

# TABLE OF CONTENTS

	<b>Page</b>
<b>I. INTRODUCTION</b> .....	1
<b>II. AS LOW AS REASONABLY ACHIEVABLE (ALARA)</b> .....	2
<b>III. RESPONSIBILITIES</b>	
Radiation Safety Officer .....	3
University Radiation Safety Committee .....	4
Responsibilities and Qualifications of Permittees .....	5
Responsibility of Others .....	6
<b>IV. PERMITTING</b>	
Application Submission and Evaluation ( <a href="#">Form RS-1</a> ) <a href="#">WordPerfect</a> , <a href="#">Word</a> .....	8
Application, Approval and Permit for Radioactive Material .....	8
Application and Permit for Sealed Sources .....	9
Application for Large Quantities of Unsealed Radioactive Materials .....	9
Application for Radioactive Gases .....	9
Application and Permit for X-Ray Emitting Machines .....	9
Permit Modification, Termination or Revocation .....	10
<b>V. PERSONNEL MONITORING</b>	
Dose Limits .....	12
External Dose Equivalent .....	13
Types of Dosimeters .....	14
Dosimeter Wear Locations .....	14
General Rules for Use of Personnel Monitors .....	14
Criteria for Requiring Extremity Monitoring .....	15
Internal Dose Equivalent .....	15
Bioassay .....	16
Prenatal Radiation Exposure .....	17
<b>VI. TRAINING AND GENERAL SAFE HANDLING PROCEDURES</b>	
Training Requirements for Permittees .....	19
Training Requirements for Users of Ionizing Radiation .....	19
Training Requirements for Nuclear Gauge Users .....	20
Additional Training Requirements for X-ray Device Users .....	20
Performance-Based Training .....	20
Training for Ancillary Staff .....	21
General Radiation Safety Guidelines for Use of Radioactive Materials .....	21
General Radiation Safety Guidelines for Radiation Producing Electronic Equipment .....	23
Animal Care Procedures (also Appendix I) .....	23
Preparation and Use of Laboratory Facilities and Equipment (also Appendix J) .....	23
<b>VII. SPILLS AND DECONTAMINATION</b>	
General Decontamination Procedures .....	25
Contamination Limits .....	26

# TABLE OF CONTENTS

	<b>Page</b>
<b>VIII. PROCUREMENT, RECEIPT AND SHIPPING</b>	
Procurement of Radioactive Materials or Equipment Containing Sources . . . . .	27
Receipt and Check-In . . . . .	27
Shipping of Radioactive Materials and Sealed Sources . . . . .	28
Transportation of Nuclear Gauges to the Field . . . . .	29
Transfer to Authorized User . . . . .	30
Disposal Records . . . . .	30
<b>IX. SECURITY AND STORAGE</b>	
Security Measures . . . . .	31
Storage Guidelines . . . . .	31
Reports . . . . .	32
<b>X. INVENTORY, SURVEYS AND LEAK TESTS</b>	
Semiannual Radioactive Materials Inventory . . . . .	33
Sealed Source Leak Tests . . . . .	33
Contamination Monitoring and Limits . . . . .	34
Selecting a Contamination Survey Instrument . . . . .	35
Frequency and Locations for Routine Contamination Survey . . . . .	36
<b>XI. POSTING AND LABELING</b>	
Minimum Required Postings . . . . .	37
Labeling . . . . .	37
<b>XII. RECORDS AND REPORTING . . . . .</b>	<b>38</b>
<b>XIII. RADIOACTIVE WASTE MANAGEMENT</b>	
Classification of Radioactive Waste and Handling Procedures . . . . .	40
Transfer to Environmental Health & Safety . . . . .	42
Disposal in Sanitary Sewerage Systems . . . . .	43
<b>XIV. EMERGENCY PROCEDURES</b>	
Emergency Telephone Numbers . . . . .	44
Injuries Involving Radioactive Contamination . . . . .	44
Reporting and Notifications . . . . .	44
Major Spill . . . . .	45
Personnel Decontamination . . . . .	46
Release or Losses of Radioactive Material . . . . .	46
Spill Response Kit . . . . .	47
<b>XV. UNCONDITIONAL RELEASE</b>	
Permittee Responsibilities . . . . .	48
Department Head Responsibilities . . . . .	48
Radiation Safety Officer Responsibilities . . . . .	48

