

# International Hazard Datasheets on Occupation



## Chemical engineer

### Who is a chemical engineer?

A worker who designs equipment and develops processes for manufacturing chemicals and related products utilizing the principles and technology of chemistry, physics, mathematics, engineering and related physical and natural sciences. Conducts research to develop new and improved chemical manufacturing processes.

### What is dangerous about this job?

- Risk of explosion from uncontrolled chemical reactions and /or overpressure in processing installations.
- Exposure to new chemicals with not yet specified toxicity and to carcinogenic, mutagenic, and teratogenic substances.
- Exposure to chemicals which may cause severe allergic reactions.
- Exposure to ionizing radiation caused by radioactive materials, used in various processes.
- Allergic reactions produced by exposure to various chemicals, giving rise to respiratory tract, eye and skin irritations.
- Stress and anxiety as a result of experimental work which can give rise to unexpected effects.

### Hazards related to this job

Specific preventive measures can be seen by clicking on the respective  in the third column of the table.

<b>Accident hazards</b>  	<ul style="list-style-type: none"> <li>• Falls from height during inspection of various industrial installations</li> </ul>	
	<ul style="list-style-type: none"> <li>• Slips, trips and falls on the level particularly on floors made wet and slippery as a result of leak or spillage of chemicals</li> </ul>	
	<ul style="list-style-type: none"> <li>• Injuries caused by striking against stationary industrial installations or being struck by falling objects, particularly in overcrowded conditions</li> </ul>	
	<ul style="list-style-type: none"> <li>• Risk of explosion from uncontrolled chemical reactions and /or overpressure in processing installations</li> </ul>	
	<ul style="list-style-type: none"> <li>• Cuts and pricks caused by sharp objects, formed during explosion of pressure devices, glass vessels, etc.</li> </ul>	
	<ul style="list-style-type: none"> <li>• Exposure to hazardous substances due to a sudden release of toxic materials from production processes, due to work-related accidents, or as a result of human error</li> </ul>	
	<ul style="list-style-type: none"> <li>• Burns caused by contact with hot surfaces, hot water and sudden escape of steam</li> </ul>	
	<ul style="list-style-type: none"> <li>• Electric shock caused by contact with "live" wires or defective electrical equipment</li> </ul>	

		<ul style="list-style-type: none"> <li>Injures caused by ionizing radiation during a fire in installations containing radiation sources</li> </ul>	4
<b>Physical hazards</b>  		<ul style="list-style-type: none"> <li>Exposure to high temperatures and thermal stress from melting, drying, burning and similar processes</li> </ul>	
		<ul style="list-style-type: none"> <li>Exposure to high levels of noise especially in grinding, milling, crushing, mixing and similar processes</li> </ul>	5
		<ul style="list-style-type: none"> <li>Exposure to ionizing radiation caused by radioactive materials, used in various processes</li> </ul>	4
<b>Chemical hazards</b>  		<ul style="list-style-type: none"> <li>Exposure to carcinogenic, mutagenic and teratogenic substances</li> </ul>	3
		<ul style="list-style-type: none"> <li>Exposure to new chemicals with not yet specified toxicity</li> </ul>	3
		<ul style="list-style-type: none"> <li>Exposure to chemicals that are stepped into or formed during processes, due to leakage in installations or in piping, or during sampling</li> </ul>	3
		<ul style="list-style-type: none"> <li>Exposure to chemicals which may cause severe allergies</li> </ul>	3
<b>Biological hazards</b>  		<ul style="list-style-type: none"> <li>Exposure to biological agents or dust, which may contain enzymes, in drug manufacturing. This may cause hypersensitivity and allergic reactions in susceptible individuals</li> </ul>	6
		<ul style="list-style-type: none"> <li>Exposure to various plants, during processing, may cause serious allergic reactions, which are expressed in respiratory tract irritation, eye and skin irritation</li> </ul>	
<b>Ergonomic, psychosocial and organizational factors</b>  		<ul style="list-style-type: none"> <li>Musculoskeletal disorders affecting, in particular, the back, the neck and the shoulders as a result of prolonged separate or combined action of such factors as: incorrect seating /work posture, ergonomically inadequate chair etc.</li> </ul>	7
		<ul style="list-style-type: none"> <li>Psychosocial problems due to increased workload, expectations of improving the output and lack of privacy due to the improved possibility of finding or reaching a worker at all times by his superiors (by means of mobile telephone or beeper) and work outside normal working hours</li> </ul>	
		<ul style="list-style-type: none"> <li>Stress and anxiety as a result of experimental work which can give rise to unexpected effects</li> </ul>	

