

Contents

Executive Summary	iii
Acknowledgments	xiii
List of Tables	xxi
List of Figures	xxii

CHAPTER 1: INTRODUCTION

1.1 Laboratory Mission and Policy	1-1
1.2 Research and Discoveries	1-2
1.3 History	1-2
1.4 Facilities and Operations	1-8
1.5 Location, Local Population, and Local Economy	1-9
1.6 Geology and Hydrology	1-10
1.7 Climate	1-14
1.8 Natural Resources	1-14
1.9 Cultural Resources	1-15
References and Bibliography	1-15

CHAPTER 2: ENVIRONMENTAL MANAGEMENT SYSTEM

2.1 Integrated Safety Management and ISO 14001	2-2
2.2 Environmental, Safety, Security, and Health Policy	2-3
2.3 Planning	2-3
2.3.1 Environmental Aspects	2-3
2.3.2 Compliance Obligations	2-3
2.3.3 Objectives and Targets	2-4
2.3.4 Environmental Management Programs	2-4
2.3.4.1 Compliance	2-4
2.3.4.2 Groundwater Protection	2-4
2.3.4.3 Waste Management	2-5
2.3.4.4 Pollution Prevention and Waste Minimization	2-7
2.3.4.5 Water Conservation	2-10
2.3.4.6 Energy Management and Conservation	2-11
2.3.4.7 Natural and Cultural Resource Management Programs	2-13
2.3.4.8 Environmental Restoration	2-14
2.4 Implementing the Environmental Management System	2-16
2.4.1 Structure and Responsibility	2-16
2.4.2 Communication and Community Involvement	2-16

2.4.2.1	Communication Forums.....	2-17
2.4.2.2	Community Involvement in Cleanup Projects.....	2-18
2.4.3	Monitoring and Measurement.....	2-19
2.4.3.1	Compliance Monitoring.....	2-19
2.4.3.2	Restoration Monitoring.....	2-20
2.4.3.3	Surveillance Monitoring.....	2-20
2.4.4	EMS Assessments.....	2-22
2.5	Environmental Stewardship at BNL.....	2-22
	References and Bibliography.....	2-23

CHAPTER 3: COMPLIANCE STATUS

3.1	Compliance with Requirements.....	3-2
3.2	Compliance With Requirements.....	3-2
3.2.1	Existing Permits.....	3-2
3.2.2	New or Modified Permits.....	3-2
3.2.2.1	New York State Wetlands and Wild, Scenic, Recreational Rivers Act....	3-2
3.2.2.2	Title V Permit.....	3-2
3.3	NEPA Assessments.....	3-9
3.4	Preservation Legislation.....	3-9
3.5	Clean Air Act (CAA).....	3-9
3.5.1	Conventional Air Pollutants.....	3-9
3.5.1.1	Boiler Emissions.....	3-9
3.5.1.2	Ozone-Depleting Substances.....	3-10
3.5.2	Hazardous Air Pollutants.....	3-10
3.5.2.1	Maximum Available Control Technology.....	3-10
3.5.2.2	Asbestos.....	3-11
3.5.2.3	Radioactive Airborne Emissions.....	3-11
3.6	Clean Water Act.....	3-11
3.6.1	Sewage Treatment Plant.....	3-12
3.6.2	Recharge Basins and Stormwater.....	3-16
3.7	Safe Drinking Water Act.....	3-18
3.7.1	Potable Water.....	3-18
3.7.2	Cross-Connection Control.....	3-23
3.7.3	Underground Injection Control.....	3-24
3.8	Preventing and Reporting Spills.....	3-24
3.8.1	Preventing Oil Pollution and Spills.....	3-24
3.8.2	Emergency Reporting Requirements.....	3-24
3.8.3	Spills and Releases.....	3-25
3.8.4	Major Petroleum Facility License.....	3-25
3.8.5	Chemical Bulk Storage.....	3-26

3.8.6 County Storage Requirements.....	3-26
3.9 RCRA Requirements	3-27
3.10 Polychlorinated Biphenyls.....	3-28
3.11 Pesticides	3-28
3.12 Wetlands and River Permits	3-28
3.13 Protection of Wildlife.....	3-29
3.13.1 Endangered Species Act.....	3-29
3.13.2 Migratory Bird Treaty Act	3-30
3.13.3 Bald and Golden Eagle Protection Act.....	3-30
3.14 Public Notification of Clearance of Property	3-31
3.15 External Audits and Oversight	3-31
3.15.1 Regulatory Agency Oversight	3-31
3.15.2 DOE Assessments/Inspections.....	3-31
3.15.3 Environmental Multi-Topic Assessment.....	3-31
3.15.4 Nevada National Security Site.....	3-32
3.16 Agreements, Enforcement Actions, and Other Environmental Reports.....	3-33
References and Bibliography	3-33

CHAPTER 4: AIR QUALITY

4.1 Radiological Emissions.....	4-1
4.2 Facility Monitoring	4-1
4.2.1 High Flux Beam Reactor	4-1
4.2.2 Brookhaven Linac Isotope Producer	4-2
4.2.3 Target Processing Laboratory	4-3
4.2.4 Additional Minor Sources.....	4-3
4.2.5 Nonpoint Radiological Emission Sources.....	4-3
4.3 Ambient Air Monitoring.....	4-3
4.3.1 Gross Alpha and Beta Airborne Activity	4-4
4.3.2 Airborne Tritium	4-5
4.4 Nonradiological Airborne Emissions.....	4-5
4.5 Greenhouse Gas Emissions	4-7
References and Bibliography.....	4-10

