



Final Uranium Leasing Program Programmatic Environmental Impact Statement

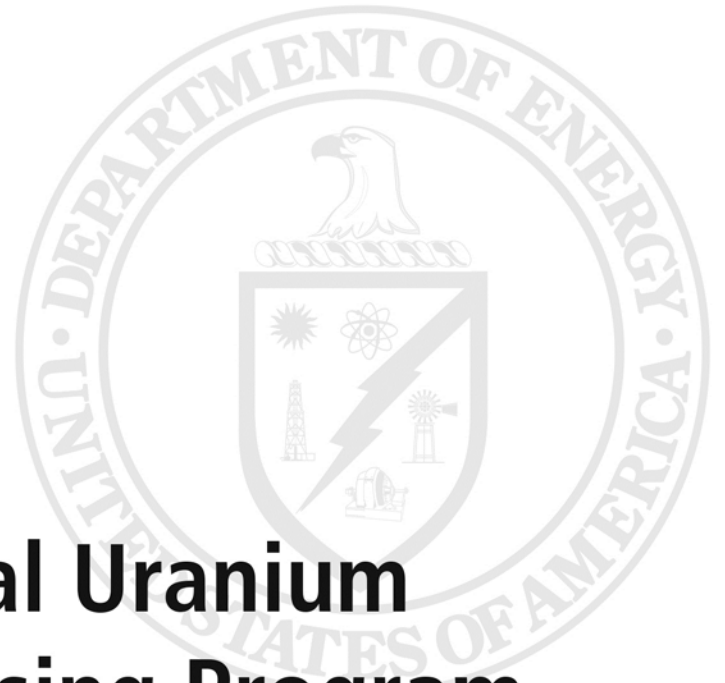
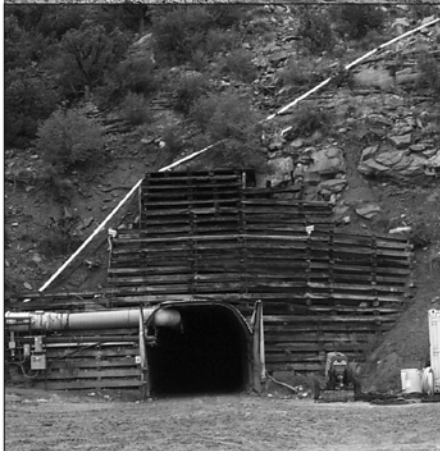
Volume 2: Chapter 5 through Appendix H

DOE/EIS-0472
March 2014



U.S. DEPARTMENT OF
ENERGY

Legacy
Management



Final Uranium Leasing Program Programmatic Environmental Impact Statement

Volume 2: Chapter 5 through Appendix H

DOE/EIS-0472
March 2014



U.S. DEPARTMENT OF
ENERGY

Legacy
Management

CONTENTS

1		
2		
3		
4	NOTATION.....	xxxiii
5		
6	CONVERSION TABLE.....	xli
7		
8	VOLUME 1: CHAPTERS 1 THROUGH 4	
9		
10	1 INTRODUCTION.....	1-1
11		
12	1.1 Background.....	1-1
13	1.2 Current Status of the ULP.....	1-6
14	1.2.1 DOE ULP Administrative Process.....	1-7
15	1.2.2 Lease Requirements.....	1-13
16	1.3 Site-Specific Information for the ULP Lease Tracts	1-14
17	1.3.1 ULP Lease Tract 5	1-14
18	1.3.2 ULP Lease Tract 5A	1-17
19	1.3.3 ULP Lease Tract 6	1-17
20	1.3.4 ULP Lease Tract 7	1-19
21	1.3.5 ULP Lease Tract 8	1-21
22	1.3.6 ULP Lease Tract 8A	1-21
23	1.3.7 ULP Lease Tract 9	1-23
24	1.3.8 ULP Lease Tract 10	1-25
25	1.3.9 ULP Lease Tract 11	1-25
26	1.3.10 ULP Lease Tract 11A	1-27
27	1.3.11 ULP Lease Tract 12	1-27
28	1.3.12 ULP Lease Tract 13	1-28
29	1.3.13 ULP Lease Tract 13A	1-30
30	1.3.14 ULP Lease Tract 14	1-30
31	1.3.15 ULP Lease Tract 15	1-31
32	1.3.16 ULP Lease Tract 15A	1-31
33	1.3.17 ULP Lease Tract 16	1-32
34	1.3.18 ULP Lease Tract 16A	1-33
35	1.3.19 ULP Lease Tract 17	1-33
36	1.3.20 ULP Lease Tract 18	1-34
37	1.3.21 ULP Lease Tract 19	1-36
38	1.3.22 ULP Lease Tract 19A	1-36
39	1.3.23 ULP Lease Tract 20	1-37
40	1.3.24 ULP Lease Tract 21	1-37
41	1.3.25 ULP Lease Tract 22	1-38
42	1.3.26 ULP Lease Tract 22A	1-39
43	1.3.27 ULP Lease Tract 23	1-39
44	1.3.28 ULP Lease Tract 24	1-40
45	1.3.29 ULP Lease Tract 25	1-40
46		

CONTENTS (Cont.)

1		
2		
3		
4	1.3.30 ULP Lease Tract 26	1-41
5	1.3.31 ULP Lease Tract 27	1-42
6	1.4 Purpose and Need for Agency Action	1-43
7	1.5 Proposed Action.....	1-44
8	1.6 Scope of the ULP PEIS.....	1-44
9	1.7 NEPA Process for the ULP PEIS.....	1-45
10	1.7.1 Public Scoping Process	1-45
11	1.7.1.1 Comments Considered Within the ULP PEIS Scope	1-46
12	1.7.1.2 Comments Considered Outside the ULP PEIS Scope	1-49
13	1.7.2 Public Comment Process	1-49
14	1.7.3 Nine Topics of Interest Based on Public Comments	
15	Received.....	1-51
16	1.8 Other Related, Similar, Connected, or Cumulative Actions.....	1-61
17	1.9 Consultation	1-62
18	1.10 Cooperating and Commenting Agencies	1-63
19	1.11 Organization of the ULP PEIS.....	1-65
20		
21	2 PROPOSED ACTION AND ALTERNATIVES	2-1
22		
23	2.1 Uranium Mining Methods and Phases.....	2-3
24	2.1.1 Exploration.....	2-3
25	2.1.2 Mine Development and Operations	2-4
26	2.1.2.1 Surface-Plant Area Construction and Operations.....	2-5
27	2.1.2.2 Mining Method – Underground Mining	2-12
28	2.1.2.3 Mining Method – Surface Open-Pit Mining.....	2-13
29	2.1.3 Reclamation	2-13
30	2.1.4 Ore Processing	2-14
31	2.1.4.1 Piñon Ridge Mill.....	2-14
32	2.1.4.2 White Mesa Mill	2-16
33	2.2 Five Alternatives Evaluated.....	2-17
34	2.2.1 Alternative 1.....	2-17
35	2.2.1.1 Basis for Impacts Analyses for Alternative 1	2-19
36	2.2.2 Alternative 2.....	2-20
37	2.2.2.1 Basis for Impacts Analyses for Alternative 2	2-21
38	2.2.3 Alternative 3.....	2-21
39	2.2.3.1 Basis for Impacts Analyses for Alternative 3	2-24
40	2.2.4 Alternative 4.....	2-26
41	2.2.4.1 Basis for Impacts Analyses for Alternative 4	2-27
42	2.2.5 Alternative 5.....	2-30
43	2.2.5.1 Basis for Impacts Analyses for Alternative 5	2-30
44	2.3 Alternatives Considered but Not Evaluated in Detail.....	2-32
45	2.4 Summary and Comparison of the Potential Impacts from the Five	
46	Alternatives	2-33

CONTENTS (Cont.)

1		
2		
3		
4	2.4.1	Air Quality 2-33
5	2.4.2	Acoustic Environment 2-38
6	2.4.3	Soil Resources..... 2-38
7	2.4.4	Water Resources 2-39
8	2.4.5	Human Health 2-40
9	2.4.6	Ecological Resources 2-42
10	2.4.6.1	Vegetation..... 2-43
11	2.4.6.2	Wildlife 2-44
12	2.4.6.3	Aquatic Biota 2-46
13	2.4.6.4	Threatened, Endangered, and Sensitive Species..... 2-47
14	2.4.7	Land Use 2-48
15	2.4.8	Socioeconomics 2-49
16	2.4.9	Environmental Justice..... 2-49
17	2.4.10	Transportation 2-50
18	2.4.11	Cultural Resources 2-51
19	2.4.12	Visual Resources..... 2-53
20	2.4.13	Waste Management..... 2-54
21	2.4.14	Cumulative Impacts 2-54
22	2.5	Irreversible and Irrecoverable Commitment of Resources..... 2-72
23	2.6	Preferred Alternative Identified 2-72
24		
25	3	AFFECTED ENVIRONMENT 3-1
26		
27	3.1	Air Quality 3-1
28	3.1.1	Climate..... 3-1
29	3.1.1.1	General Climate 3-1
30	3.1.1.2	Wind..... 3-2
31	3.1.1.3	Temperature 3-5
32	3.1.1.4	Precipitation 3-5
33	3.1.1.5	Severe Weather 3-5
34	3.1.2	Existing Air Emissions 3-8
35	3.1.3	Existing Air Quality..... 3-11
36	3.1.4	Regulatory Environment..... 3-14
37	3.1.4.1	Prevention of Significant Deterioration 3-14
38	3.1.4.2	Visibility Protection 3-18
39	3.1.4.3	General Conformity 3-18
40	3.1.4.4	Air Quality-Related Values 3-18
41	3.2	Acoustic Environment 3-20
42	3.2.1	Sound Fundamentals..... 3-20
43	3.2.2	Background Noise Levels 3-21
44	3.2.3	Noise Regulations 3-22
45	3.3	Geological Setting and Soil Resources 3-23
46	3.3.1	Geological Setting..... 3-23

