Contents and Subject Index

SECTION 1

INTRODUCTION TO INDUSTRIAL HYGIENE ENGINEERING AND CONTROL

1. RECOGNITION OF HEALTH HAZARDS	2
Introduction	2
An Easy Way to Recognize Hazards	3
The Classification of Hazards.	5
Methods That Can be Used to Recognize Hazards	7
Accident or Injury Reports	7
Physical Examinations	7
Employee Nofifications	7
Required Inspections	7
Literature and Discussions with Other Professionals	8
Walk-Through Inspections	8
Sampling and Spot Inspections	8
🗡 Preliminary Hazard Analysis	8
Review of Process Flows	8
Fault-Tree Analysis	9
Critical Incident Technique	9
Failure Mode and Effect	9
Job Safety Analysis	9
Summary	9
2. METHODS FOR MEASURING AND EVALUATING HEALTH HAZARDS	11
A Suggested Analysis Study Outline	
Recognition of Hazards	
Walk-Through Survey.	
Preliminary Hazard Recognition.	
Hazard Assessment Study Design	
/ Preliminary Hazard Assessment	15
Hazard Assessment Study	15
Summary	17
Case Study.	
Introduction.	
General Description	

3.	HUMAN SYSTEMS		•			. 3	36
	Introduction		•	•••	••		36
	The Study of Human Systems	•••	•	•••	• •	. :	37
	The Basic Unit of Life-The Cell	• •			• •	. :	39
	The Structure of the Body–The Skeleton	• • •	•			. 4	41
	The Moving Force—The Muscles					. 4	44
	The Control System-The Nervous System					. 4	46
	Fuel Processing-The Digestive System					. 4	47
	The Distribution System–The Circulatory System					.4	48
	The Combustion Fuel Supply System—The Respiratory System					. (50
	The Filtering System-The Renal System					. [51
	The Defense Systems-Skin and Sense Organs					.!	51
	Other Systems-Reproductive and Chemical Control					.!	52
	Summary					. !	53
4.	INDUSTRIAL TOXICOLOGY.					. !	54
	Introduction					!	54
	Toxicology					. !	55
	Exposure Routes of Toxic Materials and Protective Mechanisms That Exist					. !	57
	The Physiological Classification of Toxic Materials in Air	•••			• •	!	59
	Irritants				• •	!	59
	Asphyxiants					. !	59
	Anesthetics					. !	59
	Hepatotoxic Agents					. !	59
	Nephrotoxic Agents.					. !	59
	Neurotoxic Agents.					. !	59
	Blood Damaging Agents					!	59
	Lung Damaging Agents.					(60
	The Physical Classification of Toxic Materials					(60
	Summary					(61
5.	PHYSICAL HAZARDS					(62
	Introduction					. (62
	Physical Hazards–Noise					(63
	Physical Hazards–Vibration					. (64
	Physical HazardsIonizing and Nonionizing Radiation					(64
	Physical Hazards–Thermal					. (65
	Physical Hazards–Mechanical					. (66
	Physical Hazards–Pressure					. (67
	Physical Hazards–Illumination.					. (37
	Physical Hazards–Traumatic					. (68
	Other Hazards–Biological					. (68
	Other Hazards–Psychological					. (69
	Summary					. (69
6.	GENERAL METHODS OF CONTROL AVAILABLE TO THE INDUSTRIAL						
	HYGIENE ENGINEER	,				•••	70
	Introduction				•		70
	General Methods of Control-Substitution						71
	General Methods of Control–Isolation of Source	,			•		72
	General Methods of Control–Vientilation						73
	General Methods of Control-Administrative.						74
	General Methods of Control-Personal Protective Equipment.						75
	Determining the Control Method to Use						76

	Summary.	. 77
7.	LEGAL ASPECTS OF OCCUPATIONAL SAFETY AND HEALTH	
	Introduction	79
	OSHA–Prescribed Duties	80
	Inspections.	80
	Citations	81
	Recordkeeping: Posting of Periodic Reports	81
	Penalties	81
	Contest of Citations and Penalties	82
	Variances	82
8.	REFERENCES	84

