

TABLE OF CONTENTS

	Page
I. INTRODUCTION	1
II. AS LOW AS REASONABLY ACHIEVABLE (ALARA)	2
III. RESPONSIBILITIES	
Radiation Safety Officer	3
University Radiation Safety Committee	4
Responsibilities and Qualifications of Permittees	5
Responsibility of Others	6
IV. PERMITTING	
Application Submission and Evaluation (Form RS-1)	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
V. PERSONNEL MONITORING	
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
VI. TRAINING AND GENERAL SAFE HANDLING PROCEDURES	
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
VII. SPILLS AND DECONTAMINATION	
General Decontamination Procedures	25
Contamination Limits	26

TABLE OF CONTENTS

	Page
VIII. PROCUREMENT, RECEIPT AND SHIPPING	
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
IX. SECURITY AND STORAGE	
Security Measures	31
Storage Guidelines	31
Reports	32
X. INVENTORY, SURVEYS AND LEAK TESTS	
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
XI. POSTING AND LABELING	
Minimum Required Postings	37
Labeling	37
XII. RECORDS AND REPORTING	38
XIII. RADIOACTIVE WASTE MANAGEMENT	
Classification of Radioactive Waste and Handling Procedures	40
Transfer to Environmental Health & Safety	42
Disposal in Sanitary Sewerage Systems	43
XIV. EMERGENCY PROCEDURES	
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
XV. UNCONDITIONAL RELEASE	
Permittee Responsibilities	48
Department Head Responsibilities	48
Radiation Safety Officer Responsibilities	48

LIST OF APPENDICES

A.	FORMS AND REPORTS	Page
	Form RS-1 Application for Ionizing Radiation Work	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.	TRAINING REQUIREMENTS	
	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
C.	RADIOTOXICITY AND FACILITY LIMITATIONS	
	Radionuclides Classified According to Relative Radiotoxicity	73
	Limitations on Activities in Various Types of Working Places or Laboratories	73
D.	FUNDAMENTALS OF RADIOACTIVITY	
	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

	Page
E. BIOASSAY	
Iodine Bioassay	85
Tritium Bioassay	86
Internal Dose Calculation	86
Record Keeping	86
F. RADIATION DETECTION AND SURVEY PROCEDURES	
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
G. RECEIVING AND SHIPPING RADIOACTIVE MATERIALS	
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
H. RADIOACTIVE WASTE MANAGEMENT	
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
I. ANIMAL CARE PROCEDURES	
Personnel Protection	109
Laboratory Management	109
Animal Care	110
Recommended Procedure for Cleaning Radioactively Contaminated Cages	110

LIST OF APPENDICES

J.	PROPER USE OF LABORATORY EQUIPMENT	Page
	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
K.	SEALED SOURCE CONDITIONS OF LICENSE	115
L.	NOTIFICATION OF INCIDENTS	117
M.	UNITS/CONVERSION TABLE	119
N.	ISOTOPE CHARACTERISTICS AND HAZARD INFORMATION	
	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
O.	PRENATAL AND OCCUPATIONAL EXPOSURE RISKS	
	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
	BEIR VII:Health Risks from Exposure to Low Levels of Ionizing Radiation June 2005	
P.	NUCLEAR GAUGE SAFETY AND TRANSPORTATION GUIDELINES	
	<i>(Manuals printed for nuclear gauge users will contain the following documents)</i>	
	Working Safely with Nuclear Gauges	
	Troxler Transportation Guide	January 2005
Q.	RADIATION MACHINES / X-ray EQUIPMENT	
	<i>(Manuals printed for x-ray users will contain the following documents)</i>	
	General Information to Operate Radiation Machines in New Mexico	NMED 022
	NMSU Radiation Machine Survey for Medical/Dental Equipment	Form RS-11A
	NMSU Radiation Machine Survey for Analytical Equipment	Form RS-11B