CONTENTS (Cont.)	
1	
2	
3	
4	3.3.1.1 Physiography 3-23
5	3.3.1.2 Structural Geology 3-24
6	3.3.1.3 Bedrock Geology 3-27
7	3.3.1.4 Seismicity 3-34
8	3.3.1.5 Topography and Geology of the Lease Tracts 3-35
9	3.3.1.6 Paleontological Resources 3-40
10	3.3.2 Soil Resources 3-42
11	3.3.2.1 Gateway Lease Tracts 3-43
12	3.3.2.2 Uravan Lease Tracts 3-45
13	3.3.2.3 Paradox Lease Tracts 3-47
14	3.3.2.4 Slick Rock Lease Tracts 3-51
15	3.4 Water Resources 3-53
16	3.4.1 Surface Water 3-53
17	3.4.1.1 Stream and Drainage Systems 3-53
18	3.4.1.2 Existing Water Quality 3-59
19	3.4.2 Groundwater 3-68
20	3.4.3 Water Management 3-76
21	3.5 Human Health 3-79
22	3.5.1 Exposure to Radiation 3-79
23	3.5.1.1 Radiation and Its Effects 3-79
24	3.5.1.2 Baseline Radiological Dose and Risk 3-83
25	3.5.2 Exposure to Hazardous Chemicals 3-88
26	3.5.2.1 Chemical Hazards 3-88
27	3.5.2.2 Baseline Chemical Risks 3-89
28	3.6 Ecological Resources 3-93
29	3.6.1 Vegetation 3-93
30	3.6.1.1 Wetlands and Floodplains 3-107
31	3.6.2 Wildlife 3-114
32	3.6.2.1 Amphibians and Reptiles 3-115
33	3.6.2.2 Birds 3-115
34	3.6.2.3 Mammals 3-130
35	3.6.3 Aquatic Biota 3-145
36	3.6.4 Threatened, Endangered, and Sensitive Species 3-153
37	3.6.4.1 Species Listed under the Endangered Species Act 3-153
38	3.6.4.2 Sensitive and State-Listed Species 3-175
39	3.7 Land Use 3-178
40	3.7.1 Specially Designated Areas and Lands with Wilderness
41	Characteristics 3-179
42	3.7.2 Agriculture 3-183
43	3.7.3 Rangeland Resources 3-190
44	3.7.3.1 Livestock Grazing 3-190
45	3.7.3.2 Wild Horses and Burros 3-190
46	3.7.4 Mineral Resources and Mining 3-191

1	CONTENTS (Cont.)		
2			
3			
4	3.7.4.1	Uranium	3-191
5	3.7.4.2	Coal.....	3-195
6	3.7.4.3	Oil and Gas	3-195
7	3.7.4.4	Other Minerals and Mineral Materials.....	3-196
8	3.7.5	Timber Harvest	3-196
9	3.7.6	Recreation	3-197
10	3.8	Socioeconomics	3-198
11	3.8.1	Economic Environment	3-200
12	3.8.1.1	ROI Employment and Unemployment	3-200
13	3.8.1.2	Employment by Sector.....	3-201
14	3.8.1.3	Personal Income.....	3-202
15	3.8.2	Social Environment.....	3-205
16	3.8.2.1	Population	3-205
17	3.8.2.2	ROI Housing.....	3-205
18	3.8.2.3	ROI Community and Social Services	3-206
19	3.8.3	Recreation and Tourism Economy.....	3-211
20	3.9	Environmental Justice.....	3-213
21	3.10	Transportation.....	3-218
22	3.11	Cultural Resources	3-224
23	3.11.1	Cultural History of Southwestern Colorado	3-224
24	3.11.2	Cultural Resource Inventories.....	3-228
25	3.11.3	Traditional Cultural Properties	3-236
26	3.12	Visual Resources.....	3-238
27	3.12.1	Regional Setting.....	3-239
28	3.12.2	Lease Tracts	3-241
29	3.12.2.1	North Group.....	3-250
30	3.12.2.2	North Central Group and South Central Group.....	3-252
31	3.12.2.3	South Group.....	3-254
32	3.12.3	Visual Resource Management	3-255
33	3.13	Waste Management.....	3-257
34			
35	4	ENVIRONMENTAL IMPACTS	4-1
36			
37	4.1	Alternative 1.....	4-1
38	4.1.1	Air Quality	4-1
39	4.1.2	Acoustic Environment	4-2
40	4.1.3	Geology and Soil Resources	4-4
41	4.1.3.1	Potential Soil Impacts Common to All Alternatives	4-4
42	4.1.3.2	Soil Impacts under Alternative 1	4-8
43	4.1.3.3	Impacts on Paleontological Resources under Alternative 1	4-8
44	4.1.4	Water Resources	4-9
45	4.1.5	Human Health.....	4-10
46	4.1.5.1	Conceptual Site Exposure Model	4-10

1	CONTENTS (Cont.)		
2			
3			
4	4.1.5.2	Potential Human Health Impacts from Alternative 1	4-14
5	4.1.5.3	Worker Exposure – Reclamation Workers	4-15
6	4.1.5.4	General Public Exposure – Residential Scenario	4-17
7	4.1.5.5	General Public Exposure – Recreationist Scenario	4-24
8	4.1.5.6	General Public Exposure – Individual Receptor Entering	
9		an Inactive Underground Mine Portal	4-26
10	4.1.6	Ecological Resources	4-26
11	4.1.6.1	Vegetation	4-26
12	4.1.6.2	Wildlife	4-30
13	4.1.6.3	Aquatic Biota	4-32
14	4.1.6.4	Threatened, Endangered, and Sensitive Species	4-32
15	4.1.7	Land Use	4-50
16	4.1.8	Socioeconomics	4-50
17	4.1.8.1	Recreation and Tourism	4-51
18	4.1.9	Environmental Justice	4-52
19	4.1.10	Transportation	4-53
20	4.1.11	Cultural Resources	4-53
21	4.1.12	Visual Resources	4-54
22	4.1.12.1	Vegetation and Landform Alterations	4-55
23	4.1.12.2	Removal of Structures and On-Site Materials	4-56
24	4.1.12.3	Roads	4-56
25	4.1.12.4	Workers, Vehicles, and Equipment	4-57
26	4.1.12.5	Lighting	4-57
27	4.1.12.6	Impacts on Lands Surrounding the Lease Tracts	4-57
28	4.1.13	Waste Management	4-67
29	4.2	Alternative 2	4-67
30	4.2.1	Air Quality	4-68
31	4.2.2	Acoustic Environment	4-68
32	4.2.3	Geology and Soil Resources	4-68
33	4.2.3.1	Paleontological Resources	4-68
34	4.2.4	Water Resources	4-68
35	4.2.5	Human Health	4-69
36	4.2.6	Ecological Resources	4-69
37	4.2.6.1	Vegetation	4-69
38	4.2.6.2	Wildlife	4-69
39	4.2.6.3	Aquatic Biota	4-69
40	4.2.6.4	Threatened, Endangered, and Sensitive Species	4-70
41	4.2.7	Land Use	4-70
42	4.2.8	Socioeconomics	4-70
43	4.2.9	Environmental Justice	4-70
44	4.2.10	Transportation	4-70
45	4.2.11	Cultural Resources	4-71
46	4.2.12	Visual Resources	4-71

CONTENTS (Cont.)

1		
2		
3		
4	4.2.13	Waste Management..... 4-71
5	4.3	Alternative 3..... 4-71
6	4.3.1	Air Quality 4-72
7	4.3.1.1	Exploration..... 4-72
8	4.3.1.2	Mine Development and Operations 4-72
9	4.3.1.3	Reclamation 4-75
10	4.3.2	Acoustic Environment 4-76
11	4.3.2.1	Exploration..... 4-76
12	4.3.2.2	Mine Development and Operations 4-76
13	4.3.2.3	Reclamation 4-79
14	4.3.3	Geology and Soil Resources 4-80
15	4.3.3.1	Exploration..... 4-80
16	4.3.3.2	Mine Development and Operations 4-80
17	4.3.3.3	Reclamation 4-81
18	4.3.3.4	Paleontological Resources 4-81
19	4.3.4	Water Resources 4-82
20	4.3.4.1	Exploration..... 4-82
21	4.3.4.2	Mine Development and Operations 4-83
22	4.3.4.3	Reclamation 4-88
23	4.3.5	Human Health 4-89
24	4.3.5.1	Worker Exposures – Uranium Miners 4-89
25	4.3.5.2	Worker Exposure – Reclamation Workers 4-91
26	4.3.5.3	General Public Exposure – Residential Scenario 4-92
27	4.3.5.4	General Public Exposures – Recreationist Scenario..... 4-101
28	4.3.5.5	Intentional Destructive Acts 4-103
29	4.3.6	Ecological Resources 4-104
30	4.3.6.1	Vegetation..... 4-104
31	4.3.6.2	Wildlife 4-108
32	4.3.6.3	Aquatic Biota 4-125
33	4.3.6.4	Threatened, Endangered, and Sensitive Species..... 4-131
34	4.3.7	Land Use 4-154
35	4.3.8	Socioeconomics 4-154
36	4.3.8.1	Recreation and Tourism..... 4-156
37	4.3.9	Environmental Justice 4-159
38	4.3.9.1	Exploration..... 4-159
39	4.3.9.2	Mine Development and Operations 4-160
40	4.3.9.3	Reclamation 4-161
41	4.3.10	Transportation 4-161
42	4.3.10.1	General Approach and Assumptions 4-161
43	4.3.10.2	Routine Transportation Risks 4-163
44	4.3.10.3	Transportation Accident Risks..... 4-172
45	4.3.10.4	Accidental Release of Uranium during Transportation 4-175
46	4.3.11	Cultural Resources 4-176

