

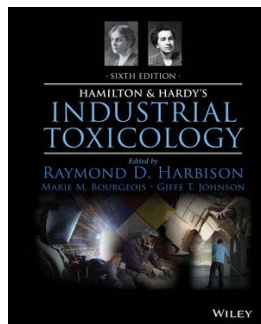


## Book Review

by

**Dr. V.P. Sharma**

*Sr. Principal Scientist & Quality Manager  
CSIR-Indian Institute of Toxicology Research  
Lucknow, India*



Hamilton & Hardy's

## Industrial Toxicology

*Sixth Edition*

**Edited by**

*Raymond D Harbison, Marie Bourgeois and Giffe T Johnson*

**Published by**

*John Wiley & Sons, Inc.; Reference: Review Copy no 8538607*

The book entitled Industrial Toxicology Edited by Raymond D Harbison, Marie Bourgeois and Giffe T Johnson published by John Wiley & Sons has IX Sections ranging from Introduction, Metals & Metalloids, Chemical Compounds, Organic Compounds, Organic High Polymers, Monomers and Polymer Additives, Pesticides, Dusts and Fibers, Physical agents to special topics on carcinogenesis, Mycotoxins, Genotoxicity, Developmental toxicology, Regulatory Toxicology etc. It is a very informative compilation of state of art knowledge in 1339 pages with hard cover and published after thorough investigation in understandable language by innovators, industrialists and academicians. It is a hurricane task as now there are more than 70,000 industrial chemicals with ever increasing numbers and > 1000 exposure limits set by prominent regulatory agencies of the globe. The efforts of contributing organizations' are praiseworthy to make the dream true of the dedicated authors.

**Introduction:** Nowadays, occupational disease is a multi disciplinary process and includes input from professionals in medicine, toxicology, pharmaceuticals and therapeutics beside alternative medicines. The ethics, etiology of disease, accuracy of diagnosis, examinations and survey work involves tests sensitivity, specificity and positive and negative predictive value. Every chemical may produce a spectrum of toxicological effects depending on dose, route of exposure and age, sex etc of the subjects. In order to identify and characterize chemical induced disease or injury one must understand both the chemical reactions and interactions with tissues, cellular, molecular and nano level for better knowledge for proteomics and genomic level. Modern Science is evolving with result of the accumulation of knowledge and experience resulting to paradigm shift in medical thinking and practices. The multiple factor approach to causation has limits, since there may be exceptions to nearly all of the factors even though an exposure disease relationship may exist. Direct extrapolation of animal data to identify human hazards is common with limitations and is done to develop voluntary and enforceable occupational exposure levels. In absence of adequate human data both qualitative and quantitative assumptions must be made to estimate human risk from animal studies.

**Metals & Metalloids:** It is compiled by Richard V Lee and covers characteristic properties of metals and metalloids. The biological processing of metals is another determinant of toxicity and are the result of the interactions between free

metal ions and a susceptible cellular target. The metallic elements have a wide range of toxic potentials. A major contemporary ecological problem is the existence of large residues of potentially toxic metallic waste at mining, refining and manufacturing sites, many of which were in operation before enactment or enforcement of industrial hygiene and environmental codes.

**Chemical Compounds:** It is compiled by Raymond D Harbison and relates to chemicals or groups of chemicals which are essential for human existence. Thousands of chemicals are being used by the consumers for wide spread industrial usage and potential occupational exposure occurs which cannot be practically avoided but minimized or used with adequate preventive measures. Knowledge of toxic levels on the basis of Material Safety Data Sheets [MSDS] becomes useful.

**Organic Compounds:** It is compiled by Raymond D Harbison and covers topics on aliphatic hydrocarbons, alcohols & glycols, aldehydes & ketones, ethers and epoxides, esters, hydrocarbons, amino compound, naphthalene, acrylonitrile with sources, exposure modes, industrial hygiene, medical management and mammalian toxicological aspects of salient compounds viz, CO<sub>2</sub>, CO, phthalates, gasoline, tetrahydrofuran. Once air water and soil are contaminated exposure may occur by way of inhalation, ingestion or dermal contact leading to bioaccumulation of the chemical in organism tissue or environment. Personal

respiratory protection may be needed if concentrations are high or aerosolized. In few cases non occupational exposures may occur from anthropogenic sources mainly through inhalation, oral or dermal contact.

