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ENVIRONMENTAL REGULATORY CALCULATIONS HANDBOOK

LEO STANDER
LOUIS THEODORE

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ENVIRONMENTAL REGULATORY CALCULATIONS HANDBOOK

To Linda, Lisa, Elaine, Jeremy, Sally, Liam, and Henry.
Thanks for your support and patience.
(LS)

To our grandson, Elias. A true joy!
(LT)

PREFACE

In the past three and one half decades there has been an increased awareness of a wide range of environmental issues covering all sources: air, land, and water. More and more people are becoming aware of these environmental concerns, and it is important that professional people, many of whom do not possess an understanding of environmental regulatory problems, have the proper information available when involved with environmental regulations and calculations, i.e., all professionals should have a basic understanding of the technical and scientific terms related to these issues as well as the regulations involved. In addition to serving the needs of the professionals in industry, this *Handbook* also provides information of value to over 100,000 (in this country alone) regulatory officials.

This book is primarily intended for individuals with environmental regulatory responsibilities and concerns. It is presented in simple, understandable terms that provide the basic fundamentals of the many environmental regulatory topics that exist and may exist in the future. The authors' objective is to provide both background material and technical know-how on these issues.

This book is divided into ten Parts. Part I Provides an essay overview of the early history of environmental problems. Part II deals with the current regulatory framework. Part III–X constitutes the heart of the *Handbook*, including problems/solutions with sections on the following key laws and regulations:

Clean Air Act (3)
Clean Water Act (4)
Safe Drinking Water Act (5)
Resource Conservation and Recovery Act (6)
Toxic Substance Control Act (7)

Superfund and Comprehensive Environmental Response, Compensation and Liability Act (8)

Occupational Safety and Health Act (9)

Pollution Prevention Act (10)

In addition, the Introduction contains numerous regulatory references employed in the preparation of this *Handbook.*

As is usually the case in preparing any text, the question of what to include and what to omit has been particularly difficult. The *Handbook* provides the reader with nearly 400 solved problems in the regulatory field. One of the key features of this book is that the solutions to the problems are presented in a stand-alone manner. Throughout the book, the problems are laid out in such a way as to develop the reader's technical understanding of the regulatory subject in question. Each problem contains a title, problem statement, reference to the key regulations (where applicable) and data and solution, with the more difficult problems located at or near the end of each problem set. Thus, this *Handbook* offers material not only to individuals with limited technical background but also to those with extensive industrial experience.

The authors cannot claim sole authorship to all the problems and material in this *Handbook.* The present book has evolved from a host of sources including: Code of Federal Regulations; Federal Register; notes, homework problems, and exam problems prepared by L. Theodore for several chemical and environmental engineering graduate and undergraduate courses; problems and solutions drawn (with permission) from numerous Theodore Tutorials; Stander's personal notes; and problems and solutions developed by faculty participants during National Science Foundation (NSF) Undergraduate Faculty Enhancement Program (UFEP) workshops.

The Appendix is another feature of this Regulatory *Handbook.* It contains three Sections:

A. International regulations
B. ISO 14000
C. Miscellaneous topics

A short writing plus several problems (and solutions) are included in sections A and B. The latter section treats the following topics:

C1. In state regulatory agency names
C2. Federation and preemption
C3. Hybrid systems
C4. Electromotive fields (EMFA)
C5. Life cycle analysis
C6. Environmental justice

One of the objectives of the aforementioned NSF workshops included the development of illustrative examples by the faculty. Some of the problems provided in

this *Handbook* were drawn, in part, from the original work of these faculty. We would like to acknowledge the following professors whose problems, in original or edited form, are included in this *Handbook*.

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During the preparation of this Handbook, the authors were ably assisted in many ways by a number of graduate students in Manhattan College's Chemical Engineering Master's Program. These students devoted time and energy researching and classroom testing various problems in the book. These students are acknowledged in the body of the book. Thanks are also due Stacey Shafer and Lucas Dorazio for their special contributions.

Reasonable care has been taken to assure the accuracy of the information contained in the *Handbook*. However, the authors and the publisher cannot be responsible for errors or omissions in the information presented or for any consequences arising from the use of this information.

LEO STANDER
LOUIS THEODORE

INTRODUCTION

Many environmental laws, in particular federal regulations as published in the code of Federal Regulations (CFR) were a generous resource for problem (and solutions). The entries in the Table below contain fields of information drawn from the Clean Air Act, Safe Drinking Water Act, etc. Many of these citations were employed in the development of problems illustrations examples contained in this calculations *Handbook*.