SECTION 2 INDUSTRIAL VENTILATION

	00
	00
Heat Intensity Temperature	00
Heat Augustity	
	91
Amelia di sefeta Contra	93
Application of the Gas Laws	94
The Effect of Moisture in Air	97
Relative Humidity	100
Summary	102
2. PROPERTIES OF AIRBORNE CONTAMINANTS	103
Properties of Gases and Vapors	103
Toxic Properties of Gases or Vapors	104
Combustibility	105
Motion of Gases and Vapor	107
Properties of Particulate Matter	
Dust	108
Fumes	109
Smoke	109
Miete	110
Particulate Size	
Toxicity of Particulate Matter	
The Metion of Particulate Matter	
Dust That Is Preissted	
	113
	113
Causes of Initial Dispersion of Particulates in the Air	113
	114
Summary.	114
3. PRINCIPLES OF AIR MOVEMENT	115
General Concepts of Ventilation.	115
Components of a Ventilation System	116
Pressure in a Ventilation System.	117
Measurement of Pressures in a Ventilation System	120
Manometer	120
Inclined Manometer	
The Impact Tube	121
	· · · · · · · · · · · · · · · · · · ·

	The Pitot Tube	122
	Flow in a Ventilation System	122
	How Air Flows in a Ventilation System	123
	The Effect of Friction on Air Flow	124
	The Effect of Changes in Duct Diameter	129
	The Effect of Changes in Direction of Airflow	130
	Summary	134
4.	DILUTION VENTILATION	135
	Principles of Dilution Ventilation	135
	Components of a Dilution Ventilation System	137
	Contamination Generation	138
	Purging of a Concentration Buildup	139
	Maintaining a Steady State Concentration	140
	Determination of the Safety Factor (K)	144
	Substitution of Waterials.	144
	Dilution Ventilation for Fire and Explosion Control	145
	Thermal Ventilation for Dilution	140
	General Bules for Application of Dilution Ventilation	149
	Problems Belated to the Use of Dilution Ventilation	150
	Summary.	150
	,	
5.		152
	Components of a Local Exhaust System	152
	Blow Versus Exhaust	
	Rate of Flow in a Hood	155
	The Application and Advantage of Local Exhaust Ventilation	155
	General Categories of Local Exhaust Ventilation Hoods	150
	Enclosing Hoods – Total Enclosures	150
	Bate of Flow for Enclosing Hoods	
	Exterior Hoods	158
	Summary	161
	Guinna, y	
6.	MAKE-UP AIR	162
	General Principles of Wake-Op Air	102
		163
	Conditioning of the Air	163
	Signs of Inadequate Make. In Air	163
	Components of a Make-Up Air System	164
	Methods of Tempering the Air	. 164
	Steam Coil.	165
	Direct-Fired Heaters.	166
	Indirect-Fired Heaters	166
	Recirculated Air	167
	Heat Recovery	167
	Determining the Amount and Cost of Tempering the Required Make-Up Air	169
7.	DESIGN OF EXHAUST HOODS	171
	Determination of Capture or Control Velocity	172
	Capture Velocity for an Exterior Hood	172
	Limitations of Theoretical Model	175