1	CONTENTS (Cont.)		
2			
3			
4		4.3.11.1 Exploration.....	4-177
5		4.3.11.2 Mine Development and Operations	4-177
6		4.3.11.3 Reclamation	4-179
7	4.3.12	Visual Resources.....	4-179
8		4.3.12.1 Exploration.....	4-180
9		4.3.12.2 Mine Development and Operations	4-180
10		4.3.12.3 Reclamation	4-184
11		4.3.12.4 Impacts on Surrounding Lands	4-184
12	4.3.13	Waste Management.....	4-192
13	4.4	Alternative 4.....	4-193
14	4.4.1	Air Quality	4-193
15		4.4.1.1 Exploration.....	4-193
16		4.4.1.2 Mine Development and Operations	4-193
17		4.4.1.3 Reclamation	4-196
18	4.4.2	Acoustic Environment	4-196
19		4.4.2.1 Exploration.....	4-196
20		4.4.2.2 Mine Development and Operations	4-197
21		4.4.2.3 Reclamation	4-199
22	4.4.3	Geology and Soil Resources	4-200
23		4.4.3.1 Exploration.....	4-200
24		4.4.3.2 Mine Development and Operations	4-200
25		4.4.3.3 Reclamation	4-200
26		4.4.3.4 Paleontological Resources	4-200
27	4.4.4	Water Resources	4-201
28		4.4.4.1 Exploration.....	4-201
29		4.4.4.2 Mine Development and Operations	4-201
30		4.4.4.3 Reclamation	4-202
31	4.4.5	Human Health	4-203
32		4.4.5.1 Worker Exposure – Uranium Miners.....	4-203
33		4.4.5.2 Worker Exposure – Reclamation Workers	4-204
34		4.4.5.3 General Public Exposure – Residential Scenario	4-205
35		4.4.5.4 General Public Exposure – Recreationist Scenario	4-210
36	4.4.6	Ecological Resources	4-211
37		4.4.6.1 Vegetation.....	4-211
38		4.4.6.2 Wildlife	4-212
39		4.4.6.3 Aquatic Biota.....	4-213
40		4.4.6.4 Threatened, Endangered, and Sensitive Species.....	4-213
41	4.4.7	Land Use	4-213
42	4.4.8	Socioeconomics	4-215
43		4.4.8.1 Recreation and Tourism.....	4-217
44	4.4.9	Environmental Justice.....	4-217
45		4.4.9.1 Exploration.....	4-217
46		4.4.9.2 Mine Development and Operations	4-217

CONTENTS (Cont.)

1		
2		
3		
4	4.4.9.3	Reclamation 4-217
5	4.4.10	Transportation 4-217
6	4.4.10.1	Routine Transportation Risks 4-218
7	4.4.10.2	Transportation Accident Risks..... 4-220
8	4.4.11	Cultural Resources 4-221
9	4.4.12	Visual Resources..... 4-222
10	4.4.12.1	Exploration, Mine Development and Operations, and Reclamation 4-222
11	4.4.12.2	Impacts on Surrounding Lands 4-222
12	4.4.13	Waste Management..... 4-234
13	4.5	Alternative 5..... 4-235
14	4.5.1	Air Quality 4-235
15	4.5.1.1	Exploration..... 4-235
16	4.5.1.2	Mine Development and Operations 4-235
17	4.5.1.3	Reclamation 4-237
18	4.5.2	Acoustic Environment 4-238
19	4.5.2.1	Exploration..... 4-238
20	4.5.2.2	Mine Development and Operations 4-238
21	4.5.2.3	Reclamation 4-240
22	4.5.3	Geology and Soil Resources 4-241
23	4.5.3.1	Paleontological Resources 4-241
24	4.5.4	Water Resources 4-241
25	4.5.4.1	Exploration..... 4-241
26	4.5.4.2	Mine Development and Operations 4-242
27	4.5.4.3	Reclamation 4-242
28	4.5.5	Human Health 4-242
29	4.5.5.1	Worker Exposure – Uranium Miners..... 4-243
30	4.5.5.2	Worker Exposure – Reclamation Workers 4-244
31	4.5.5.3	General Public Exposure – Residential Scenario 4-245
32	4.5.5.4	General Public Exposure – Recreationist Scenario 4-250
33	4.5.6	Ecological Resources 4-251
34	4.5.6.1	Vegetation..... 4-251
35	4.5.6.2	Wildlife 4-252
36	4.5.6.3	Aquatic Biota 4-252
37	4.5.6.4	Threatened, Endangered, and Sensitive Species..... 4-253
38	4.5.7	Land Use 4-253
39	4.5.8	Socioeconomics 4-253
40	4.5.8.1	Recreation and Tourism..... 4-255
41	4.5.9	Environmental Justice..... 4-255
42	4.5.9.1	Exploration..... 4-255
43	4.5.9.2	Mine Development and Operations 4-255
44	4.5.9.3	Reclamation 4-255
45	4.5.10	Transportation 4-256
46		

CONTENTS (Cont.)

1		
2		
3		
4	4.5.10.1	Routine Transportation Risks 4-256
5	4.5.10.2	Transportation Accident Risks..... 4-259
6	4.5.11	Cultural Resources 4-259
7	4.5.12	Visual Resources..... 4-260
8	4.5.12.1	Exploration, Mine Development and Operations,
9		and Reclamation 4-260
10	4.5.12.2	Impacts on Surrounding Lands 4-260
11	4.5.13	Waste Management..... 4-260
12	4.6	Measures To Minimize Potential Impacts from ULP Mining Activities..... 4-261
13	4.7	Cumulative Impacts 4-261
14	4.7.1	Reasonably Foreseeable Future Actions 4-276
15	4.7.1.1	Piñon Ridge Mill..... 4-276
16	4.7.1.2	Planned Uranium Exploration 4-278
17	4.7.1.3	Coal Mining 4-278
18	4.7.1.4	Uranium Mill Remediation 4-281
19	4.7.1.5	Reforestation Projects 4-284
20	4.7.1.6	Western Area Power Administration ROW Maintenance 4-284
21	4.7.1.7	Construction of Agricultural Water Facilities 4-285
22	4.7.1.8	Other Future Projects 4-285
23	4.7.2	Present and Ongoing Actions..... 4-287
24	4.7.2.1	White Mesa Mill 4-287
25	4.7.2.2	Uranium Mining 4-289
26	4.7.2.3	Coal and Other Mineral Mining..... 4-303
27	4.7.2.4	Oil and Gas Exploration and Extraction 4-303
28	4.7.2.5	Long-Term Grazing Permits and Allotments 4-304
29	4.7.2.6	Power Generation and Transmission 4-304
30	4.7.2.7	Potash Exploration..... 4-306
31	4.7.2.8	Lisbon Natural Gas Processing Plant..... 4-308
32	4.7.2.9	Paradox Valley Desalinization Plant 4-308
33	4.7.2.10	Cameo Station Power Plant 4-309
34	4.7.2.11	Reconstruction of the Hanging Flume Replica..... 4-309
35	4.7.3	General Trends..... 4-309
36	4.7.3.1	Population Growth..... 4-310
37	4.7.3.2	Energy Demand 4-310
38	4.7.3.3	Water Use and Availability..... 4-311
39	4.7.3.4	Climate..... 4-311
40	4.7.4	Cumulative Impacts from the ULP Alternatives 4-312
41		
42		

CONTENTS (Cont.)

1
2
3
4 **VOLUME 2: CHAPTER 5 THROUGH APPENDIX H**
5
6 5 APPLICABLE LAWS AND REQUIREMENTS 5-1
7
8 5.1 Applicable Federal Laws and Regulations 5-1
9 5.2 State of Colorado Environmental Laws 5-7
10 5.3 County Environmental Ordinances and Plans 5-7
11 5.4 Memoranda of Understanding 5-7
12
13 6 CONSULTATION PROCESS FOR THE DOE ULP PEIS..... 6-1
14
15 6.1 Tribal Government-to-Government Consultation..... 6-1
16 6.2 Consultation for the ESA 6-3
17 6.3 Consultation for the NHPA..... 6-4
18
19 7 INDEX..... 7-1
20
21 8 REFERENCES 8-1
22
23 APPENDIX A: Examples of Existing Leases for the Uranium Leasing Program A-1
24
25 APPENDIX B: Summary of the Public Scoping Process for the ULP PEIS B-1
26
27 APPENDIX C: Emission Inventories, Costs, and Other Estimates Used as a Basis
28 for the ULP PEIS Impact Analyses..... C-1
29
30 APPENDIX D: Impact Assessment Methodologies..... D-1
31
32 APPENDIX E: Correspondence Associated with Endangered Species Act (ESA)
33 Consultation, Biological Opinion, and Biological Assessment E-1
34
35 APPENDIX F: Correspondence Associated with Tribal and National Historic
36 Preservation Act (NHPA) Consultation F-1
37
38 APPENDIX G: List of Preparers G-1
39
40 APPENDIX H: Contractor Disclosure Statement..... H-1
41
42

CONTENTS (Cont.)