CHAPTER 5: WATER QUALITY

5.1 Surface Water Monitoring Program.....	5-1
5.2 Sanitary System Effluents.....	5-3
5.2.1 Sanitary System Effluent – Radiological Analyses.....	5-4
5.2.2 Sanitary System Effluent – Nonradiological Analyses	5-6
5.3 Process-Specific Wastewater.....	5-6

5.4 Recharge Basins	5-7
5.4.1 Recharge Basins – Radiological Analyses.....	5-10
5.4.2 Recharge Basins – Nonradiological Analyses.....	5-11
5.4.3 Stormwater Assessment	5-12
5.5 Peconic River Surveillance.....	5-14
5.5.1 Peconic River – Radiological Analyses.....	5-15
5.5.2 Peconic River – Nonradiological Analyses.....	5-15
References and Bibliography.....	5-15

CHAPTER 6: NATURAL AND CULTURAL RESOURCES

6.1 Natural Resource Management Program.....	6-1
6.1.1 Identification and Mapping	6-1
6.1.2 Habitat Protection and Enhancement	6-3
6.1.2.1 Salamander Protection Efforts.....	6-3
6.1.2.2 Banded Sunfish	6-4
6.1.2.3 Migratory Birds	6-4
6.1.2.4 Bald Eagle	6-5
6.1.2.5 Northern Long-eared Bat.....	6-5
6.1.3 Population Management	6-5
6.1.3.1 Wild Turkey	6-5
6.1.3.2 White-Tailed Deer.....	6-5
6.1.4 Compliance Assurance and Potential Impact Assessment.....	6-6
6.2 Upton Ecological and Research Reserve.....	6-6
6.3 Monitoring Flora and Fauna	6-7
6.3.1 Deer Sampling.....	6-7
6.3.1.1 Cesium-137 in White-Tailed Deer	6-8
6.3.2 Other Animals Sampled.....	6-13
6.3.3 Fish Sampling.....	6-13
6.3.3.1 Fish Population Assessment	6-13
6.3.4 Vegetation Sampling.....	6-14
6.3.4.1 Grassy Plants and Soil	6-14
6.4 Precipitation Monitoring.....	6-14
6.4.1 Mercury Monitoring of Precipitation	6-14
6.5 Wildlife Programs	6-14
6.6 Cultural Resource Activities	6-16
References and Bibliography.....	6-17

CHAPTER 7: GROUNDWATER PROTECTION

7.1 The BNL Groundwater Protection Management Program.....	7-1
7.1.1 Prevention	7-1
7.1.2 Monitoring	7-2
7.1.3 Restoration.....	7-2
7.1.4 Communication	7-2
7.2 Groundwater Protection Performance	7-2
7.3 Groundwater Monitoring Programs	7-3
7.4 Groundwater Monitoring Results	7-3
7.5 Groundwater Treatment Systems	7-7
References and Bibliography.....	7-10

CHAPTER 8: RADIOLOGICAL DOSE ASSESSMENT

8.0 Introduction.....	8-2
8.1 Direct Radiation Monitoring	8-2
8.1.1 Ambient Radiation Monitoring.....	8-2
8.1.2 Facility Area Monitoring	8-6
8.1.2.1 Neutron Monitoring	8-9
8.2 Dose Modeling for Airborne Radionuclides	8-9
8.2.1 Dose Modeling Program.....	8-10
8.2.2 Dose Calculation Methods and Pathways.....	8-12
8.2.2.1 Maximally Exposed Off-site and On-site Individual.....	8-12
8.2.2.2 Dose Calculation: Fish Ingestion	8-13
8.2.2.3 Dose Calculation: Deer Meat Ingestion	8-13
8.3 Sources: Diffuse, Fugitive, “Other”	8-13
8.3.1 Remediation Work	8-13
8.4 Dose From Point Sources	8-13
8.4.1 Brookhaven Linac Isotope Producer.....	8-13
8.4.2 Target Processing Laboratory.....	8-14
8.4.3 High Flux Beam Reactor.....	8-14
8.4.4 Brookhaven Medical Research Reactor	8-14
8.4.5 Brookhaven Graphite Research Reactor.....	8-14
8.4.6 Waste Management Facility	8-15
8.4.7 Unplanned Releases.....	8-15
8.5 Dose from Ingestion	8-15
8.6 Dose to Aquatic and Terrestrial Biota.....	8-15
8.7 Dose From All Pathways	8-16
References and Bibliography.....	8-16

CHAPTER 9: QUALITY ASSURANCE

9.1 Quality Program Elements	9-1
9.2 Sample Collection and Handling.....	9-2
9.2.1 Field Sample Handling.....	9-3
9.2.1.1 Custody and Documentation	9-3
9.2.1.2 Preservation and Shipment	9-3
9.2.2 Field Quality Control Samples.....	9-3
9.2.3 Tracking and Data Management.....	9-4
9.3 Sample Analysis.....	9-4
9.3.1 Qualifications.....	9-5
9.4 Verification and Validation of Analytical Results	9-5
9.4.1 Checking Results	9-7
9.5 Contract Analytical Laboratory QA/QC	9-7
9.6 Performance or Proficiency Evaluations.....	9-7
9.6.1 Summary of Test Results.....	9-7
9.6.1.1 Radiological Assessments	9-9
9.6.1.2 Nonradiological Assessments	9-9
9.7 Audits	9-9
9.8 Conclusion.....	9-10
References and Bibliography	9-10
Appendix A: Glossary.....	A-1
Acronyms and Abbreviations.....	A-1
Technical Terms.....	A-5
Appendix B: Understanding Radiation.....	B-1
Appendix C: Units of Measure and Half-Life Periods	C-1
Appendix D: Federal, State, and Local Laws and Regulations Pertinent to BNL	D-1
Appendix E: BNL Site Sustainability Plan: Status Summary for Fiscal Year 2020	E-1