Experimental Determination of Contours	176
Efficiency of Exhaust Hoods	177
Coefficient of Entry-C _e	179
Hood Entry Loss-h _e	180
Hood Design Relationships	181
Hood Design	183
Hood Design Procedure	 185
Summary	187
	400
8. PRINCIPLES OF AIR CLEANING.	
Remove Hazardous Contaminants.	
Protect Air Moving Equipment	
Recover Valuable Materials	
Meet Environmental Requirements	
Factors Affecting Air Cleaning.	
The Type of Contaminant	190
The Volume of Air Handled	190
The Degree of Collection Required	190
The Toxicity of the Contaminant	190
Radioactivity of the Contaminant	191
Temperature and Humidity	
The Presence of Corrosive Contaminant Material	
The Presence of Abrasive Particulates	
Disposal of the Collected Contaminant	
Flammability of the Carrier Gas or the Contaminant	
Chemical Reactions	192
Pressure Losses	192
The Integrity of the Air Cleaner	
Variations in Contaminant Loading.	
The Cycle for Cleaning	
The Cost of Cleaning the Air	192
The Efficiency of the Air Cleaner	193
Characteristics of the Contaminant	193
General Methods of Air Cleaning	194
Gravitational Force	194
Centrifugal Force	
Inertial Impaction	
Direct Interception	
Diffusion.	
Electrostatic Precipitation.	
Adsorption,	
Absorption.	
Incineration	
Catalytic Combustion	197
Summary.	
9. AIR-CLEANING DEVICES.	198
Air Cleaners for Particulate Contaminants—Mechanical Separators	198
Gravity Settling Chamber	198
Cyclone Cleaners.	200
Impingement or Impaction Devices	201

202
203
203
203
204
205
206
206
206
207
207
<i>.</i> 208
208
209
210
210
210
210
211
215
215
220
223
225
226
226
227
228
228
230
231
231
231
235
236
238
239
239
239
239

	Slip Joints	
	Cleanouts	
	Weather Cap or Stackhead.	240
	Supports	<i></i> 240
	Transitions	240
	Summary	241
		24.2
12.	PRINCIPLES OF SYSTEM DESIGN.	
	The Effect of Branches in a Ventilation System.	
	Sizing the Duct.	248
	Determining the SP _f	
	The Calculation Worksheet	254
	Some Final Comments on the Principles of System Design	258
	Velocity Pressure Method of Calculation	262
	Summary	262
12	VENTILATION SYSTEM DESIGN	264
10.	Introduction	
	A Design Procedure for Ventilation Systems	
	Types of Ventilation System Design	
	Balanced-System Design	
	Blast-Gate Design	
	Plenum Design	
	Advantages and Disadvantages of the Three Methods of Design	
	Other Design Considerations	
	Transport Velocity	270
	Fire and Explosion Hazards.	270
	Make-Up Air	
	Maintenance.	
	Noise	271
	Summary	272
		070
14.	RECIRCULATION OF EXHAUST AIR	2/3
	Problems Relating to Recirculation.	2/3
	Obtaining Clean Air to Be Recirculated	2/4
	Necessity to Monitor Incoming Recirculated Air	2/5
	Contaminants Not to Be Recirculated	2/5
	An Approach to Recirculation	275
	Some General Considerations in Designing a Recirculation System	2/6
	Other Alternatives to Conserve Energy Usage	278
	Summary	280
15	CORRECTING FOR NONSTANDARD CONDITIONS	281
10.	Standard Versus Nonstandard Conditions	281
	Need for Correction	281
	Summary	
16.	THERMAL VENTILATION EFFECTS	289
	General Principles of Air Motion About a Hot Process	289
	Draft Pressure	289
	Velocity of Air in a Heated Column	289
	Formula for Rate of Flow of Hot-Air Column	290
	Convectional Heat Loss Formula	291
	Control of Contaminants from Processes—The Low Canopy Hood	292