VOLUME 3: APPENDIX I

APPENDIX I: Comment Response Document	I-1
I.1 Public Comment Process	I-1
I.2 Summary of Changes to the Draft PEIS	I-2
I.3 Topics of Interest	I-4
I.4 Comments and Responses.....	I-16
I.4.1 Organizations That Submitted Comments in Writing via Letter, E-mail, or Web Portal or Orally at One of the Public Hearings	I-16
I.4.2 Individuals Who Submitted Comments in Writing via Letter, E-mail, or Web Portal or Orally at One of the Public Hearings	I-16
Organizations	I-23
Members of the Public	I-147

FIGURES

1.2-1	Locations of the 31 ULP Lease Tracts in Colorado.....	1-11
1.3-1	Location of C-JD-5 Mine on Lease Tract 5	1-16
1.3-2	Location of C-JD-6 Mine on Lease Tract 6	1-18
1.3-3	Location of C-JD-7 Mine on Lease Tract 7	1-20
1.3-4	Location of C-JD-8 Mine on Lease Tract 8	1-22
1.3-5	Location of C-JD-9 Mine on Lease Tract 9	1-24
1.3-6	Location of C-SR-11 Mine on Lease Tract 11.....	1-26
1.3-7	Location of C-SR-13 Mine on Lease Tract 13.....	1-29
1.3-8	Location of C-SM-18 Mine on Lease Tract 18.....	1-35
1.7-1	NEPA Process for the ULP PEIS.....	1-45
2-1	Thirteen Human Health and Environmental Resource Areas That Are Evaluated for Potential Impacts from Exploration, Mine Development and Operations, and Reclamation	2-2
2.1-1	Photograph of Mine Plant Surface Configuration at Lease Tract 5.....	2-6

FIGURES (Cont.)

1			
2			
3			
4	2.1-2	Photograph of Mine Plant Surface Configuration at Lease Tract 7.....	2-7
5			
6	2.1-3	Photograph of Mine Plant Surface Configuration at Lease Tract 8.....	2-8
7			
8	2.1-4	Photograph of Former Mine Plant Surface Configuration at Lease Tract 13A	2-9
9			
10	2.1-5	Schematic of a Generic Mine Plant Surface Configuration.....	2-10
11			
12	2.1-6	Locations of White Mesa Mill and Proposed Piñon Ridge Mill.....	2-15
13			
14	2.2-1	Locations of Lease Tracts Evaluated under Alternatives 1 and 2.....	2-18
15			
16	2.2-2	Locations of Lease Tracts Evaluated under Alternative 3	2-22
17			
18	3.1-1	Wind Roses at the Proposed Piñon Ridge Mill, Montrose County, Colorado, April 2008–March 2011: (a) Site 1, 33-ft Level; and (b) Site 2, 98-ft Level	3-3
19			
20			
21	3.1-2	Wind Rose at 20-ft Level at Nucla, Montrose County, Colorado, 2006–2010	3-4
22			
23	3.1-3	Monitored PM ₁₀ Concentrations at Sites 1 and 2 of the Proposed Piñon Ridge Mill, April 2008–March 2010	3-15
24			
25			
26	3.1-4	PSD Class I Areas and Colorado Sensitive Class II Areas around the ULP Lease Tracts.....	3-17
27			
28			
29	3.3-1	Physiographic Map of the Colorado Plateau	3-23
30			
31	3.3-2	Extent of the Paradox Basin and the Paradox Fold and Fault Belt in Southwestern Colorado and Southeastern Utah.....	3-25
32			
33			
34	3.3-3	Shaded Relief Map Showing Location of ULP Lease Tracts	3-26
35			
36	3.3-4	Extent of the Uravan Mineral Belt in Relation to Known Uranium-Vanadium Deposits	3-28
37			
38			
39	3.3-5	Geologic Map Covering the ULP Lease Tracts.....	3-29
40			
41	3.3-6	Generalized Stratigraphy of the Paradox Basin	3-31
42			
43	3.3-7	Topography of the Gateway Lease Tracts	3-36
44			
45	3.3-8	Topography of the Uravan Lease Tracts.....	3-37
46			
47			

FIGURES (Cont.)

1			
2			
3			
4	3.3-9	Topography of the Paradox Lease Tracts	3-39
5			
6	3.3-10	Topography of the Slick Rock Lease Tracts.....	3-41
7			
8	3.3-11	Soils within and around the Gateway Lease Tracts	3-44
9			
10	3.3-12	Soils within and around the Uravan Lease Tracts	3-46
11			
12	3.3-13	Soils within and around the Paradox Lease Tracts	3-48
13			
14	3.3-14	Soils within and around the Slick Rock Lease Tracts.....	3-52
15			
16	3.4-1	Average Annual Precipitation in Colorado, 1961–1990.....	3-54
17			
18	3.4-2	Map of Surface Water Features in the Region of the DOE ULP Lease Tracts	3-55
19			
20	3.4-3	Seasonal Hydrograph and Monthly Discharge Values in the Dolores River near Bedrock, Colorado, 1990–2010	3-57
21			
22			
23	3.4-4	Seasonal Hydrograph and Monthly Discharge Values in the San Miguel River near Uravan, Colorado, 1990–2010	3-58
24			
25			
26	3.4-5	Location of Impaired Water Bodies.....	3-66
27			
28	3.4-6	Conceptual Diagram of the Hydrogeologic Stratigraphy of the Paradox Basin.....	3-70
29			
30	3.4-7	Locations of 88 Domestic Wells and One Municipal Well in and near the Lease Tracts	3-74
31			
32			
33	3.5-1	Location of the Proposed Piñon Ridge Mill	3-87
34			
35	3.6-1	Level IV Ecoregions in the Vicinity of DOE ULP Lease Tracts.....	3-94
36			
37	3.6-2	Land Cover Types in the Vicinity of DOE ULP Lease Tracts 26 and 27	3-96
38			
39	3.6-3	Land Cover Types in the Vicinity of DOE ULP Lease Tracts 18–20, 24, and 25.....	3-97
40			
41			
42	3.6-4	Land Cover Types in the Vicinity of DOE ULP Lease Tracts 5–8, 17, and 21–23.....	3-98
43			
44			
45	3.6-5	Land Cover Types in the Vicinity of DOE ULP Lease Tracts 10–16	3-99
46			
47			

FIGURES (Cont.)

1			
2			
3			
4	3.6-6	NWI Wetlands Mapped in the Vicinity of Lease Tracts 13 and 14.....	3-108
5			
6	3.6-7	Wild Turkey Activity Areas within the Three-County Study Area	
7		That Encompasses the Lease Tract Boundaries.....	3-128
8			
9	3.6-8	Desert Bighorn Sheep Activity Areas within the Three-County Study Area	
10		That Encompasses the Lease Tract Boundaries.....	3-135
11			
12	3.6-9	Elk Activity Areas within the Three-County Study Area That Encompasses	
13		the Lease Tract Boundaries.....	3-138
14			
15	3.6-10	Elk Winter Activity Areas within the Lease Tracts	3-139
16			
17	3.6-11	Mule Deer Activity Areas within the Three-County Study Area That	
18		Encompasses the Lease Tract Boundaries	3-141
19			
20	3.6-12	Mule Deer Winter Activity Areas within the Lease Tracts	3-142
21			
22	3.6-13	Pronghorn Activity Areas within the Three-County Study Area That	
23		Encompasses the Lease Tract Boundaries	3-144
24			
25	3.6-14	Locations of Designated Critical Habitat for the Colorado River Endangered	
26		Fishes in the Vicinity of the ULP Lease Tracts	3-167
27			
28	3.6-15	Distribution of Proposed Critical Habitat for the Gunnison Sage-Grouse	
29		in the Vicinity of the ULP Lease Tracts	3-169
30			
31	3.6-16	Recorded Occurrences and Distribution of Potentially Suitable Habitat	
32		for the Mexican Spotted Owl in the Vicinity of the ULP Lease Tracts.....	3-170
33			
34	3.6-17	Distribution of Potentially Suitable Habitat for the Southwestern Willow	
35		Flycatcher in the Vicinity of the ULP Lease Tracts	3-172
36			
37	3.6-18	Distribution of Potentially Suitable Habitat for the Western Yellow-Billed	
38		Cuckoo and Canada Lynx in the Vicinity of the ULP Lease Tracts.....	3-173
39			
40	3.6-19	Distribution of Potentially Suitable Habitat for the Gunnison's Prairie Dog	
41		in the Vicinity of the ULP Lease Tracts	3-174
42			
43	3.7-1	Specially Designated Areas on Public Lands near the ULP Lease Tracts.....	3-180
44			
45	3.7-2	Land with Wilderness Characteristics near the ULP Lease Tracts.....	3-184
46			
47			

FIGURES (Cont.)

1			
2			
3			
4	3.7-3	Wild and Scenic River Segments near the ULP Lease Tracts	3-185
5			
6	3.7-4	Permitted Oil and Gas Wells and Mines within 25 mi of the ULP Lease Tracts ...	3-192
7			
8	3.8-1	ROI Population from 1960–2010.....	3-200
9			
10	3.9-1	Minority Populations within the 50-mi Radius surrounding the Proposed Lease Tracts	3-216
11			
12			
13	3.9-2	Low-Income Populations within the 50-mi Radius surrounding the Proposed Lease Tracts	3-217
14			
15			
16	3.10-1	Road Network by the Lease Tract and Uranium Mills	3-219
17			
18	3.10-2	Local Road Network around the Slick Rock Lease Tracts	3-220
19			
20	3.10-3	Local Road Network around the Paradox and UraVan Lease Tracts	3-221
21			
22	3.10-4	Local Road Network around the Gateway Lease Tracts	3-222
23			
24	3.12-1	Locations of the Four Lease Tract Groups: North; North Central; South Central; and South	3-240
25			
26			
27	3.12-2	View from the Western Edge of Lease Tract 26 Facing Southwest.....	3-242
28			
29	3.12-3	View from Mesa Top near Lease Tract 19 Facing West	3-243
30			
31	3.12-4	View of Lease Tract 16A.....	3-244
32			
33	3.12-5	View of the Cotter Mine on Lease Tract 11	3-245
34			
35	3.12-6	View of the New Verde Mine Reclamation Site on Lease Tract 26.....	3-246
36			
37	3.12-7	View of Lease Tract 19 Facing West.....	3-247
38			
39	3.12-8	View of Entrance to Underground Mine at Lease Tract 18.....	3-248
40			
41	3.12-9	Composite Viewshed of Four Lease Tract Groups.....	3-249
42			
43	3.12-10	Composite Viewshed with Overlay of Sensitive Visual Resource Areas.....	3-251
44			
45	4.1-1	Conceptual Exposure Model for the Exploration, Mining Development and Operations, and Reclamation Phases at the ULP Lease Tracts	4-11
46			
47			

FIGURES (Cont.)