## Preventive measures

**1** Inspect ladder before climbing; never climb a shaky ladder or a ladder with broken rungs

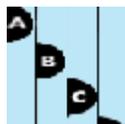
**2** Wear safety shoes with non-skid soles; where needed, floor should be made ragged in problematic zones

- 3 Apply chemical safety rules when handling or working with hazardous chemicals; read MSDSs and consult a safety supervisor regarding specific chemicals
- 4 Wear a radiation dosimeter (badge or any other type) when exposed to radiation; comply with all safety instructions to reduce exposure to a minimum
- 5 Learn and use safe lifting and moving techniques for heavy or awkward loads; use mechanical aids for the lifting of heavy loads.
- 6 Follow appropriate safety procedures while working with biological materials; in special circumstances, consult a safety supervisor
- 7 Prepare computer workstation according to ergonomic requirements and with appropriate consideration of human factor (worker's height and personal characteristics); control and adjust the equipment and the workstation: the height and the angle of the screen; the height of the seat and the back of the chair

## Specialized information

**Synonyms** Industrial chemist

### Definitions and/or description



Designs equipment and develops processes for manufacturing chemicals and related products utilizing the principles and technology of chemistry, physics, mathematics, engineering, and related physical and natural sciences: Conducts research to develop new and improved chemical manufacturing processes. Designs, plans layout, and oversees workers engaged in constructing, controlling, and improving equipment to carry out chemical processes on commercial scale. Analyzes operating procedures and equipment and machinery functions to reduce processing time and cost. Designs equipment to control movement, storage, and packaging of solids, liquids, and gases. Designs and plans measurement and control systems for chemical plants based on data collected in laboratory experiments and pilot plant operations. Determines most effective arrangement of unit operations such as mixing, grinding, crushing, heat transfer, size reduction, hydrogenation, distillation, purification, oxidation, polymerization, evaporation, and fermentation, exercising judgment to compromise between process requirements, economic evaluation, operator effectiveness, and physical and health hazards. Directs activities of workers who operate and control such equipment as condensers, absorption and evaporation towers, kilns, pumps, stills, valves, tanks, boilers, compressors, grinders, pipelines, electro-magnets, and centrifuges to effect required chemical or physical change. Performs tests and takes measurements throughout stages of production to determine degree of control over variables such as temperature, density, specific gravity, and pressure. May apply principles of chemical engineering to solve environmental problems. May apply principles of chemical engineering to solve bio-medical problems. May develop electro-chemical processes to generate electric currents, using controlled chemical reactions or to produce chemical changes, using electric currents. May specialize in heat transfer and energy conversion, petrochemicals and fuels, materials handling, pharmaceuticals, foods, forest products, or products such as plastics, detergents, rubber, or synthetic textiles. May be designated according to area of specialization.

### Related and specific occupations

Centrifuge; container; conveyor; tank.

### Tasks

Chemical industry; drug industry; paper plants; cosmetics plant; petrochemical industry; army industry; etc.

### Primary equipment

Boilers; crushers; grinders; measuring-vessels; mills; mixers; mixing and stirring devices; paint-tanks; pH-meter; scales.

used

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**Workplaces  
where the  
occupation  
is common**

Chemical industry; drug industry; paper plants; cosmetics plant; petrochemical industry; army industry; etc.

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**Notes**



1. All production processes of new products must be developed with maximum precision and according to safety guides in order to prevent work-related accidents and exposures to hazardous materials.
  2. All production processes, which may cause explosions or release hazardous materials should be controlled and monitored from a safe distance.
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**References**



1. ILO Encyclopaedia of Occupational Health and Safety, 3rd Ed., Geneva, 1983.
  2. ILO Encyclopaedia of Occupational Health and Safety, 4th Ed., Geneva, 1998.
  3. Kirk-Othmer, Encyclopedia of Chemical Technology, 4th Ed., 1992.
  4. U.S. Department of Labor: Dictionary of Occupational Titles – DOT, 2 Vol., 1991.
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This datasheet was authored by a group of experts headed by prof. Donagi from the Israel Institute for Occupational Safety and Hygiene

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*Updated by VM. Approved by AS. Last update: 06.05.2009.*