Control of Contaminants from Hot Processes—High Canopy Hood	296
Enclosures for Hot Processes	297
Natural Ventilation in Buildings	298
Summary	299
17. TESTING PROCEDURES IN THE PLANT	300
Reasons for Ventilation System Tests	300
Types of Ventilation System Tests	301
The Location and Purpose of Ventilation System Tests.	302
Testing Local Exhaust Systems	302
Determining the Static Pressure of the System	302
Determining Velocity Pressure- The Pitot Tube	304
Determining Velocity Pressure Other Instruments	308
Testing Dilution or Make-Up Air Systems	310
Other Methods Available for Testing Ventilation Systems	312
Determining Where Problems Exist.	313
Summary	314
18. ENVIRONMENTAL AIR POLLUTION.	315
Bevond the Plant.	315
The Effects of Air Pollution	315
Determining the Extent of Air Pollution—Measuring the Ambient Air.	316
Determining the Extent of Pollution–Measuring at the Source	318
Control of Environmental Air Pollution.	320
Cleaners for Particulate Matter	320
Cleaners for Gases and Vapors	320
Weather Considerations for Pollution Control	320
Summary.	321

SECTION 3 THERMAL STRESS

323

A LIEAT EVOLUANCE AND ITS FEFOTS ON MAN	200
1. HEAT EXCHANGE AND ITS EFFECTS ON MAN	320
Heat Exchange	326
Methods of Heat Exchange	328
Sources of Heat.	330
Physiological Responses to Extreme Temperatures.	330
Stress and Strain	331
Indicators of Thermal Strain	331
Factors in Heat Stress.	334
Age	334
Acclimatization.	334
Other Effects of Heat Stress	335
Summary	335
2. THERMAL MEASUREMENT	336
Introduction	336
Measurement of Air Temperature	336
Measurement of Radiant Heat	338
Measurement of Air Velocity.	339
Measurement of Humidity.	340
The Psychrometric Chart	342

	Equipment for Measuring Humidity	342
	Summary	344
3.	THERMAL STRESS INDICES	. 345
	Introduction	. 345
	Effective Temperature	. 346
	Heat-Stress Index	. 349
	The Predicted Four-Hour Sweat Rate	. 354
	The Wet-Bulb Globe Temperature Index	. 354
	The ACGIH Guide for Assessing Heat Stress	. 356
	The Wind-Chill Index	. 358
	Summary	. 358
4.	METHODS FOR CONTROLLING THERMAL EXPOSURES	360
	Introduction	360
	General Administrative Methods for Reducing Heat Stress	360
	Decreasing the Work Required	360
	Modifying the Worker's Exposure to Heat Stress	361
	Screening of Workers	361
	Education and Training of Workers	362
	Acclimatization of Workers	362
	Other Administrative Controls	362
	Modifying the Thermal Environment for Radiant Heat	363
	Lower the Radiant Heat Level	363
	Shielding for Control of Radiant Heat	364
	Personal Protective Equipment.	364
	Modifying the Thermal Environment for Convective Heat	365
	General Dilution Ventilation	365
	Removing Heat from the Air	366
	Protection from Climatic Conditions.	366
	Modifying the Environment for Moisture	366
	Modifying the Environment for Cold.	367
	Personal Protective Clothing	367
	Summary,	368

369

SECTION 4 SOUND

1. PHYSICS OF SOUND	372
Introduction	372
What is Sound?	372
An Example of Sound	372
Sound Wave	373
Velocity of Sound	375
Frequency of Sound	375
Wavelength	376
Summary	377
Sound Pressure	378
Sound Power	380
Sound Intensity	382
Relationship Between Sound Power and Sound Pressure	386
Summary	387