TABLE 1 Key Regulations

Regulation 2006
40 Code of Federal Regulations (CFR), Part xxx, 2006 Edition
Clean Air Act (CAA)
40 CFR Part 50, National Primary and Secondary Ambient Air Quality Standards
40 CFR Part 60, Standards of Performance for New Stationary Sources
40 CFR Part 61, National Emission Standards for Hazardous Air Pollutants
40 CFR Part 63, National Emission Standards for Hazardous Air Pollutants for Source Categories
SDWA (Safe Drinking Water Act)
70 FR 9071 February 24, 2005, "Contaminant Candidate List"

(*Continued*)

TABLE 1 *Continued*

Regulation 2006
40CFR141.11: MCL (maximum contaminant level) for inorganic chemicals
40CFR141.13: MCL for turbidity
40CFR141.23: Inorganic chemical sampling and analytical requirements
40CFR141.24: Organic chemicals other than total trihalomethanes, sampling and analytical requirements
40CFR141.40: Monitoring requirements for unregulated contaminants
40CFR141.40.j: Monitoring at the discretion of the state
40CFR141.50(b): MCLG (maximum contaminant level goal) for organic contaminants
40CFR141.51: MCLG for inorganic contaminants
40CFR141.61: MCL for organic chemicals
40CFR141.62: MCL for inorganic chemicals
40CFR141.80: General requirements for control of lead and copper
40CFR141.82: Description of corrosion control treatment requirement
40CFR141.87: Monitoring requirements for water quality parameters
40CFR142.62: Variances and exemptions from the maximum contaminant levels for organic and inorganic chemicals
40CFR143.3: Secondary maximum contaminant levels
40CFR148.10: Waste specific prohibitions-solvent wastes
RCRA (Resource Conservation and Recovery Act)
40CFR261.24: Toxicity characteristic (D waste) RCRA, 40 CFR302.4: designation of hazardous substances
40CFR261.31: Hazardous wastes from non-specific sources (or F waste) RCRA, 40CFR302.4: designation of hazardous substances
40CFR261.32: Hazardous wastes from specific sources (or K waste) RCRA, 40 CFR302.4: designation of hazardous substances
40CFR258.40: Design criteria for municipal solid waste landfill (MSWLF)
40CFR258-Appendix 1: Constituents for detection monitoring (for MSWLF)
40CFR258-Appendix 2: List of hazardous inorganic and organic constituents
40CFR261.33: Discarded commercial chemical products, off-specification species, container residues, and spill residues thereof. 261.33.e. (P waste)
40CFR261.33: Discarded commercial chemical products, off-specification species, container residues, and spill residues thereof. 261.33.f. (U waste)
40CFR261 Appendix VIII: Hazardous constituents, see also 40 CFR261.11
40CFR264 Appendix IX: Ground water monitoring list
40CFR266 Appendix IV: Reference air concentration
40CFR266 Appendix V: Risk specific doses
40CFR266 Appendix VII: Health based limits for exclusion of waste-derived residues
40CFR266 Appendix VIII: Organic compounds for which residues must be analysed
40 CFR Part 270, EPA Administered Hazardous Waste Permit Program
40 CFR Part 271, State Administered Hazardous Waste Program

(*Continued*)

TABLE 1 *Continued*

Regulation 2006
SUPERFUND & CERCLA (Comprehensive Environmental Response, Compensation and Liability Act)
40CFR302.4: Designation of hazardous substances
40CFR355-Appendix A: 40 CFR355-Appendix B: list of extremely hazardous substances and their threshold planning quantities
40CFR372.65(b): Chemicals and chemical categories to which this part applies (CAS number listing)
40CFR372.65: Chemicals and chemical categories to which this part applies (chemical categories in alphabetical order)
40CFR372.65(b): Chemicals and chemical categories to which this part applies (under diisocyanates)
40CFR372.65: Chemicals and chemical categories to which this part applies (under polycyclic aromatic compounds)
CWA (Clean Water Act)
40CFR1164.4: Designation of hazardous substances
40CFR117.3: Determination of reportable quantities
40CFR401.15: Toxic pollutants (identical to compounds in 40 CFR403 Appendix B)
40CFR413.02: Total toxic organics (TTOCs)
40CFR423-Appendix A: 126 priority pollutants
TSCA (Toxic Substances Control Act)
Chemical substance matrix by CAS registry number and trade name matrix in alphabetical order
40CFR712.30: Chemical lists and reporting periods
40CFR712.30d: Chemical listsed by reporting dates
40CFR712.30.e: Substances listed by categories
40CFR712.30.e: Aldehydes
40CFR712.30.e: Alkyl-, chloro-, and hydroxy-methyl diary ethers
40CFR712.30.e: Alkyl phosphates
40CFR712.30.e: Brominated flame retardants
40CFR712.30e: Chloroalkyl phosphates
40CFR712.30.e: Cyanoacrylates
40CFR712.30.e: IRIS chemicals
40CFR712.30.e: Isocyanates
40CFR712.30.e: Methyl ethylene glycol ethers and esters
40CFR712.30.e: OSHA chemicals in need of dermal absorption testing
40CFR712.30.e: Propylene glycol ethers and esters
40CFR712.30.e: Siloxanes
40CFR712.30.e: Substantially produced chemicals in need of subchronic tests
40CFR712.30.e: Sulphones
40CFR716.120.a-d: Substances and listed mixtures to which this subpart (specific chemical listing applies)