1			
2			
3			
4	4.1-2	Existing Structures in the ULP Lease Tract Surrounding Area.....	4-18
5			
6	4.1-3	Viewshed Analysis for Portions of the North Lease Group under Alternative 1 ...	4-60
7			
8	4.1-4	Viewshed Analysis for the North Central Lease Group under Alternative 1	4-61
9			
10	4.1-5	Viewshed Analysis for the South Central Lease Group under Alternative 1	4-63
11			
12	4.1-6	Viewshed Analysis for the South Lease Group under Alternative 1	4-66
13			
14	4.3-1	Viewshed Analysis for the North Central Lease Group under Alternative 3	4-186
15			
16	4.3-2	Viewshed Analysis for the South Central Lease Group under Alternative 3	4-188
17			
18	4.3-3	Viewshed Analysis for the South Lease Group under Alternative 3	4-191
19			
20	4.4-1	Viewshed Analysis for the North Lease Group under Alternative 4	4-224
21			
22	4.4-2	Viewshed Analysis for the North Central Lease Group under Alternative 4	4-226
23			
24	4.4-3	Viewshed Analysis for the South Central Lease Group under Alternative 4	4-229
25			
26	4.4-4	Viewshed Analysis for the South Lease Group under Alternative 4	4-233
27			
28	4.7-1	Region of Influence for Cumulative Effects	4-275
29			
30	4.7-2	Uranium Mining and Oil and Gas Wells within the Region of Influence	
31		for Cumulative Effects	4-277
32			
33	D.5-1	Designated Grouping of the ULP Lease Tracts Used as a Basis for	
34		Human Health Impacts Evaluation	D-10
35			
36			

TABLES

37			
38			
39			
40	1.1-1	Summary of Three Leasing Programs Administered between 1949 and 2008	1-2
41			
42	1.1-2	Summary of Uranium Ore Production from 1974 to 2008	1-3
43			
44	1.2-1	Summary of the 31 DOE ULP Lease Tracts in 2011.....	1-8
45			
46	1.3-1	Estimated Remaining Ore Reserve at the ULP Lease Tracts	1-15
47			

TABLES (Cont.)

1

2

3

4 1.7-1 Draft ULP PEIS Public Hearing Locations in Colorado, Dates, and

5 Attendance 1-50

6

7 2.2-1 Lease Tracts Evaluated under Alternatives 1 and 2..... 2-19

8

9 2.2-2 Lease Tracts Evaluated under Alternative 3 2-23

10

11 2.2-3 Number of Mines, Ore Production Rate, Disturbed Surface Area, Number of

12 Workers, and Water Usage Assumed for the Peak Year of Operations under

13 Alternative 3..... 2-26

14

15 2.2-4 Number of Mines, Ore Production Rate, and Disturbed Surface Area

16 Assumed for the Peak Year of Operations under Alternative 4..... 2-28

17

18 2.2-5 Amount of Water To Be Utilized per Mine under Alternative 4..... 2-30

19

20 2.2-6 Number of Mines, Ore Production Rate, and Disturbed Surface Area

21 Assumed for the Peak Year of Operations under Alternative 5..... 2-31

22

23 2.2-7 Assumed Amount of Water To Be Utilized per Mine under Alternative 5 2-32

24

25 2.4-1 Meaning of Qualitative Terms Used To Describe Potential Impact Levels 2-34

26

27 2.4-2 Summary of Known Cultural Resource Sites by Lease Tract Cluster 2-52

28

29 2.4-3 Summary of Potential Impacts on Known Cultural Resource Sites 2-52

30

31 2.4-4 Comparison of the Potential Impacts on Air Quality, the Acoustic

32 Environment, and Soil Resources from Alternatives 1 through 5 2-57

33

34 2.4-5 Comparison of the Potential Impacts on Water Resources, Land Use, and

35 Waste Management from Alternatives 1 through 5 2-60

36

37 2.4-6 Comparison of the Potential Impacts on Human Health from

38 Alternatives 1 through 5..... 2-62

39

40 2.4-7 Comparison of the Potential Impacts on Ecological Resources from

41 Alternatives 1 through 5..... 2-65

42

43 2.4-8 Comparison of the Potential Impacts on Socioeconomics, Environmental

44 Justice, and Transportation from Alternatives 1 through 5..... 2-68

45

46

TABLES (Cont.)

1			
2			
3			
4	2.4-9	Comparison of the Potential Impacts on Cultural Resources and Visual Resources from Alternatives 1 through 5	2-70
5			
6			
7	2.5-1	Estimated Amount of Resources Assumed To Be Irreversible and Irretrievable as a Result of the Implementation of the ULP Alternatives.....	2-72
8			
9			
10	3.1-1	Temperature and Precipitation Data Summaries at Selected Meteorological Stations around the ULP Lease Tracts, in Order of Meteorological Station Starting from North to South	3-6
11			
12			
13			
14	3.1-2	Annual Emissions of Criteria Pollutants and Volatile Organic Compounds in Mesa, Montrose, and San Miguel Counties, Colorado, Encompassing the ULP Lease Tracts, 2008	3-9
15			
16			
17			
18	3.1-3	National Ambient Air Quality Standards, Colorado State Ambient Air Quality Standards, and Background Concentration Levels Representative of the ULP Lease Tracts in Mesa, Montrose, and San Miguel Counties, Colorado.....	3-12
19			
20			
21			
22			
23	3.1-4	Maximum Allowable PSD Increments for PSD Class I and Class II Areas.....	3-16
24			
25	3.2-1	Colorado Limits on Maximum Permissible Noise Levels.....	3-22
26			
27	3.3-1	Geologic Units in the Lease Tracts and Their PFYC Ranking.....	3-42
28			
29	3.4-1	Range in Reported Peak Discharge Values for Intermittent and Ephemeral Streams in the Region of the DOE ULP Lease Tracts.....	3-59
30			
31			
32	3.4-2	Impaired Water Bodies on the Colorado 2012 303(d) and M&E Lists or in the Process of Implementing TMDL within the Upper Dolores, San Miguel, and Lower Dolores Watersheds.....	3-61
33			
34			
35			
36	3.4.3	COC Concentrations in the Dolores River at SRE and SRW Sites near Slick Rock Lease Tract 13	3-69
37			
38			
39	3.4-4	Depths to Groundwater Observed in USGS Monitoring Wells Located within the Upper Dolores, San Miguel, and Lower Dolores Basins.....	3-72
40			
41			
42	3.4-5	Monitoring Data Collected at Springs Located within the Vicinity of the DOE ULP Tracts.....	3-73
43			
44			
45	3.4-6	Domestic and Municipal Wells in the Area 5 mi from the DOE ULP Lease Tracts	3-75
46			
47			

TABLES (Cont.)

1			
2			
3			
4	3.4-7	COC Concentrations in Groundwater at SRE and SRW Sites near	
5		Slick Rock Lease Tract 13	3-77
6			
7	3.4-8	Water Use by Category for Mesa, Montrose, and San Miguel Counties	
8		in 2005	3-78
9			
10	3.5-1	Uranium-Mining-Related Regulations and Guidelines for Workers	
11		and Members of the Public	3-84
12			
13	3.5-2	Comparison of Radiation Exposures from Natural Background Sources near	
14		ULP Lease Tracts Versus the U.S. National Average	3-86
15			
16	3.5-3	Estimated Radiation and Chemical Exposures for Receptors in the DOE	
17		Lease Tracts Based on Environmental Monitoring Data from Energy Fuels	
18		Resources Corp.	3-90
19			
20	3.6-1	Land Cover Types within DOE ULP Lease Tracts	3-100
21			
22	3.6-2	Descriptions of Land Cover Types	3-104
23			
24	3.6-3	Noxious Weeds Occurring on or in the Vicinity of ULP Lease Tracts	3-106
25			
26	3.6-4	Wetlands Mapped by the National Wetlands Inventory within ULP Lease	
27		Tracts.....	3-109
28			
29	3.6-5	Descriptions of Wetland Types.....	3-113
30			
31	3.6-6	Number of Wildlife Species in the Three-County Study Area	3-115
32			
33	3.6-7	Amphibian and Reptile Species Expected To Occur within the Lease Tract	
34		Boundaries	3-116
35			
36	3.6-8	Songbird Species Expected To Occur within the Lease Tract Boundaries	3-119
37			
38	3.6-9	Raptor Species Expected To Occur within the Lease Tract Boundaries	3-126
39			
40	3.6-10	Upland Game Bird Species Expected To Occur within the Lease Tract	
41		Boundaries	3-127
42			
43	3.6-11	Acreages of Wild Turkey Activity Areas within the Three-County Study	
44		Area and the Combined Boundary for the Lease Tracts.....	3-129
45			
46			

TABLES (Cont.)

