

ExxonMobil DESIGN PRACTICES	AIR POLLUTION CONTROL, INDUSTRIAL HYGIENE, AND NOISE CONTROL GUIDELINES FOR INDUSTRIAL HYGIENE	Section XVIII-B	Page 1 of 11
		December, 2001	

Changes shown by ↗

CONTENTS

Section	Page
SCOPE	2
REFERENCES	2
DEFINITIONS	3
INTRODUCTION	5
RISK OF ADVERSE HEALTH EFFECTS	5
SOURCES OF EXPOSURE	6
FUGITIVE EMISSIONS	6
MANUAL OPERATIONS	6
MATERIALS HANDLING	6
MAINTENANCE	7
EXPOSURE CONTROL	7
CONTROL OPTIONS	7
HIERARCHY OF CONTROLS	7
ENGINEERING CONTROLS	7
Substitution	8
Process Changes	8
Emission Control Technology for Health Protection	8
Ventilation	8
Other Engineering Control Methods	8
ADMINISTRATIVE CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT	8
Administrative Controls	8
Personal Protective Equipment	8
PROJECT DEVELOPMENT AND HEALTH REVIEWS	9
PROJECT PHASES	9
Screening Phase	9
Definitive Planning Phase	9
Basic Design Phase	10
Detailed Engineering, Procurement, Construction	10
SCHEDULED REVIEWS	10
Inherent S/H/E Review	10
HAZOP Review	10
Pre-Startup Safety Review	10
TABLES	
Table 1 Industrial Hygiene Related DP Subsections	2
Table 2 Source → Path → Receiver Model	9
Table 3 Overview of Project Development With Health Input	11

Revision Memo

12/01 Minor editorial changes.

Section XVIII-B	Page 2 of 11	AIR POLLUTION CONTROL, INDUSTRIAL HYGIENE, AND NOISE CONTROL	ExxonMobil
December, 2001		GUIDELINES FOR INDUSTRIAL HYGIENE	DESIGN PRACTICES

SCOPE

This section provides an overview of industrial hygiene principles to enable engineers to recognize and reduce personnel health risks through good design. It introduces the other industrial hygiene subsections and covers the definitions and terminology in common usage in toxicology and industrial hygiene. The relationship between the hazard of a substance, workplace exposure, and the risk of adverse effects is introduced. Included is background on toxicology concepts and types of toxic effects, workplace exposure monitoring and occupational exposure limits, and sources of exposure to chemical substances or physical agents in the workplace. Discussion of options for worker exposure control, the source-path-receiver model, the hierarchy of controls, and examples of engineering controls for open and closed systems are also covered. Finally, IH reviews in the project development process are reviewed.

Table 1 lists related DP sections in IH and air pollution control according to topic.

TABLE 1
INDUSTRIAL HYGIENE RELATED DP SUBSECTIONS

DP SECTION	EXPOSURE LIMITS	TOXIC EFFECTS	CONTROL DESCRIPTION	CONTROL SELECTION	IH SYSTEM CONTROL
XVIII-A					
XVIII-A2			X		
XVIII-B					
XVIII-B1	X	X			
XVIII-B2 FUTURE				X	
XVIII-B3 FUTURE					X

REFERENCES

DESIGN PRACTICES

- DP XVIII-A** Guidelines and Considerations for Selection of Air Pollution Control Equipment
- DP XVIII-A2** Control of Hydrocarbons, VOC and Air Toxics Emissions
- DP XVIII-B1** Exposure Limits and Toxics Effects
- DP XVIII-C** Guidelines and Considerations for Noise Control

COMPANY MANUALS, APPLICATION GUIDES AND REPORTS

Exxon Engineering, *Hazop and Review Procedure*, Exxon Research and Engineering Co., November, 1995.

Exxon Engineering, *OIMS Work Processes Manual for Exxon Engineering*, Manual TMEE 060, October, 1994.

Exxon Projects Network, Small Projects Execution Guide, Exxon Research and Engineering Co., Document EE.89E.94, October 1994.

ExxonMobil Biomedical Sciences, Inc., *ExxonMobil Occupational Exposure Limits for Chemical Contaminants*, 2001 (published annually – refer to current version).

OTHER LITERATURE

Bowes, S. M., *Equipment Selection Matrix for Industrial Hygiene Design Review*, Exxon Biomedical Sciences Report MR.19.DQ.93, July 1993.

Chemical Agents TLV Committee, *2001 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*, American Conference of Governmental Industrial Hygienists, Cincinnati, OH, 2001 (published annually – refer to current version).