ห้องสมุดกรมวิทยาศาสตร์บริการ

xvi Contents and Subject Index

2.	PHYSICS OF SOUND	
	Frequency Bands.	
	Decibels	
	Adding and Subtracting Decibels	
	The Relationship Between Sound-Power Level and Sound-Pressure Level	
	Correction for Atmospheric Conditions.	
	Correction for the Directivity of a Sound Source.	
	Summary	
3.	PHYSICS OF SOUND	410
	Introduction	410
	Sound in a Room	410
	Absorption	413
	Room Constant.	415
	Room Constant and Sound Pressure	
	Critical Distance	
	Sound in an Adjoining Room.	
	Transmission Loss of Combined Materials	
	Summary	433
4.	THE EAR AND THE EFFECTS OF SOUND	438
	Introduction	438
	The Threshold of Hearing	438
	Hearing Loss and Age	440
	Other Causes of Hearing Loss	440
	Other Effects of Noise	441
	Sound (Noise) Level, dBA	448
	Extra-Auditory Effects.	452
	Damage-Risk Criteria	452
	Summary,	453
5.	VIBRATION	455
	Introduction	455
	Definition of Vibration	455
	Periodic Vibration.	455
	When to Use What	
	Resonance	459
	Vibration Measurement	
	The Effects of Vibration.	461
	Raynaud s Syndrome.	
	Summary	
6.	NOISE CONTROL	470
	Introduction.	470
	Does Noise Control Pay?	470
	Basics of Noise Control.	4/1
	Plant Planning	4/1
	A Simple Example of a New Plant Noise Prediction	4/1
	New Plant Planning and Substitution of Equipment-Some General Rules	4/2 170
	Controlling Noise in an Existing Facility	4/3

Controlling Noise at the Source	473
Mufflers	477
Controlling Noise Along Its Path	478
Enclosures	479
Additional Notes About Total Enclosures	482
Enclosures Inside a Noisy Work Area	483
Partial Enclosures	486
Shields and Barriers	486
Controlling Noise Along Its Path Using Room Absorption	488
Noise Control at the Receiver	490
EFERENCES	492

SECTION 5 INDUSTRIAL ILLUMINATION

1. LIGHT	494
Introduction	494
What Is Light?	494
Electromagnetic Spectrum	502
The Quantum Theory	503
The Emission Spectra	505
In candescence.	505
Fluorescence and Fluorescent Lamps .	506
Comparing Different Light Sources	507
2. LIGHT AND SEEING/DESIGN OF A LIGHTING SYSTEM	
Behavior of Light	509
The Human Eye	512
Variables in the Seeing Process	514
Terminology Used in the Science of Light	516
Luminous Flux (F)	516
Luminous Intensity	518
Illumination	519
Luminance	519
Reflectance	519
The Measurement of Light	
Foot-Candle Measurements	
Light Survey Procedures	
Evaluation of Results	523
3. LIGHTING DESIGN	
Introduction.	
Quantity of Light	
Quality of Light	
Glare	
Luminaire Classification	531
Indirect Lighting	531
Semi-Indirect Lighting	531
General Diffuse or Indirect Lighting and Direct-Indirect Lighting	1 531
Semi-Direct Lighting A	532
Supplementary Lighting	532
Lighting Systems or Illumination Methods	533
General Lighting	533

Localized General Lighting	534
Supplementary Lighting	534
Other Factors to Consider When Designing a Lighting System	534
Lumen Method of Lighting Design	536
Introduction	536
The Formula	537
Coefficient of Utilization	538
The Light Loss Factor	554
Summary of Steps Involved in Computing Lumen Method	559

561

SECTION 6 RADIATION

1 DRINGIRI ES OF NONIONIZINO DADIATION	
	564
	564
	564
Units of Measure.	565
Nonionizing Radiation—General.	567
Nonionizing Radiation—Specific Regions	568
Ultraviolet Region	568
Exposure Criteria	573
Visible Light	575
Infrared Radiation	575
Threshold Limit Values	577
Radio Frequencies	578
Microwaves	582
Biological Effects	585
Threshold Limit Values	585
Lasers	587
Biological Effects	591
Threshold Limit Values	591
Summary	597
2. CONTROL OF NONIONIZING RADIATION	598
Ultraviolet Radiation	598
Personnel Protection	602
Shielding	602
Lasers	608
Medical Surveillance.	614
Microwaves	615
Hazard Control.	618
Summary	620
	. 670
3. PRINCIPLES OF IONIZING RADIATION	621
Atomic Structure	621
Radioactivity	621
Alpha Particles	623
Beta Particles	624
Gamma Radiation	626
X-Radiation	629
Neutrons	630
Units of Measure	621