(*Continued*)

TABLE 1 *Continued*

Regulation 2006
40CFR716.120.a: List of substances
40CFR716.120.c: Substances listed by categories
40CFR716.120.c: Alkylepoxides, including all noncyclic aliphatic hydrocarbons with one or more epoxy functional TSCA groups
40CFR716.120.c: Alkylphthalates - all alkyl esters of 1,2-benzenedicarboxylic acid (ortho-phthalic acid)
40CFR716.120.c: Alkyltin compounds
40CFR716.120.c: Aniline and chloro-, bromo-, and/or nitroanilines
40CFR716.120.c: Aryl phosphates-phosphate esters of pherol or of alkyl-substituted phenols. Triaryl and mixed alkyl and aryl esters are included but trialkyl esters are excluded
40CFR716.120.c: Asbestos-asbestiform varieties of chrycolite (serpentine); crocidolite (riebeckite); amosite TSCA, (cummingtonite-grunerte); anthophyllite; tremolite; and actino lite
40CFR716.120.c: Bisazobiphenyl dyes derived from benzidine and its congeners, ortho-toluidine (dimethylbenzidine)and dianisidine (dimethoxybenzidine)
40CFR716.120.c: Chlorinated benzenes, mono-, di-, tri- tetra-, and penta-
40CFR716.120.c: Chlorinated naphthalene, chlorinated derivatives of naphthalene (empirical formula) C_{10} H_x Cl_y where $x = y = 8$
40CFR716.120.c10: Chlorinated paraffins-chlorimated paraffin oils and chlorinated paraffin waxes, with chlorine content of 35% through 70% by weight
40CFR716.120.c11: Ethyltoluenes-ethyltoluene (mixed isomers) and the ortho (1,2-), meta (1,3-), and para (1,4-) isomers
40CFR716.120.c12: Fluoroalknes-general formula: Cn H2nxfx where n = 2 to and X = 1 to 6
40CFR716.120.c13: Glycidol (oxirancemethanol and its derivatieves)
40CFR716.120.c14: Halogenated alkyl esposcideshalogenated noncyclic aliphatic hydrocarbons with one or more epoxy functional groups
40CFR716.120.c15: Phenylenediamines (benzenediamines) – all nitrogen unsubstituted phenylenediamine and their salts with zero to two substitutents
40CFR716.120.d: Listed members of categories
40CFR716.120.d: Aldehydes
40CFR716.120.d: Alkyl-, chloro-, and hydroxy-methyl diary ethers
40CFR716.120.d: Alkyl phosphates
40CFR716.120.d: Brominated flame retardants
40CFR716.120.d: Chloralkyl phosphates
40CFR716.120.d: Cyanoacrylates
40CFR716.120.d: IRIS chemicals
40CFR716.120.d: Isocyanates
40CFR716.120.d: Methyl ethylene glycol ethers and esters
40CFR716.120.d: OSHA chemicals in need of dermal absorption testing
40CFR716.120.d: Propylene glycol ethers and esters
40CFR716.120.d: Siloxanes
40CFR716.120.d: Substantially produced chemical in need of subchronic test
40CFR716.120.d: Sulphones

(*Continued*)

TABLE 1 *Continued*

Regulation 2006
40CFR716.120.c: Bisazobiphenyl dyes derived from benzidine and its congeners, ortho-toluidine (dimethylbenzidine) and dianisidine (dimethoxybenzidine)
40CFR716.120.c: Chlorinated benzenes, mono-, di-, tri-, tetra-, and penta-
40CFA716-120.c: Chlorinated naphthalene, chlorinated derivatives of naphthalene (empirical formula) C_{10} H_x Cl_y where x = y = 8
40CFR716.120.c: Chlorinated paraffins-chlorinated paraffin oils and chlorinated paraffin waxes, with chlorine content of 35% through 70% by weight
40CFR716.120.c: Ethyltoluenes-ethyltoluene (mixed isomers) and the ortho (1,2-), meta (1,3-), and para (1,4-) isomers
40CFR716.120.c: Fluoroalkenes-general formula: $C_nH_{2nx}F_x$ where n = 2 to 3 and x = 1 to 6
40CFR716.120.c: Glycidol (oxiranemethanol and its derivatives)
40CFR716.120.c: Halogenated alkyl eposcides halogenated noncyclic aliphatic hydrocarbons with one or more epoxy functional groups
40CFR716.120.c: Phenylenediamines (benzenediamines) – all nitrogen unsubstituted phenylenediamine and their salts with zero to two substitutents

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