1			
2			
3			
4	3.6-12	Descriptions of Big Game Activity Areas in Colorado	3-131
5			
6	3.6-13	Habitat Information for Big Game Species Expected To Occur within the	
7		Lease Tract Boundaries.....	3-132
8			
9	3.6-14	Acreages of American Black Bear Activity Areas within the	
10		Three-County Study Area and the Combined Boundary for the	
11		Lease Tracts	3-133
12			
13	3.6-15	Acreages of Desert Bighorn Sheep Activity Areas within the	
14		Three-County Study Area and the Combined Boundary for the	
15		Lease Tracts	3-136
16			
17	3.6-16	Acreages of Elk Activity Areas within the Three-County Study Area and	
18		the Combined Boundary for the Lease Tracts	3-140
19			
20	3.6-17	Acreages of Mule Deer Activity Areas within the Three-County Study Area	
21		and the Combined Boundary for the Lease Tracts.....	3-143
22			
23	3.6-18	Acreages of Pronghorn Activity Areas within the Three-County Study Area	
24		and the Combined Boundary for the Lease Tracts.....	3-145
25			
26	3.6-19	Bat Species Reported from Abandoned Mines within the ULP Lease Tracts	3-146
27			
28	3.6-20	Small Game, Furbearer, and Nongame Mammal Species Expected To Occur	
29		within the Lease Tract Boundaries	3-147
30			
31	3.6-21	Threatened, Endangered, and Sensitive Species That May Occur in the	
32		Vicinity of the ULP Lease Tracts	3-154
33			
34	3.6-22	Species Listed, Proposed for Listing, or Candidates for Listing under the	
35		ESA That May Occur in the Vicinity of the ULP Lease Tracts	3-165
36			
37	3.6-23	Number of Sensitive Species That May Occur on or near ULP Lease	
38		Tracts.....	3-176
39			
40	3.7-1	Specially Designated Areas on Public Lands within 25 mi of the ULP Lease	
41		Tracts.....	3-181
42			
43	3.7-2	Lands with Wilderness Characteristics within 25 mi of the ULP Lease Tracts	3-182
44			
45	3.7-3	Eligible Wild and Scenic River Segments within 25 mi of the ULP Lease	
46		Tracts.....	3-186

TABLES (Cont.)

1			
2			
3			
4	3.7-4	Number of Farms and Acreage of Agricultural Lands by County.....	3-189
5			
6	3.7-5	Active Uranium Mining Permits in Southwestern Colorado.....	3-193
7			
8	3.7-6	Uranium Projects in Southwestern Utah, 2010.....	3-194
9			
10	3.8-1	ROI Employment, 2001–2010.....	3-201
11			
12	3.8-2	ROI and State Unemployment Data, 2001–2011	3-201
13			
14	3.8-3	ROI Employment by Sector, 2009.....	3-203
15			
16	3.8-4	ROI Personal Income, 2000–2009.....	3-204
17			
18	3.8-5	ROI Population, 2000–2023	3-204
19			
20	3.8-6	ROI Urban Population and Income, 1999–2010.....	3-206
21			
22	3.8-7	ROI Housing Characteristics, 2000 and 2009.....	3-207
23			
24	3.8-8	ROI Jurisdictions	3-208
25			
26	3.8-9	ROI School District Data, 2010.....	3-208
27			
28	3.8-10	ROI Physicians, 2010.....	3-209
29			
30	3.8-11	ROI Public Safety Employment, 2009.....	3-210
31			
32	3.8-12	ROI and County Crime Rates, 2009	3-210
33			
34	3.9-1	Minority and Low-Income Populations within the 50-mi Radius Surrounding the Proposed Lease Tracts	3-215
35			
36			
37	3.10-1	Annual Average Daily Traffic Volumes for Major Roads near the Lease Tracts, 2010.....	3-223
38			
39			
40	3.11-1	Cultural Resource Survey Coverage of the Lease Tracts	3-230
41			
42	3.11-2	Correlation of Lease Tract Cluster Designations.....	3-231
43			
44	3.11-3	Cultural Resource Survey Coverage, Site Tallies, and Site Density within 15 mi of Lease Tract Clusters	3-231
45			
46			

TABLES (Cont.)

1
2
3
4 3.11-4 Cultural Resource Survey Coverage, Site Tallies, and Site Density within
5 Each Lease Tract Cluster3-231
6
7 3.11-5 Eligible and Potentially Eligible Sites in the Lease Tracts3-233
8
9 3.12-1 Sensitive Visual Resource Areas with Potential Views of the North Group3-252
10
11 3.12-2 Sensitive Visual Resource Areas with Potential Views of the North Central
12 Group3-253
13
14 3.12-3 Sensitive Visual Resource Areas with Potential Visibility of the
15 South Central Group3-254
16
17 3.12-4 Sensitive Visual Resource Areas with Potential Views of the South Group3-256
18
19 4.1-1 Peak-Year Air Emissions from Reclamation under Alternative 1 4-3
20
21 4.1-2 Potential Impacts from Mining Activities on Soil Resources 4-5
22
23 4.1-3 Potential Human Receptors, Uranium Sources, and Exposure Pathways
24 to Exploration, Mining Development and Operations, and Reclamation
25 Phases at the ULP Lease Tracts 4-12
26
27 4.1-4 Dimensions of the Waste-Rock Piles per Mine Size Assumed for Human
28 Health Impact Analysis 4-16
29
30 4.1-5 Estimated Upper-Bound Emission Rates of Particulates, Radon, and
31 Radionuclides for the Four Assumed Waste-Rock Pile Sizes 4-20
32
33 4.1-6 Potential Maximum Radiation Doses and LCF Risks to a Resident as a Result
34 of the Emission of Radon from the Four Assumed Waste-Rock Pile Sizes 4-20
35
36 4.1-7 Potential Maximum Radiation Doses and LCF Risks to a Resident as a
37 Result of the Emission of Particulates from the Four Assumed Waste-Rock
38 Pile Sizes 4-21
39
40 4.1-8 Potential Maximum Total Doses and LCF Risks to a Resident as a Result
41 of the Emission of Radon and Particulates from the Four Assumed Waste-
42 Rock Pile Sizes 4-21
43
44 4.1-9 Seed Mixture Developed for Reseeding on the DOE ULP Lease Tracts 4-28
45
46

TABLES (Cont.)

1		
2		
3		
4	4.1-10	Potential Effects of the Uranium Leasing Program under Alternative 1 on
5		Threatened, Endangered, and Sensitive Species..... 4-33
6		
7	4.1-11	Socioeconomic Impacts of Uranium Mining Reclamation in the Region of
8		Influence under Alternative 1 4-51
9		
10	4.3-1	Peak-Year Air Emissions from Mine Development, Operations, and
11		Reclamation under Alternative 3 4-73
12		
13	4.3-2	Radiation Doses and LCF Risks Received by Underground Uranium Miners
14		under Alternative 3 4-91
15		
16	4.3-3	Radon Emission Rates per Type of Mine during Mine Operations Assumed
17		for Alternative 3 4-94
18		
19	4.3-4	Potential Maximum Radon Levels, Radiation Doses, Radon Concentrations,
20		and LCF Risks to a Resident Associated with the Emission of Radon from
21		Four Uranium Mine Sizes under Alternative 3..... 4-96
22		
23	4.3-5	Collective Doses and LCF Risks to the General Public from Radon Emissions
24		from Uranium Mines during the Peak Year of Operations under Alternative 3..... 4-99
25		
26	4.3-6	Summary of Potential Impacts on Wildlife Associated with Alternative 34-118
27		
28	4.3-7	Potential Impacts on Aquatic Biota Associated with Alternative 3.....4-127
29		
30	4.3-8	Potential Effects of the Uranium Leasing Program under Alternative 3
31		on Threatened, Endangered, and Sensitive Species.....4-132
32		
33	4.3-9	Socioeconomic Impacts of Uranium Mine Development, Operations, and
34		Reclamation in the Region of Influence under Alternative 34-155
35		
36	4.3-10	Recreation Sector Activity in the Region of Influence in 2012.....4-158
37		
38	4.3-11	Impacts from Reductions in Recreation Sector Employment Resulting
39		from Uranium Mining Development in the Region of Influence, 20124-159
40		
41	4.3-12	Distances from Lease Tracts to Ore Processing Mills4-164
42		
43	4.3-13	Peak-Year Collective Population Transportation Impacts under Alternative 3.....4-165
44		
45		

TABLES (Cont.)

1			
2			
3			
4	4.3-14	Potential Haul Truck Traffic on Local Roads.....	4-166
5			
6	4.4-15	Potential Number of Truck Shipments to the White Mesa Mill Passing through Collector Road Intersections with U.S. and State Highways	4-167
7			
8			
9	4.3-16	Potential Number of Truck Shipments to the Piñon Ridge Mill Passing through Collector Road Intersections with U.S. and State Highways	4-169
10			
11			
12	4.3-17	Single-Shipment Collective Population Impacts from Transporting Ore from Lease Tracts to Piñon Ridge Mill	4-173
13			
14			
15	4.3-18	Single-Shipment Collective Population Impacts from Transporting Ore from Lease Tracts to White Mesa Mill.....	4-174
16			
17			
18	4.3-19	Hypothetical Single-Shipment Radiological Impacts on Individual Receptors	4-175
19			
20	4.3-20	Cultural Resource Sites That Could Be Directly Affected under Alternative 3	4-178
21			
22	4.4-1	Peak-Year Air Emissions from Mine Development, Operations, and Reclamation under Alternative 4	4-194
23			
24			
25	4.4-2	Radon Emission Rates per Type of Mine during Mine Operations Assumed for Alternative 4	4-208
26			
27			
28	4.4-3	Collective Doses and LCF Risks to the General Public from Radon Emissions from Uranium Mines during the Peak Year of Operations under Alternative 4.....	4-209
29			
30			
31	4.4-4	Potential Effects of the Uranium Leasing Program under Alternative 4 on Threatened, Endangered, and Sensitive Species That Would Not Be Affected under Alternative 3	4-214
32			
33			
34			
35	4.4-5	Socioeconomic Impacts from Uranium Mine Development, Operations, and Reclamation in the Region of Influence under Alternative 4	4-215
36			
37			
38	4.4-6	Peak-Year Collective Population Transportation Impacts under Alternative 4.....	4-219
39			
40	4.4-7	Cultural Resource Sites That Could Be Directly Affected under Alternative 4	4-222
41			
42	4.5-1	Peak-Year Air Emissions from Mine Development, Operations, and Reclamation under Alternative 5	4-236
43			
44			
45	4.5-2	Radon Emission Rates per Type of Mine during Mine Operations Assumed for Alternative 5	4-246
46			
47			

TABLES (Cont.)