			621
			621
			621
	Exposure		031
	Absorbed Dose		631
	Dose Equivalent	•••••	
	Fluence	•••••	635
	Flux Density	•••••	635
	Biological Effects of Ionizing Radiation	••••••	635
	Industrial Uses of Ionizing Radiation.		636
	Radiation Gauges		637
	Radiography and Fluoroscopy		639
	X-Ray Diffraction and Fluorescent Analysis	•••••	639
	Electron-Beam Equipment		640
	Activation Analysis		641
	Radioactive Tracers		641
	Aerosol Fire Detectors		642
	Luminescent Dials		642
	Large Radiation Sources		642
	Agricultural Uses.		643
	Medical Uses		643
	Hazards		645
	Maximum Permissible Dose		645
	Summary		647
4.	INSTRUMENTATION		648
	Introduction		648
	Instrumentation		649
	Ionization Chamber Instruments		649
	Proportional Counter Instruments		650
	Geiger-Mueller (G-M) Counter		651
	Scintillation Detector.		653
	Photographic Devices.		654
	Solid-State and Activation Devices		656
	Personnel Monitoring Devices		657
	Film Badges		657
	Pocket Dosimeter		658
	Pocket Chamber		658
	Choice and Use of Instruments		. 658
5	CONTROL OF IONIZING BADIATION		659
0.	Identification of Badiation Safety Problems		659
	Authorization for Badionuclide Use		660
	Protection from Badiation Hazard		662
			. 662
			. 663
			. 664
	Gamma Badiation Shielding		. 665
	Y. Radiation Shielding		. 676
	Survey and Monitoring Procedures for Radiation Hazards		. 682
	Democratic Monitoring		684
	Fersonnel Wonktonny, ,		685
	Facilities		687
	Trave and Handling Tools		688
	Trays and Figure of Pedionustides		688
	Storage and Disposal of Nacionucildes.		

Personnel	69) 2
Radiation Accidents.	69	3 5
Emergency Instructions in the Event of Release of Radioactivity and		
Contamination of Personnel	69	3 5
Objectives of Remedial Action	69	3 5
Procedures for Dealing with Minor Spills and Contamination	69	96
Personnel Decontamination	69) 6
Reporting Radiation Accidents	69	3 7
Responsibilities of the Industrial Hygiene Engineer	69	37
Summary	69) 8
REFERENCES	69	99

SECTION 7 ERGONOMICS

1.	INTRODUCTION TO ERGONOMICS.	
	The Man/Machine System	
	The Systems Approach	
	Function and Task Analysis	
	Procedure for Conducting a Eurotional and Task Analysis	
	Summary	711
	Summary	•••••••••••••
2.	THE WORKER AS THE PHYSICAL COMPONENT	712
	Introduction	712
	The Average Man	712
	Using Anthropometrical Data	714
	Structural Anthropometry	714
	Functional Anthropometry	715
	Biomechanics	719
	Classification of Body Movements	721
	Factors Affecting the Performance of Physical Tasks	725
	Range of Movement	726
	Strength	726
	Endurance	727
	Speed	728
	Accuracy	728
	Summary	729
3.	THE WORKER AS THE CONTROLLING COMPONENT.	
	Introduction.	
	The Worker As a Sensor—Visual	
	Visual Discrimination	
	The Worker As a Sensor—Auditory	
	The Worker As a Sensor–Tactual	
	Displays.	
	Qualitative Visual Displays	737
	Status Indicators	
	Auditory Range Displays	
	Tactual Display 🐣	
	Choosing the Type of Stimulus	
	Grouping of Visual Displays	
	Summary	

