised 'normative' behaviour or method with which workers have to carry out their tasks for achieving: Adequate personal protective equipment	23	2	3	13%
Competence for: Adequate personal protective equipment	The management system must provide for the knowledge, skills and abilities of the workers who are selected and trained for the carrying out of the tasks for achieving: Adequate personal protective equipment	23	2	3	13%

<sup>6</sup> Note: there can be more than one underlying cause per accident

<sup>7</sup> Excluding unknowns