

Contents

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

Chapter 1: Introduction

1.1 Laboratory Vision and Mission.....	1-3
1.2 Major Initiatives	1-5
1.3 History and Overview of Major Scientific Facilities	1-7
1.4 Facilities and Operations	1-12
1.5 Location, Local Population, and Local Economy.....	1-15
1.6 Geology and Hydrology.....	1-16
1.7 Climate	1-18
1.8 Natural Resources	1-21
1.9 Cultural Resources.....	1-21
References and Bibliography.....	1-22

Chapter 2: Environmental Management System

2.1 Integrated Safety Management and ISO 14001	2-4
2.2 Environmental, Safety, Security, and Health Policy	2-5
2.3 Planning.....	2-6
2.3.1 Environmental Aspects.....	2-6
2.3.2 Compliance Obligations	2-6
2.3.3 Objectives and Targets.....	2-7
2.4 Environmental Management Programs	2-7
2.4.1 Compliance	2-7
2.4.2 Groundwater Protection	2-8
2.4.3 Waste Management	2-8
2.4.4 Pollution Prevention and Waste Minimization	2-10
2.4.5 Water Conservation.....	2-14
2.4.6 Energy Management and Conservation	2-14
2.4.6.1 Site Energy Usage	2-15
2.4.6.2 Current Conservation Efforts	2-16
2.4.6.3 Future Federal Net-Zero Goals.....	2-17
2.4.7 Natural and Cultural Resource Management Programs.....	2-19
2.4.8 Environmental Restoration.....	2-19
2.5 Implementing the Environmental Management System	2-21
2.5.1 Structure and Responsibility.....	2-21
2.5.2 Communication, Community Involvement and Environmental Justice.....	2-22
2.5.2.1 Communication Forums.....	2-22



2.5.2.2 Community Involvement in Cleanup Projects	2-24
2.5.2.3 Environmental Justice	2-24
2.5.3 Monitoring and Measurement.....	2-25
2.5.3.1 Compliance Monitoring	2-27
2.5.3.2 Restoration Monitoring.....	2-28
2.5.3.3 Surveillance Monitoring	2-28
2.5.4 EMS Assessments	2-28
2.6 Environmental Stewardship at BNL.....	2-29
References and Bibliography	2-30

Chapter 3: Compliance Status

3.1 Compliance with Requirements	3-4
3.2 Compliance with Requirements	3-8
3.2.1 Existing Permits	3-8
3.2.2 New or Modified Permits	3-11
3.2.2.1 New York State Wetlands and Wild, Scenic, Recreational Rivers Act.....	3-11
3.2.3. EPA's Enforcement & Compliance History Online (ECHO).....	3-11
3.3 National Environmental Policy Act (NEPA) Assessments.....	3-11
3.4 Preservation Legislation.....	3-11
3.5 Clean Air Act (CAA)	3-12
3.5.1 Conventional Air Pollutants.....	3-12
3.5.1.1 Boiler Emissions	3-12
3.5.1.2 Ozone-Depleting Substances.....	3-13
3.5.2 Hazardous Air Pollutants	3-13
3.5.2.1 Maximum Available Control Technology	3-13
3.5.2.2 Asbestos	3-14
3.5.2.3 Radioactive Airborne Emissions	3-14
3.6 Clean Water Act (CWA)	3-14
3.6.1 Sewage Treatment Plant (STP)	3-15
3.6.2 Recharge Basins and Stormwater	3-21
3.7 Safe Drinking Water Act (SDWA).....	3-21
3.7.1 Potable Water	3-21
3.7.2 Cross-Connection Control.....	3-27
3.7.3 Underground Injection Control.....	3-27
3.8 Preventing and Reporting Spills.....	3-27
3.8.1 Preventing Oil Pollution and Spills.....	3-27
3.8.2 Emergency Reporting Requirements	3-28
3.8.3 Spills and Releases	3-28
3.8.4 Major Petroleum Facility (MPF) License.....	3-30
3.8.5 Chemical Bulk Storage (CBS).....	3-31
3.8.6 County Storage Requirements	3-31
3.9 Resource Conservation and Recovery Act (RCRA) Requirements.....	3-31



3.10 Polychlorinated Biphenyls (PCBs)	3-32
3.11 Pesticides	3-32
3.12 Wetlands and River Permits.....	3-33
3.13 Protection of Wildlife	3-33
3.13.1 Endangered Species Act	3-33
3.13.2 Migratory Bird Treaty Act.....	3-35
3.13.3 Bald and Golden Eagle Protection Act	3-35
3.14 Public Notification of Clearance of Property	3-35
3.15 External Audits and Oversight	3-36
3.15.1 Regulatory Agency Oversight.....	3-36
3.15.2 DOE Assessments/Inspections.....	3-36
3.15.3 Environmental Multi-Topic Assessment	3-36
3.15.4 Nevada National Security Site.....	3-36
3.16 Agreements, Enforcement Actions, and Other Environmental Reports.....	3-37
References and Bibliography	3-38

Chapter 4: Air Quality

4.1 Radiological Emissions.....	4-3
4.2 Facility Monitoring	4-5
4.2.1 High Flux Beam Reactor (HFBR)	4-5
4.2.2 Brookhaven LINAC Isotope Producer (BLIP)	4-5
4.2.3 Radionuclide Research and Production Laboratory (RRPL).....	4-6
4.2.4 Additional Minor Sources.....	4-6
4.2.5 Nonpoint Radiological Emission Sources	4-6
4.3 Ambient Air Monitoring.....	4-7
4.3.1 Gross Alpha and Beta Airborne Activity.....	4-8
4.3.2 Airborne Tritium	4-9
4.4 Non-radiological Airborne Emissions	4-10
4.5 Greenhouse Gas Emissions.....	4-12
4.5.1 Hydrofluorocarbons.....	4-13
References and Bibliography	4-13