4.	DESIGN OF THE JOB.			7	41
	The Worker's Function in the Workplace			7	41
	The Job Functions			7	41
	A General Procedure for Determining Where Controls for Hazard Exposures	;			
	Are Required	•		7	42
	The Data Gathering Function			7	'43
	Processing Information.			7	'45
	Controlling the System			7	'46
	The Recommended Direction of Control Movements			7	'48
	General Control Design Principles	-		7	'48
	Physical Requirements-Material Handling	-		7	′50
	Summary	•		7	′51
5.	DESIGN OF THE WORKPLACE			7	/52
	General Work Station Design Principles			7	/52
	Design for Visibility and Hearing			7	/53
	Design for Worker Operations			7	/54
	Provision for Equipment in the Workplace.			7	/55
	Standard Design			7	/56
	Provide Adequate Storage			7	756
	Workplace Space Considerations.			7	156
	The Design of the Plant Equipment Layout			7	758
	Use of Color Coding in the Plant			7	759
	Traffic Spaces.			7	759
	Aisles and Corridors			7	759
	Exits and Entrances			7	760
	Ladders, Stairs, and Ramps			7	762
	Summary		• • • •	7	763
6.	REFERENCES			7	765

SECTION 8 OTHER TOPICS

1. CONTROL OF INDUSTRIAL WATER QUALITY	768
	768
Water Treatment	770
Sedimentation	770
Control of pH	771
Coagulation and Flocculation	771
Filtration.	772
Bacterial Digestion.	773
Control of Disease-Causing Organisms	773
Aeration	774
Removal of Waste Sludge	774
Other Water Treatment.	774
Thermal Pollution	775
Cross Connection of Water Sources.	776
Control of Hazardous Materials in Water Treatment	777
Summary	779
2. CONTROL OF SOLID WASTE	780
Introduction.	780
The Objectives of a Solid Waste Disposal Program	780

	The Sources of Industrial Waste	781
	Raw Material Extraction	781
	Process Industries	782
	Manufacturing and Assembly	782
	Packaging	783
	Consumer Use	783
	Solid Waste Disposal Methods	783
	Sanitary Landfill	<i>.</i> 783
	Incineration	784
	Recycling	785
	Grinding-Compaction	785
	Meeting the Objectives of a Solid Waste Disposal Program	786
	Summary	788
3.	PURCHASE, HANDLING, AND STORAGE OF HAZARDOUS MATERIALS	
	Introduction.	
	Areas for Control of Hazardous Materials.	
	The Purchase of Hazardous Materials.	
	Information Required for Potentially Hazardous Materials	
	A Suggested Data Base for Hazardous Materials.	
	Computerization of Data Base	
	Handling of Hazardous Materials	
	Some Basic Rules for Handling of Hazardous Materials.	
	Storage of Hazardous Materials	
	Summary	799
4		900
	Introduction	900
	Personal Protective Equipment As a Control	
	Protection from Bespirable Hazards	801
	The Air-Purifying Respirator	802
	Cartridge Type Respirators	804
	Mechanical Filter Type Respirator	805
	Air-Supplied Respirators.	805
	The Self-Contained Breathing Unit	807
	Precautions That Should Be Taken When Using Respirators	808
	Other Personal Protective Equipment	809
	Summary	810
5.	COSTS OF INDUSTRIAL HYGIENE CONTROL	812
	Economic Cost of Not Providing Controls	
	Workers ¹ Componention	
	Replacing Last Employees	
	Medical Incurance	
	Availability of Labor Pool	
	Production Labor Full	
	Public Relations	
	Social Costs	
	The Acceleration of Dick	
	The Economic Cost of Brouiding Industrial Liveing Contrate	
	Equipment Costs	

Effects on Production	
Costs of Control Operation	
Cost of Training	
Equipment Life.	
Other Related Costs.	
Selecting a Control Method	
Identify the Exposure	
Choosing Alternatives.	
Predicting Results	
Evaluation of Alternatives.	
Summary	
6. BASIC ECONOMIC ANALYSIS.	
Introduction.	
The N-Year Payback	
Economic Analysis Using the Present Worth Approach.	
Effects of Taxes on Economic Analysis	
Summary	
7. REFERENCES	831

.