## LIST OF APPENDICES

<b>A.</b>	<b>FORMS AND REPORTS</b>	<b>Page</b>
	Form RS-1 Application for Ionizing Radiation Work <a href="#">WordPerfect</a> , <a href="#">Word</a> . . . . .	49
	Form RS-2 Permit for Radioactive Material Use (example) . . . . .	53
	Form RS-2 Sewage Disposal Addendum to Permit . . . . .	54
	Form RS-3 Hazard Identification and Emergency Contact Information Sign . . . . .	55
	Form RS-4 Radioactive Materials Inventory Report (example) . . . . .	56
	Form RS-5 Emergency Procedures for Radionuclides . . . . .	59
	Form RS-6 Radiological Waste Tag . . . . .	61
	Form RS-7 Radioactive Material Package Wipe Test and Usage Logsheet . . . . .	62
	Form RS-8 Contamination Monitoring Report . . . . .	63
	Form RS-9 Shipping Limited Quantity of Radioactive Material . . . . .	64
	Form RS-9B Shipping Other than Limited Quantity of Radioactive Material . . . . .	65
	Form RS-10 Survey Record for Unconditional Release . . . . .	66
	Form RS 12 Bill of Lading for Nuclear Gauge Field Use . . . . .	67
	NMED RPS-13 Occupational Exposure Report . . . . .	68
	NMED 045 Notice to Employees . . . . .	69
	Landauer Radiation Dosimetry Report (example) . . . . .	70
<b>B.</b>	<b>TRAINING REQUIREMENTS</b>	
	Required Information and Training for Users of Radioactive Materials . . . . .	71
	Training Requirements for Permittees . . . . .	71
	Training Requirements for Users of Ionizing Radiation and other Ancillary Staff . . . . .	72
	Training Requirements for Nuclear Gauge Users . . . . .	72
	Training Requirements for X-ray Device Users . . . . .	72
<b>C.</b>	<b>RADIOTOXICITY AND FACILITY LIMITATIONS</b>	
	Radionuclides Classified According to Relative Radiotoxicity . . . . .	73
	Limitations on Activities in Various Types of Working Places or Laboratories . . . . .	73
<b>D.</b>	<b>FUNDAMENTALS OF RADIOACTIVITY</b>	
	Components of an Atom . . . . .	75
	Radioactive Decay . . . . .	75
	Units . . . . .	76
	Half-life . . . . .	77
	Inverse Square Law . . . . .	78
	Biological Effects . . . . .	79
	Dose-Effect Models for Response . . . . .	79
	Figure of Radiation Dose Versus Observed Biological Effect . . . . .	80
	Radiation Protection . . . . .	80
	Exposure Risks . . . . .	81
	Control (Minimization) of External Exposures . . . . .	81
	Control (Minimization) of Internal Exposures . . . . .	83

## LIST OF APPENDICES

	<b>Page</b>
<b>E. BIOASSAY</b>	
Iodine Bioassay . . . . .	85
Tritium Bioassay . . . . .	86
Internal Dose Calculation . . . . .	86
Record Keeping . . . . .	86
<b>F. RADIATION DETECTION AND SURVEY PROCEDURES</b>	
Radiation Detection Instrumentation . . . . .	87
Area Radiation Surveys . . . . .	89
Units of Radiation . . . . .	89
Choosing an Instrument for an Area Radiation Survey . . . . .	90
Radiation Survey Instrument Calibration . . . . .	90
Performing/Documenting an Area Radiation Survey . . . . .	91
Survey of Working Area for Contamination . . . . .	91
Performing/Documenting a Wipe Test Survey for Removable Contamination . . . . .	92
Performing/Documenting a Contamination Survey Using a Survey Meter . . . . .	93
Personnel Contamination Survey Using a Survey Meter . . . . .	93
Choosing a System for Counting Removable Contamination Wipe Tests . . . . .	94
Calibration of Laboratory Counting Instruments . . . . .	94
Calculation of Minimum Detectable Activity (MDA) for Counting Instruments . . . . .	94
<b>G. RECEIVING AND SHIPPING RADIOACTIVE MATERIALS</b>	
Receipt of Radioactive Materials: Wipe Procedure for Packages . . . . .	97
Transfer of Licensed Material Off Campus . . . . .	98
Packaging of Radioactive Materials for Shipping . . . . .	98
Excepted Quantity Radioactive Materials Packaging . . . . .	99
Quality Control Requirements Prior to Each Shipment of Radioactive Materials . . . . .	100
Shipper's Certification . . . . .	100
Transportation by Air . . . . .	101
<b>H. RADIOACTIVE WASTE MANAGEMENT</b>	
Radioactive Waste Management Guidelines . . . . .	103
Waste Stream . . . . .	104
Nuclide Characteristics/Segregation . . . . .	105
Waste Form . . . . .	105
Identifying Contaminated Waste . . . . .	106
Deregulated Waste . . . . .	106
Special Problems Mixed Waste . . . . .	106
Biohazardous and Biological Waste . . . . .	107
Sharps . . . . .	107
Lead . . . . .	107
Uranium or Thorium Lab Chemicals . . . . .	107
<b>I. ANIMAL CARE PROCEDURES</b>	
Personnel Protection . . . . .	109
Laboratory Management . . . . .	109
Animal Care . . . . .	110
Recommended Procedure for Cleaning Radioactively Contaminated Cages . . . . .	110