Chapter 5: Water Quality

5.1 Surface Water Monitoring Program.....	5-3
5.2 Sanitary System Effluent.....	5-5
5.2.1 Sanitary System Effluent – Radiological Analyses.....	5-6
5.2.2 Sanitary System Effluent – Non-radiological Analyses	5-6
5.3 Process-Specific Wastewater	5-8
5.4 Recharge Basins.....	5-8
5.4.1 Recharge Basins – Radiological Analyses	5-11
5.4.2 Basins – Non-radiological Analyses.....	5-11
5.4.3 Stormwater Management	5-15



5.5 Peconic River Surveillance.....	5-15
5.5.1 Peconic River – Radiological Analyses	5-16
5.5.2 Peconic River – Non-radiological Analyses.....	5-16
References and Bibliography.....	5-20

Chapter 6: Natural and Cultural Resources

6.1 Natural Resource Management Program (NRMP)	6-3
6.1.1 Identification and Mapping.....	6-3
6.1.2 Habitat Protection and Enhancement	6-5
6.1.2.1 Salamander Protection Efforts.....	6-5
6.1.2.2 Banded Sunfish	6-6
6.1.2.3 Migratory Birds	6-6
6.1.2.4 Bald Eagle	6-7
6.1.2.5 Northern Long-eared Bat.....	6-7
6.1.3 Population Management.....	6-7
6.1.3.1 White-Tailed Deer.....	6-7
6.1.4 Compliance Assurance and Potential Impact Assessment.....	6-8
6.2 Upton Ecological and Research Reserve	6-8
6.3 Monitoring Flora and Fauna.....	6-9
6.3.1 Deer Sampling	6-9
6.3.1.1 Cesium-137 in White-Tailed Deer	6-11
6.3.2 Fish Sampling	6-15
6.3.2.1 Fish Population Assessment	6-15
6.3.3 Vegetation Sampling	6-16
6.3.3.1 Grassy Plants and Soil	6-16
6.4 Other Monitoring	6-16
6.4.1 Basin Sediments.....	6-16
6.4.2 Precipitation Monitoring for Mercury.....	6-18
6.5 Educational Programs	6-18
6.6 Cultural Resource Activities	6-19
References and Bibliography.....	6-19

Chapter 7: Groundwater Protection

7.1 The BNL Groundwater Protection Management Program.....	7-3
7.1.1 Protection	7-4
7.1.2 Monitoring	7-4
7.1.3 Remediation	7-5
7.1.4 Communication	7-5
7.2 Groundwater Protection Performance.....	7-5
7.3 Groundwater Monitoring Programs.....	7-5
7.3.1 Emerging Contaminants of Concern	7-6
7.4 Groundwater Monitoring Results	7-8



7.5 Groundwater Treatment Systems	7-13
References and Bibliography.....	7-16

Chapter 8: Radiological Dose Assessment

8.0 Introduction	8-4
8.1 Direct Radiation Monitoring	8-4
8.1.1 Ambient Radiation Monitoring.....	8-4
8.1.2 Facility Area Monitoring.....	8-9
8.1.2.1 Neutron Monitoring	8-10
8.2 Dose Modeling for Airborne Radionuclides	8-12
8.2.1 Dose Modeling Program	8-14
8.2.2 Dose Calculation Methods and Pathways.....	8-15
8.2.2.1 Maximally Exposed Off-site and On-site Individual.....	8-15
8.2.2.2 Dose Calculation: Fish Ingestion	8-15
8.2.2.3 Dose Calculation: Deer Meat Ingestion.....	8-15
8.3 Sources: Diffuse, Fugitive, "Other"	8-16
8.3.1 Remediation Work.....	8-16
8.4 Dose From Air Emission-Monitored Facilities.....	8-16
8.4.1 Brookhaven LINAC Isotope Producer (BLIP)	8-16
8.4.2 Radionuclide Research and Production Laboratory (RRPL).....	8-16
8.4.3 High Flux Beam Reactor (HFBR).....	8-17
8.4.4 Brookhaven Medical Research Reactor (BMRR)	8-17
8.4.5 Brookhaven Graphite Research Reactor (BGRR)	8-17
8.4.6 Waste Management Facility	8-17
8.4.7 Unplanned Releases.....	8-17
8.5 Dose From Ingestion	8-17
8.6 Dose to Aquatic and Terrestrial Biota	8-18
8.7 Dose From All Pathway	8-18
References and Bibliography.....	8-20

Chapter 9: Quality Assurance

9.1 Quality Program Elements	9-3
9.2 Sample Collection and Handling.....	9-5
9.2.1 Field Sample Handling	9-5
9.2.1.1 Custody and Documentation	9-5
9.2.1.2 Preservation and Shipment	9-6
9.2.2 Field Quality Control Samples	9-6
9.2.3 Tracking and Data Management	9-8
9.3 Sample Analysis.....	9-9
9.3.1 Qualifications	9-9
9.4 Verification and Validation of Analytical Results	9-10
9.4.1 Checking Results.....	9-11



9.5 Contract Analytical Laboratory QA/QC	9-11
9.6 Performance or Proficiency Evaluations	9-11
9.6.1 Summary of Test Results	9-12
9.6.1.1 Radiological Assessments	9-13
9.6.1.2 Non-radiological Assessments	9-13
9.7 Audits	9-14
9.8 Conclusion.....	9-14
References and Bibliography.....	9-14
 Appendix A: Glossary.....	A-1
Acronyms and Abbreviations.....	A-1
Technical Terms	A-6
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 2023	E-1