Chemical Agents TLV Committee, *Documentation of the TLVs and BEIs (7th ed.)*, American Conference of Governmental Industrial Hygienists, Cincinnati, OH, 2001 (updated periodically – refer to current version).

ExxonMobil DESIGN PRACTICES	AIR POLLUTION CONTROL, INDUSTRIAL HYGIENE, AND NOISE CONTROL GUIDELINES FOR INDUSTRIAL HYGIENE	Section	Page
		XVIII-B	3 of 11
		December, 2001	

REFERENCES (Cont)

Clayton, G. D. and F. E. Clayton, Eds., *Patty's Industrial Hygiene and Toxicology: General Principles* (5th ed.), New York: Wiley-Interscience, 2000 (also available online at <http://www3.interscience.wiley.com:8093/>).

Curtis, D. Klaassen (Ed), *Casarett and Doull's Toxicology* (6th ed.), McGraw Hill, New York, NY, 2001.

DiNardi, S. R. (Ed), *The Occupational Environment - Its Evaluation and Control*, AIHA Press, 1998,

French, R. W., Williams, D. D., and Wixom, E. D., *Inherent Safety, Health, and Environmental Reviews*, Presented at the 1995 AIChE Summer National Meeting, April 1995.

Heating, Ventilating and Air-Conditioning Systems - Applications, American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), Inc., Atlanta, GA, 2000.

Industrial Ventilation: A Manual of Recommended Practice (24th ed.), American Conference of Governmental Industrial Hygienists, Cincinnati, OH, 2001 (updated periodically – refer to current version).

Lipton, S., Lynch, J., *Handbook of Health Hazard Control in the Chemical Process Industry*, Wiley-Interscience, New York, 1994.

NIOSH Pocket Guide to Chemical Hazards, U.S. Department of Health and Human Services, June, 1997.

Plog, B. A., Ed., *Fundamentals of Industrial Hygiene* (4th ed.), National Safety Council, Chicago, IL, 1996.

Workplace Environmental Exposure Levels Committee, *Workplace Environmental Exposure Level (WEEL) Guides*, American Industrial Hygiene Association, Akron, OH, 2001 (updated periodically – refer to current version).

USEFUL WEBSITES

- Occupational Safety and Health (OSHA) website: <http://www.osha-slc.gov> - Provides information on current regulations.
- ExxonMobil OEL values: <http://159.70.37.160/EMBSIPProducts/OEL/currentoel.htm>.
- National Institute for Occupational Safety and Health (NIOSH) website: <http://www.cdc.gov/niosh/homepage.html> - Provides information on IDLH, chemical hazards, personal protective equipment, etc.
- American Industrial Hygiene Association (AIHA) website: <http://www.aiha.org> - Premiere industrial hygiene organization.
- American Conference of Governmental Industrial Hygienists (ACGIH) web site: <http://www.acgih.org> - Provides information on the TLVs.

DEFINITIONS

Absorption - The movement of a chemical into the bloodstream after its entrance into the body through the skin, lungs, or gastrointestinal tract.

ACGIH - The American Conference of Governmental Industrial Hygienists. A worldwide organization of industrial hygienists from national and local governments and educational organizations.

Acute Effects - Sharp, having a rapid onset, with severe symptoms and a relatively short course. Refers to the development of symptoms soon after a single exposure to a substance.

Acute Exposures - Toxicological reference to a single or repeated within 24 hours exposure to an agent.

Cancer - A disease characterized by uncontrolled cell growth due to DNA injury caused by genetic or environmental sources.

Chronic Effects - Effects associated with long-term exposures at low-dose levels.

Chronic Exposures - Exposures that occur over long time periods ranging from months to years.

Dermatitis - Local inflammation of the skin.

Distribution - Movement of a substance from the site of entry to other parts of the body.

Dose - A measure of exposure to a chemical or physical expressed as an absorbed quantity of the agent per unit of body weight, unit volume, an organ, a person.

Effect - The response produced due to exposure to a chemical or physical agent.

Elimination - Removal of a chemical from the body by metabolism or excretion.

Epidemiology - The study of the distribution and determinants of disease frequency in human populations.

Excretion - Elimination of toxicants from the body through body secretions, Urine, feces and expired air are the primary routes of excretion.

Exposure - Receiving a dose of a chemical substance or physical agent due to a contact with it.



