
October 2017
FOREWORD

This National Report describes the implementation status of the Republic of Korea as a contracting party to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (hereinafter referred to as “Joint Convention”) which deposited the instruments of ratification on September 16, 2002.

This National Report was prepared in accordance with the “Guidelines Regarding the Form and Structure of National Reports (INFCIRC/604/Rev.3)” under the Joint Convention and described the implementation status by reflecting the observations given in the Summary Report of the 5th Review Meeting. This Report maintains the structure of article-by-article approach based on every implementation of the obligations contained within the topical arrangement of the Joint Convention. The cutoff date of this national report preparation was March 31, 2017, otherwise specified in the report.

This National Report covers the civilian facilities and their associated lands, buildings and equipment in which spent fuel and radioactive waste were handled, processed, stored or disposed of on such a scale that consideration of safety is required under the jurisdiction of Korea as defined in Articles 2 and 3 of the Joint Convention.

This National Report was drafted by the “Working Group for the Implementation of the Joint Convention” organized by the Nuclear Safety and Security Commission (NSSC), Korea Institute of Nuclear Safety (KINS), Korea Radioactive Waste Agency (KORAD), Korea Atomic Energy Research Institute (KAERI), Korea Hydro & Nuclear Power Co., Ltd (KHNP), Korea Electric Power Corporation Nuclear Fuel Co., Ltd (KEPCO NF).
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEC</td>
<td>Atomic Energy Committee</td>
</tr>
<tr>
<td>AFR</td>
<td>Away From Reactor</td>
</tr>
<tr>
<td>ALARA</td>
<td>As Low As Reasonably Achievable</td>
</tr>
<tr>
<td>APPRE</td>
<td>Act on Physical Protection and Radiological Emergency</td>
</tr>
<tr>
<td>AtomCARE</td>
<td>Atomic Computerized Technical Advisory System for the Radiological Emergency</td>
</tr>
<tr>
<td>CANARE</td>
<td>Convention on Early Notification of a Nuclear Accident</td>
</tr>
<tr>
<td>CENNA</td>
<td>Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency</td>
</tr>
<tr>
<td>CP</td>
<td>Construction Permit</td>
</tr>
<tr>
<td>DAW</td>
<td>Dry Active Waste</td>
</tr>
<tr>
<td>EAB</td>
<td>Exclusion Area Boundary</td>
</tr>
<tr>
<td>EBA</td>
<td>Electricity Business Act</td>
</tr>
<tr>
<td>ECL</td>
<td>Effluent Control Limit</td>
</tr>
<tr>
<td>FSAR</td>
<td>Final Safety Analysis Report</td>
</tr>
<tr>
<td>HANARO</td>
<td>High-flux Advanced Neutron Application Reactor</td>
</tr>
<tr>
<td>HEPA</td>
<td>High-Efficiency Particulate Air</td>
</tr>
<tr>
<td>HLW</td>
<td>High Level Radioactive Waste</td>
</tr>
<tr>
<td>IAEA</td>
<td>International Atomic Energy Agency</td>
</tr>
<tr>
<td>ICRP</td>
<td>International Commission on Radiological Protection</td>
</tr>
<tr>
<td>INES</td>
<td>International Nuclear Event Scale</td>
</tr>
<tr>
<td>INSS</td>
<td>International Nuclear Safety School</td>
</tr>
<tr>
<td>IRRS</td>
<td>Integrated Regulatory Review Service</td>
</tr>
<tr>
<td>KAERI</td>
<td>Korea Atomic Energy Research Institute</td>
</tr>
<tr>
<td>KEPCO NF</td>
<td>KEPCO Nuclear Fuel Co., Ltd.</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>KHNP</td>
<td>Korea Hydro &amp; Nuclear Power Co., Ltd.</td>
</tr>
<tr>
<td>KINS</td>
<td>Korea Institute of Nuclear Safety</td>
</tr>
<tr>
<td>KISOE</td>
<td>Korea Information System on Occupational Exposure</td>
</tr>
<tr>
<td>KIRAMS</td>
<td>Korea Institute of Radiological and Medical Science</td>
</tr>
<tr>
<td>KoFONS</td>
<td>Korea Foundation of Nuclear Safety</td>
</tr>
<tr>
<td>KORAD</td>
<td>Korea Radioactive Waste Agency</td>
</tr>
<tr>
<td>KRR</td>
<td>Korea Research Reactor</td>
</tr>
<tr>
<td>KRMC</td>
<td>Korea Radioactive Waste Management Corporation</td>
</tr>
<tr>
<td>LEMC</td>
<td>Local Emergency Management Center</td>
</tr>
<tr>
<td>LILW</td>
<td>Low and Intermediate Level Radioactive Waste</td>
</tr>
<tr>
<td>MOE</td>
<td>Ministry of Environment</td>
</tr>
<tr>
<td>MOEL</td>
<td>Ministry of Employment and Labor</td>
</tr>
<tr>
<td>MOLIT</td>
<td>Ministry of Land, Infrastructure and Transport</td>
</tr>
<tr>
<td>MOSPA</td>
<td>Ministry of Security and Public Administration</td>
</tr>
<tr>
<td>MOST</td>
<td>Ministry of Science and Technology</td>
</tr>
<tr>
<td>MOTIE</td>
<td>Ministry of Trade, Industry and Energy</td>
</tr>
<tr>
<td>MSIT</td>
<td>Ministry of Science and ICT</td>
</tr>
<tr>
<td>MSIP</td>
<td>Ministry of Science, ICT and Future Planning</td>
</tr>
<tr>
<td>NEMA</td>
<td>National Emergency Management Agency</td>
</tr>
<tr>
<td>NPP</td>
<td>Nuclear Power Plant</td>
</tr>
<tr>
<td>NSA</td>
<td>Nuclear Safety Act</td>
</tr>
<tr>
<td>NSSC</td>
<td>Nuclear Safety and Security Commission</td>
</tr>
<tr>
<td>NSIC</td>
<td>Nuclear Safety Information Center</td>
</tr>
<tr>
<td>OEMC</td>
<td>Off-site Emergency Management Center</td>
</tr>
<tr>
<td>OL</td>
<td>Operation License</td>
</tr>
<tr>
<td>PHWR</td>
<td>Pressurized Heavy Water Reactor</td>
</tr>
<tr>
<td>PIEF</td>
<td>Post-Irradiation Examination Facility</td>
</tr>
</tbody>
</table>
# List of Abbreviation