1			
2			
3			
4	4.5-3	Potential Maximum Radiation Doses, Radon Concentrations, and LCF Risks	
5		to a Resident Associated with the Emission of Radon from Three Sizes of	
6		Uranium Mines	4-247
7			
8	4.5-4	Collective Doses and LCF Risks to the General Public from Radon Emissions	
9		from Uranium Mines during the Peak Year of Operations under Alternative 5	4-248
10			
11	4.5-5	Socioeconomic Impacts of Uranium Mine Development, Operations, and	
12		Reclamation in the Region of Influence under Alternative 5	4-254
13			
14	4.5-6	Peak-Year Collective Population Transportation Impacts under Alternative 5	4-257
15			
16	4.5-7	Cultural Resource Sites Expected To Be Directly Affected under	
17		Alternative 5	4-260
18			
19	4.6-1	Measures Identified to Minimize Potential Impacts from Uranium Mining	
20		at the ULP Lease Tracts	4-262
21			
22	4.7-1	Potential Environmental Impacts of the Proposed Piñon Ridge Mill	4-279
23			
24	4.7-2	Potential Environmental Impacts of the Proposed Book Cliff Mine	4-282
25			
26	4.7-3	Potential Environmental Impacts from Operation of the White Mesa Mill	4-288
27			
28	4.7-4	Potential Environmental Impacts of the Daneros Mine	4-291
29			
30	4.7-5	Potential Environmental Impacts of the Whirlwind Mine	4-293
31			
32	4.7-6	Summary of Exploration Plans for the ULP Lease Tracts	4-297
33			
34	4.7-7	Summary of Reclamation Plans Implemented in 2009 to 2011 for the	
35		ULP Lease Tracts	4-299
36			
37	4.7-8	Potential Environmental Impacts of Oil and Gas Exploration	
38		and Development	4-305
39			
40	4.7-9	Potential Environmental Impacts of Livestock Grazing	4-307
41			
42	4.7-10	General Trends in the Region of Influence for Cumulative Effects	4-310
43			
44	4.7-11	Summary of Major Projects and Activities in the Region of Influence	
45		for Cumulative Effects	4-314
46			

TABLES (Cont.)

1
2
3
4 4.7-12 Potential Impacts of Select Projects Considered with the
5 DOE ULP Alternatives 4-322
6
7 5.2-1 Potentially Applicable State Requirements 5-9
8
9 5.3-1 Potentially Applicable County Requirements..... 5-11
10
11 6.1-1 Indian Tribal Governments Contacted by DOE with Regard
12 to Their Interest in Being Consulted on the ULP PEIS 6-2
13
14 6.3-1 NHPA Consultation Efforts 6-6 |
15
16 B-1 Public Scoping Meeting Locations, Dates, and Attendance B-4
17
18 B-2 Public Scoping Comments Considered To Be Within the Scope of the
19 ULP PEIS..... B-5 |
20
21 B-3 Public Scoping Issues Considered To Be Outside the Scope of the ULP PEIS B-12 |
22
23 C.1-1 Number of Mines Considered per Mine Size and Alternative..... C-4
24
25 C.1-2 Total Disturbed Acreage per Mine Size and Alternative during Exploration C-4
26
27 C.1-3 Assumed Workforce per Labor Category and Alternative during Exploration C-5
28
29 C.1-4 Assumed Total Costs per Alternative during Exploration..... C-6
30
31 C.1-5 Assumed Equipment and Total Hours Operated per Mine Size and
32 Alternative during Exploration C-7
33
34 C.1-6 Assumed Total Material Amounts per Alternative during Exploration..... C-8
35
36 C.1-7 Assumed Annual Air Emissions on an Individual Mine Basis during
37 Exploration..... C-9
38
39 C.1-8 Assumed Total Air Emissions during Exploration C-10
40
41 C.1-9 Wastes Generated per Alternative during Exploration C-10
42
43 C.2-1 Estimated Material Amounts and Labor Time per Mine Size during
44 Development C-11
45
46 C.2-2 Estimated Materials and Labor Time per Alternative during Development..... C-11
47

TABLES (Cont.)

1			
2			
3			
4	C.2-3	Number of Workers per Mine Size and Worker Salary per Labor Category	C-12
5			
6	C.2-4	Annual Worker Salaries per Labor Category and Mine Size	C-12
7			
8	C.2-5	Number and Cost of Capital Equipment Units per Mine Size.....	C-13
9			
10	C.2-6	Total Capital Equipment Costs per Alternative	C-14
11			
12	C.2-7	Estimated Total Capital Costs per Mine Size	C-15
13			
14	C.2-8	Estimated Total Capital Costs per Alternative.....	C-16
15			
16	C.2-9	Assumed Annual Air Emissions on an Individual Mine Basis during	
17		Development	C-17
18			
19	C.2-10	Estimated Annual Air Emissions per Alternative during Development.....	C-18
20			
21	C.2-11	Wastes Generated per Alternative during Development	C-18
22			
23	C.2-12	Total Worker Peak-Year Annual Wages per Mine Size and Alternative	C-19
24			
25	C.2-13	Peak-Year Annual Water Usage per Mine Size and Alternative	
26		during Operations.....	C-19
27			
28	C.2-14	Total Peak-Year Annual Cost of Operations per Alternative	C-20
29			
30	C.2-15	Assumed Annual Air Emissions on an Individual Mine Basis during	
31		Operations	C-20
32			
33	C.2-16	Estimated Peak-Year Annual Air Emissions per Alternative during Operations...	C-21
34			
35	C.3-1	Assumed Workforce per Labor Category, Team, JD-7 Mine, and	
36		Alternative during Reclamation.....	C-22
37			
38	C.3-2	Total Disturbed Acreage per Mine Size and Alternative during Reclamation	C-22
39			
40	C.3-3	Assumed Total Costs per Alternative during Reclamation.....	C-23
41			
42	C.3-4	Assumed Equipment and Total Hours of Operation per Mine Size and	
43		Alternative during Reclamation.....	C-24
44			
45	C.3-5	Assumed Amounts of Materials per Mine Size and Alternative during	
46		Reclamation	C-25
47			

TABLES (Cont.)

1
2
3
4 C.3-6 Assumed Annual Air Emissions on an Individual Mine Basis during
5 Reclamation C-26
6
7 C.3-7 Assumed Total Air Emissions during Reclamation..... C-27
8
9 C.3-8 Wastes Generated per Alternative during Reclamation..... C-27
10
11 D.5-1 Meteorological Data Used in the COMPLY-R Calculations..... D-15
12
13 D.5-2 Comparison of the Radon Doses Calculated by CAP88-PC and Those
14 Calculated by COMPLY-R..... D-15
15
16 D.10-1 Individual Exposure Scenarios..... D-31
17
18 D.10-2 Mine Size for Each Lease Tract as Assumed for the Transportation
19 Analysis for Alternatives 3, 4, and 5..... D-34
20
21 E-1 Endangered Species Act Consultation Correspondence E-3
22
23 F-1 Consultation Correspondence F-3
24
25 F-2 Correspondence Regarding the Establishment of a Programmatic
26 Agreement for Section 106 Consultation..... F-94
27
28 G-1 DOE Management Team G-3
29
30 G-2 ULP PEIS Preparers..... G-4
31
32 I.1-1 Draft ULP PEIS Public Hearing Locations in Colorado, Dates, and
33 Estimated Attendance I-2
34
35 I.4-1 Organizations That Submitted Comments in Writing via Letter, E-mail,
36 or Web Portal or Orally at One of the Public Hearings for ULP I-17
37
38 I.4-2 Individuals Who Submitted Comments in Writing via Letter, E-mail,
39 or Web Portal or Orally at One of the Public Hearings for ULP I-17
40

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

This page intentionally left blank

1	CRD	Comment Response Document
2	CRS	<i>Colorado Revised Statutes</i>
3	CWA	Clean Water Act
4	CWCB	Colorado Water Conservation Board
5		
6	DCF	dose conversion factor
7	DEM	Digital Elevation Model
8	DNL	day-night average sound level
9	DOE	U.S. Department of Energy
10	DOE-LM	DOE Office of Legacy Management
11	DOI	U.S. Department of the Interior
12	DOT	U.S. Department of Transportation
13	DPS	distinct population segment (USFWS)
14	DRI	Desert Research Institute
15		
16	EA	environmental assessment
17	EDE	effective dose equivalent
18	EF	enhanced Fujita (scale)
19	EFR	Energy Fuels Resources
20	EIA	Energy Information Administration
21	EIS	environmental impact statement
22	EMF	electromagnetic field
23	E.O.	Executive Order
24	EPA	U.S. Environmental Protection Agency
25	EPP	environmental protection plan
26	EPS	Economic and Planning Systems
27	ERNA	Ecological Research Natural Area
28	ESA	Endangered Species Act
29		
30	FGR	Federal Guidance Report
31	FLM	Federal Land Manager
32	FONSI	Finding of No Significant Impact
33	FR	<i>Federal Register</i>
34	FTW	full-time worker
35		
36	GAO	Government Accountability Office
37	GHG	greenhouse gas
38	GIS	geographic information system
39		
40	HA	herd area
41	HAP	hazardous air pollutant
42	HEAST	Health Effect Assessment Summary Tables
43	HFC	hydrofluorocarbon
44	HI	hazard index
45	HMA	herd management area
46	HMR	hazardous materials regulation (DOT)