Section XVIII-B	Page 4 of 11	<i>AIR POLLUTION CONTROL, INDUSTRIAL HYGIENE, AND NOISE CONTROL</i>	ExxonMobil
December, 2001		GUIDELINES FOR INDUSTRIAL HYGIENE	DESIGN PRACTICES

DEFINITIONS (Cont)

ExxonMobil OEL - ExxonMobil Occupational Exposure Limit. ExxonMobil OELs are the Company equivalent of the ACGIH chemical agent Threshold Limit Values (TLVs) and are adopted as needed for substances which do not have TLVs, or where there is a reason to modify the TLV.

Hazard - The inherent property of an agent which, if improperly handled, may result in damage to health or well-being.

Hypersensitivity - A type of adverse response of the immune system to environmental agents resulting in an allergic reaction. Occurs after rechallenge with an antigen (allergen) to which an individual has been sensitized before. Can be immediate (e.g., asthma) or of a delayed type (e.g., contact dermatitis).

IDLH - Immediately Dangerous to Life or Health. Developed by the U.S. National Institute for Occupational Safety and Health (NIOSH). An IDLH exposure condition is a condition that poses a threat of exposure to airborne contaminants that is likely to cause death, immediate or delayed permanent adverse health effects, or prevent escape from such an environment.

Inflammation - Response of the body to infection or irritation caused by hazardous agents, characterized by redness, fever, swelling, and pain.

Industrial Hygiene - The discipline devoted to the anticipation, recognition, evaluation and control of those environmental factors or stresses arising in or from the workplace that may cause sickness, impaired health and well-being, or significant discomfort and inefficiency among workers.

Leukemia - A group of diseases characterized by wide-spread, uncontrolled proliferation of white blood cells, failure of many cells to reach maturity and abnormal accumulation of such cells. In occupational environments, benzene (in reformat, gasoline or crude benzene) and X-ray are two examples of agents that can cause leukemia.

Local Toxic Effect - Toxic effect that occurs at the site of application.

LOEL - Lowest Observed Effect Level. Pertains to substances that exhibit adverse effects in a "threshold" manner. Is not applicable to carcinogens.

NOEL - No Observed Effect Level. The highest dosage that does not produce toxic effects. Pertains to substances that exhibit adverse effects in a "threshold" manner. Is not applicable to carcinogens.

OEL - Occupational Exposure Limit. A generic term which represents the allowable concentration for a specific time of exposure (see TLV, ExxonMobil OEL).

Respiratory - Pertaining to the respiratory tract system.

Response - The reaction of the body to a toxic agent.

Risk - The probability of an adverse effect. A function of the exposure level and potency (health effect per unit exposure or dose) of a toxic agent.

Safety Factor - NOEL in animal experiments is reduced by this factor to account for the uncertainty in both intraspecies and interspecies differences. The result is then treated as an "acceptable" level of exposure in humans. Pertains to substances that exhibit adverse effects in a "threshold" manner. Is not applicable to carcinogens.

Sensitization - The initial exposure of an individual to a specific antigen resulting in subsequent allergic responses. Dermatitis may develop from subsequent exposures to very low, nonirritating concentrations that previously could have been handled without any problem.

Subchronic - Occurring after a limited period of time, generally about one-tenth of the lifetime of the exposed subjects.

Systemic Toxic Effect - Toxic effect that manifests itself on organs or systems that were not the site of application.

Teratogen - An agent or factor that causes teratogenesis.

▶ **Teratogenesis** - Congenital malformation resulted from interference with normal embryonic development by an environmental agent.

TLV - Threshold Limit Values (TLV) represent airborne concentrations of chemical substances or such conditions created by physical agents under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects. Are developed by the American Conference of Governmental Industrial Hygienists (ACGIH).

TLV-C - Threshold Limit Value - Ceiling: the concentration that should not be exceeded during any part of the working exposure.

TLV-STEL - Threshold Limit Value - Short Term Exposure Limit: the concentration to which it is believed workers can be exposed continuously for a short period of time without suffering from (1) irritation, (2) chronic or reversible tissue damage, or (3) narcosis of sufficient degree to increase the likelihood of accidental injury, impair self-rescue, or materially reduce work efficiency, provided that the daily TLV-TWA is not exceeded. A STEL is defined as a 15-min TWA exposure which should not be exceeded at any time during a workday even if the 8-hr TWA is within the TLV-TWA.

TLV-TWA - Threshold Limit Value - Time-Weighted Average: the time-weighted average concentration for a normal 8-hour workday and a 40-hour workweek, to which it is believed nearly all workers may be repeatedly exposed, day after day, without adverse effect.