## LIST OF APPENDICES

<b>J.</b>	<b>PROPER USE OF LABORATORY EQUIPMENT</b>	<b>Page</b>
	Laboratory Surfaces and Surface Coverings . . . . .	111
	Labeling Work Areas and Containers of Radioactive Material . . . . .	111
	Engineering Controls - Fume Hoods . . . . .	112
	Rules for Fume Hood Use . . . . .	112
	Fume Hood Filtration . . . . .	113
<b>K.</b>	<b>SEALED SOURCE CONDITIONS OF LICENSE . . . . .</b>	<b>115</b>
<b>L.</b>	<b>NOTIFICATION OF INCIDENTS . . . . .</b>	<b>117</b>
<b>M.</b>	<b>UNITS/CONVERSION TABLE . . . . .</b>	<b>119</b>
<b>N.</b>	<b>ISOTOPE CHARACTERISTICS AND HAZARD INFORMATION</b>	
	Excerpts from “Radiation Safety Training for General Laboratory Workers” by John J. Pickering, published January 1998, Pickering Enterprises, Livermore California, USA	
	Tritium (H-3) . . . . .	N-84
	Carbon-14 (C-14) . . . . .	N-85
	Sodium -22 (Na-22) . . . . .	N-86
	Phosphorus-32 (P-32) . . . . .	N-87
	Phosphorus-33 (P-33) . . . . .	N-88
	Sulfur-35 (S-35) . . . . .	N-89
	Chlorine-36 (Cl-36) . . . . .	N-90
	Calcium-45 (Ca-45) . . . . .	N-91
	Chromium-51 (Cr-51) . . . . .	N-92
	Iron-55 (Fe-55) . . . . .	N-93
	Cobalt-57 (Co-57) . . . . .	N-94
	Iron-59 (Fe-59) . . . . .	N-95
	Iodine-125 (I-125) . . . . .	N-96
	Iodine-131 (I-131) . . . . .	N-97
<b>O.</b>	<b>PRENATAL AND OCCUPATIONAL EXPOSURE RISKS</b>	
	U.S. Nuclear Regulatory Commission Regulatory Guide 8.13: Instruction Concerning Prenatal Radiation Exposure . . . . .	8.13-1
	U.S. Nuclear Regulatory Commission Regulatory Guide 8.29: Instruction Concerning Risks from Occupational Radiation Exposure . . . . .	8.29-1
	<a href="#">BEIR VII:Health Risks from Exposure to Low Levels of Ionizing Radiation June 2005</a>	
<b>P.</b>	<b>NUCLEAR GAUGE SAFETY AND TRANSPORTATION GUIDELINES</b>	
	<i>(Manuals printed for nuclear gauge users will contain the following documents)</i>	
	Working Safely with Nuclear Gauges . . . . .	
	Troxler Transportation Guide . . . . .	January 2005
<b>Q.</b>	<b>RADIATION MACHINES / X-ray EQUIPMENT</b>	
	<i>(Manuals printed for x-ray users will contain the following documents)</i>	
	General Information to Operate Radiation Machines in New Mexico . . . . .	NMED 022
	<a href="#">NMSU Radiation Machine Survey for Medical/Dental Equipment . . . . .</a>	<a href="#">Form RS-11A</a>
	<a href="#">NMSU Radiation Machine Survey for Analytical Equipment . . . . .</a>	<a href="#">Form RS-11B</a>