1	HQ	hazard quotient
2		
3	I-	Interstate (Highway)
4	ICRP	International Commission on Radiological Protection
5	IDA	intentional destructive act
6	IPaC	Information, Planning, and Conservation System (USFWS)
7	IRIS	Integrated Risk Information System
8	ISM	Integrated Safety Management
9		
10	KOP	key observation point
11	KREX	KREX News Channel
12		
13	L ₉₀	sound level exceeded 90% of the time
14	LCF	latent cancer fatality
15	L _{dn}	day-night average sound level
16	L _{eq}	equivalent continuous sound level
17	L _g	surface wave
18	LHA	landscape health assessment
19	LR2000	Land and Mineral Rehost 2000 System (BLM)
20	LSA	low specific activity
21		
22	M&E	Monitoring & Evaluation (List)
23	ML _g	surface wave magnitude
24	MOU	Memorandum of Understanding
25	MSHA	Mine Safety and Health Administration
26		
27	NAAQS	National Ambient Air Quality Standard(s)
28	NAICS	North American Industry Classification System
29	NCA	National Conservation Area
30	NCDC	National Climatic Data Center
31	NCRP	National Council on Radiation Protection
32	NED	National Elevation Data
33	NEPA	National Environmental Policy Act
34	NESHAP	National Emission Standards for Hazardous Air Pollutants
35	NHPA	National Historic Preservation Act
36	NLCS	National Landscape Conservation System (BLM)
37	NMFS	National Marine Fisheries Service
38	NOI	Notice of Intent
39	NP	National Park
40	NPDES	National Pollutant Discharge Elimination System
41	NPS	National Park Service
42	NRC	U.S. Nuclear Regulatory Commission
43	NRCS	Natural Resources Conservation Service
44	NRHP	<i>National Register of Historic Places</i>
45	NWCC	National Wind Coordinating Committee
46	NWI	National Wetlands Inventory

1		
2	OAHP	Office of Archaeology and Historic Preservation (Colorado)
3	OHV	off-highway vehicle
4	OMP	operations and maintenance plan
5	ONA	Outstanding Natural Area
6	ORV	Outstanding Remarkable Value
7		
8	PA	programmatic agreement
9	PEA	programmatic environmental assessment
10	PEIS	programmatic environmental impact statement
11	PFC	perfluorocarbon
12	PFYC	Potential Fossil Yield Classification
13	P.L.	Public Law
14	PLS	pure live seed
15	PM	particulate matter
16	PM _{2.5}	particulate matter with a mean aerodynamic diameter of 2.5 µm or less
17	PM ₁₀	particulate matter with a mean aerodynamic diameter of 10 µm or less
18	PSD	Prevention of Significant Deterioration
19		
20	QDEH	Queensland Department of Environment and Heritage
21		
22	RCRA	Resource Conservation and Recovery Act
23	RfC	reference dose concentration
24	RfD	reference dose
25	RILOR	reclamation in lieu of royalties
26	RMP	resource management plan
27	RNA	Research Natural Area
28	ROD	Record of Decision
29	ROI	region of influence
30	ROW	right-of-way
31		
32	SAAQS	State Ambient Air Quality Standard(s)
33	SDWA	Safe Drinking Water Act
34	SH	State Highway
35	SHPO	State Historic Preservation Office
36	SIP	State Implementation Plan
37	SJPLC	San Juan Public Lands Center
38	SRE	Slick Rock East
39	SRMA	Special Recreation Management Area
40	SRW	Slick Rock West
41	SVRA	sensitive visual resource area
42	SWCTR	Southwest Colorado Travel Region
43	SWMP	stormwater management plan
44	SWReGAP	Southwest Regional Gap Analysis Project
45		

1	TDS	total dissolved solids
2	TEDE	total effective dose equivalent
3	THC	total hydrocarbons
4	TIS	traffic impact study
5	TMDL	total maximum daily load
6	TSCA	Toxic Substances Control Act
7	TSP	total suspended particulates
8		
9	UCC	Union Carbide Corporation
10	UDEQ	Utah Department of Environmental Quality
11	UDNR	Utah Department of Natural Resources
12	UDOGM	Utah Division of Oil, Gas, and Mining
13	UDOT	Utah Department of Transportation
14	UDWR	Utah Division of Wildlife Resources
15	UGS	Utah Geological Survey
16	ULP	Uranium Leasing Program
17	UMTRCA	Uranium Milling Tailings Radiation Control Act
18	UNSCEAR	United Nations Scientific Committee on the Effects of Radiation
19	US	U.S. Highway
20	USACE	U.S. Army Corps of Engineers
21	USC	<i>United States Code</i>
22	USDA	U.S. Department of Agriculture
23	USFS	U.S. Forest Service
24	USFWS	U.S. Fish and Wildlife Service
25	USGRCRP	U.S. Global Research Change Research Program
26	USGS	U.S. Geological Survey
27		
28	VOC	volatile organic compound
29	VRI	visual resource inventory
30	VRM	visual resource management
31		
32	WA	Wilderness Area
33	WAPA	Western Area Power Administration
34	WHO	World Health Organization
35	WL	working level
36	WLM	working level month
37	WRCC	Western Regional Climate Center
38	WSA	Wilderness Study Area
39	WSR	National Wild and Scenic Rivers
40		
41		
42		

1 **CHEMICALS**

2

3 CH₄ methane
 4 CO carbon monoxide
 5 CO₂ carbon dioxide
 6 CO_{2e} carbon dioxide equivalent

7

8 K-40 potassium-40

9

10 NO₂ nitrogen dioxide11 N₂O nitrous oxide12 NO_x nitrogen oxides

13

14 O₃ ozone

15

16 Pb lead

17

18 SF₆ sulfur hexafluoride19 SO₂ sulfur dioxide

20

21 U₃O₈ uranium oxide (triuranium octoxide)

22

23 V₂O₅ vanadium oxide (divanadium pentoxide)

24

25

26 **UNITS OF MEASURE**

27

28 ac-ft acre-foot (feet)

29

30 bbl barrel(s)

31

32 °C degree(s) Celsius

33 Ci curie(s)

34 cm centimeter(s)

35 cm³ cubic centimeter(s)

36

37 d day(s)

38 dB decibel(s)

39 dBA a-weighted decibel(s)

40

41 °F degree(s) Fahrenheit

42 ft foot (feet)

43 ft³ cubic foot (feet)

44

45 g gram(s)

46 gal gallon(s)

47

1	h	hour(s)
2	ha	hectare(s)
3	hp	horsepower
4	Hz	hertz
5		
6	in.	inch(es)
7	in. ³	cubic inch(es)
8		
9	kg	kilogram(s)
10	km	kilometer(s)
11	km ²	square kilometer(s)
12		
13	L	liter(s)
14	lb	pound(s)
15		
16	m	meter(s)
17	m ²	square meter(s)
18	m ³	cubic meter(s)
19	mg	milligram(s)
20	mGy	milligray
21	mi	mile(s)
22	mi ²	square mile(s)
23	min	minute(s)
24	mm	millimeter(s)
25	mo	month(s)
26	mph	mile(s) per hour
27	mrem	millirem
28	MW	megawatt(s)
29		
30	pCi	picocurie(s)
31	ppb	part(s) per billion
32	ppm	part(s) per million
33		
34	rem	roentgen equivalent man
35		
36	s	second(s)
37		
38	yd	yard(s)
39	yd ³	cubic yard(s)
40	yr	year(s)
41		
42	μg	microgram(s)
43	μm	micrometer(s)
44	μmho(s)	micromho(s)
45	μS	microsievert(s)

1
2
3
4
5
6
7
8
9
10
11
12
13
14

This page intentionally left blank

CONVERSION TABLE
ENGLISH/METRIC AND METRIC/ENGLISH EQUIVALENTS

Multiply	By	To Obtain
<i>English/Metric Equivalentents</i>		
acres	0.004047	square kilometers (km ²)
acre-feet (ac-ft)	1,234	cubic meters (m ³)
cubic feet (ft ³)	0.02832	cubic meters (m ³)
cubic yards (yd ³)	0.7646	cubic meters (m ³)
degrees Fahrenheit (°F) -32	0.5555	degrees Celsius (°C)
feet (ft)	0.3048	meters (m)
gallons (gal)	3.785	liters (L)
gallons (gal)	0.003785	cubic meters (m ³)
inches (in.)	2.540	centimeters (cm)
miles (mi)	1.609	kilometers (km)
miles per hour (mph)	1.609	kilometers per hour (kph)
pounds (lb)	0.4536	kilograms (kg)
short tons (tons)	907.2	kilograms (kg)
short tons (tons)	0.9072	metric tons (t)
square feet (ft ²)	0.09290	square meters (m ²)
square yards (yd ²)	0.8361	square meters (m ²)
square miles (mi ²)	2.590	square kilometers (km ²)
yards (yd)	0.9144	meters (m)
<i>Metric/English Equivalentents</i>		
centimeters (cm)	0.3937	inches (in.)
cubic meters (m ³)	0.00081	acre-feet (ac-ft)
cubic meters (m ³)	35.31	cubic feet (ft ³)
cubic meters (m ³)	1.308	cubic yards (yd ³)
cubic meters (m ³)	264.2	gallons (gal)
degrees Celsius (°C) +17.78	1.8	degrees Fahrenheit (°F)
hectares (ha)	2.471	acres
kilograms (kg)	2.205	pounds (lb)
kilograms (kg)	0.001102	short tons (tons)
kilometers (km)	0.6214	miles (mi)
kilometers per hour (kph)	0.6214	miles per hour (mph)
liters (L)	0.2642	gallons (gal)
meters (m)	3.281	feet (ft)
meters (m)	1.094	yards (yd)
metric tons (t)	1.102	short tons (tons)
square kilometers (km ²)	247.1	acres
square kilometers (km ²)	0.3861	square miles (mi ²)
square meters (m ²)	10.76	square feet (ft ²)
square meters (m ²)	1.196	square yards (yd ²)

1
2
3
4

5
6

1
2
3
4
5
6
7
8
9
10
11
12
13
14

This page intentionally left blank