#### **Organic High Polymers, Monomers and Polymer**

**Additives:** It is compiled by Raymond D Harbison and explains about hazards arising following combustion of thermoset and thermoplastics. The predominant concerns are the parent materials, the additives and the related chemicals used to manufacture the product. Plastics and related chemical industries have experienced pronounced growth. Many consumer products and food packaging products contain phthalate esters as plasticizers. They are added to impart flexibility to plastics products. The various aspects on plastics have been compiled by Dr Marek Banasik. The exponential growth and use of plastics had a significant impact on waste disposal practices in areas where these materials are significantly disposed in landfills or Municipal Solid Waste [MSW]. The toxic phenomenon associated with high polymers may be related to their leaching; un reacted or under reacted constituents to varied auxiliary substances or degradation moieties. Effects may vary from systemic to chronic effects on hepatic, nephrology system and/ or carcinogenicity. Polymerization of epoxy resins in some cases has been known to cause adverse health effects. Bisphenol A is a halogenated cyclic hydrocarbon that is also used as a fungicide and a component of epoxy resins. It is a white solid that is insoluble in water and is used in producing polycarbonates which polyesters are formed from the polymerization of BPA through carbonate linkages. Phthalate esters account for approximately 2/3<sup>rd</sup> of the total plasticizer production and include DEHP, DBP, DEP, and DMP. They are not covalently bound in the products in which they are used; human exposure to phthalate esters is widespread. Occurrence of phthalate esters in food is more likely to be the result of contamination by transfer of the phthalate ester from materials in contact with the food during processing, handling or transportation. Migration is more extensive to fatty foods because the octanol – water partition coefficient ( $\log K_{ow}$ ) exceeds. The acid phthalates may cause burns when they come in contact with damp skin. The dusts are irritating to the eyes and upper airway, but there is no systemic toxicity.

Prevention of problems from epoxy resins is based on the meticulous cleanliness of work areas. The preventive strategy is to limit the exposure in women of childbearing age to the phthalate esters showing developmental toxicity especially during the critical window of exposure, gestation weeks 8-14 (Welsh et al 2008; page 817 of book *Industrial Chemistry*). Foaming agents, stabilizers, peroxides, fillers and flame retardants may also contain significant organic high polymeric products.

**Pesticides:** It is compiled by Raymond D Harbison and has highlighted that pesticide use shifted from metallic pesticides

to synthetic chemical formulations with broad spectrum effects. In spite of the long term ban on the production and sales of organochlorine pesticides they are still widely used in developing tropical and sub tropical nations to control malaria through mosquito control. Intentional and accidental ingestions remain the most common routes of over exposure to most pesticides. Organophosphorus and carbamate insecticides have a wide variety of uses including protection of crops, grains, gardens and public health. When organisms are exposed chronically or sub chronically to Organophosphorus compounds, overt signs and symptoms of exposure may be absent. Epidemiology studies and case reports have implicated chlorpyrifos in causing birth defects in humans after the mother had been exposed to high levels of exposure during pregnancy. Dermal contact should also be avoided for pesticides. Exposure in the environment may occur through spray drifts from aerial applications and dermal contacts from reentry to treated fields. Contaminated surface waters are another source of environmental exposures.

**Dusts and Fibers:** The dust may be complex mixtures of organic and inorganic substances and dispersed as airborne particles of varied origins. The respiratory system has potential chances of exposure in different occupations through inhalation of dusts and fibers eg asbestos, glass fibre etc. With the variability in nature and complexity of dusts it is difficult to establish the specific putative agent, mechanism of action and /or chemical pathology in conjunction with respiratory dysfunction and OSHA/ NIOSH guidelines. Clinical and diagnostic aspects are related to wide spectrum of acute or chronic diseases and with quantification of exposure through advanced measurement methods.

**Physical agents:** This is elegantly compiled by Dr Marie Bourgeois and covers radiofrequency, optical radiations, ionising radiations, UV and visible light, infrared, lasers, vibrations, electro magnetic waves and their health effects etc.

**Special topics:** The additional topics covered in this voluminous book are Mycotoxins, carcinogenesis, genotoxicity, reproductive, developmental, regulatory toxicity, ototoxicity, ocular toxicity and also drug abuse. Even the spaceflight operations with diverse workforce and extremely large quantities of hazardous materials usage are important areas of critical discussions and study to safeguard from adverse implications. This field is supported by array of industrial, government, academic, R&D organizations throughout the globe. Importance of validated testing guidelines and legal provisions are also mentioned for the benefit of interested target groups.

**The book is strongly recommended for state of art knowledge in context to CFR, OECD, REACH, EU, EPA, OSHA, USHCS and others for students, researchers and members of allied fields. The information is well presented in an interesting manner.**