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSAR</td>
<td>Preliminary Safety Analysis Report</td>
</tr>
<tr>
<td>PSR</td>
<td>Periodic Safety Review</td>
</tr>
<tr>
<td>PWR</td>
<td>Pressurized Water Reactor</td>
</tr>
<tr>
<td>QA</td>
<td>Quality Assurance</td>
</tr>
<tr>
<td>QAP</td>
<td>Quality Assurance Program</td>
</tr>
<tr>
<td>RCA</td>
<td>Radiation Control Area</td>
</tr>
<tr>
<td>RER</td>
<td>Radiological Environmental Report</td>
</tr>
<tr>
<td>RI</td>
<td>Radioisotope</td>
</tr>
<tr>
<td>RWMA</td>
<td>Radioactive Waste Management Act</td>
</tr>
<tr>
<td>SAR</td>
<td>Safety Analysis Report</td>
</tr>
<tr>
<td>SIR</td>
<td>Site Investigation Report</td>
</tr>
<tr>
<td>SIREN</td>
<td>System for Identifying Radiation in Environments Nationwide</td>
</tr>
<tr>
<td>SSC</td>
<td>Structures, Systems and Components</td>
</tr>
<tr>
<td>UCF</td>
<td>Uranium Conversion Facility</td>
</tr>
<tr>
<td>WACID</td>
<td>Waste Comprehensive Information Database</td>
</tr>
</tbody>
</table>
FOREWORD

List of Abbreviation

A. Introduction .................................................................................................................................................. 1
   A.1 Preface .................................................................................................................................................. 3
   A.2 Major Changes and Improvements since the 5th Review Meeting ..................................................... 6
   A.3 Implementation of the Challenges and Proposed Good Practices .................................................... 9
      A.3.1 Implementation Status of Challenges from 5th Review Meeting ............................................. 9
      A.3.2 Proposed Good Practices ............................................................................................................ 10
   A.4 Overview Matrix .................................................................................................................................. 13

B. Policies and Practices (Article 32, Paragraph 1) ................................................................................... 15
   B.1 Policy for Radioactive Waste and Spent Fuel Management .............................................................. 17
      B.1.1 Basic Policy .................................................................................................................................. 17
      B.1.2 Strategy and Management Plan .................................................................................................. 19
   B.2 Spent Fuel Management Practices ..................................................................................................... 21
      B.2.1 Nuclear Power Plants .................................................................................................................. 21
      B.2.2 Nuclear Research Facilities ........................................................................................................ 22
   B.3 Radioactive Waste Management Practices .......................................................................................... 23
      B.3.1 Nuclear Power Plants .................................................................................................................. 23
      B.3.2 Nuclear Research Facilities ........................................................................................................ 24
      B.3.3 Nuclear Fuel Fabrication Facilities ............................................................................................. 25
      B.3.4 RI Waste Management Facility .................................................................................................. 26
      B.3.5 LLW Disposal Facility .................................................................................................................. 26
   B.4 Definition and Classification of Radioactive Waste .............................................................................. 28

C. Scope of Application (Article 3) .................................................................................................................. 31
   C.1 Radioactive Waste within the Scope of the JC ................................................................................... 33
   C.2 Reprocessing of Spent Fuel ............................................................................................................... 34
   C.3 Naturally Occurring Radioactive Materials .......................................................................................... 34
   C.4 Radioactive Waste within Military or Defense Programs ..................................................................... 34
## Contents

D. Inventories and Lists (Article 32, Paragraph 2) .................................................. 35  
D.1 Spent Fuel Management Facilities ................................................................. 37  
  D.1.1 Nuclear Power Plants .............................................................................. 37  
  D.1.2 Nuclear Research Facilities ..................................................................... 38  
D.2 Radioactive Waste Management Facilities .................................................... 40  
  D.2.1 Nuclear Power Plants .............................................................................. 40  
  D.2.2 Nuclear Research Facilities ..................................................................... 41  
  D.2.3 Nuclear Fuel Fabrication Facilities ............................................................ 41  
  D.2.4 RI Waste Management Facility ................................................................. 42  
  D.2.5 LILW Disposal Facility ........................................................................... 43  
  D.2.6 Other Facilities ....................................................................................... 43  
D.3 Decommissioning .............................................................................................. 44  
D.4 Record Keeping and Reporting ....................................................................... 44  

E. Legislative and Regulatory Framework ................................................................ 45  
E.1 Implementing Measures (Article 18) ................................................................. 47  
E.2 Legislative and Regulatory Framework (Article 19) ......................................... 47  
  E.2.1 Legislative Framework of Nuclear Regulation ............................................ 48  
  E.2.2 Nuclear Regulatory Framework ................................................................. 56  
  E.2.3 Licensing Procedure ................................................................................ 57  
  E.2.4 Regulatory Inspection ............................................................................... 58  
  E.2.5 Enforcement .............................................................................................. 59  
  E.2.6 Allocation of Responsibilities ................................................................... 60  
E.3 Regulatory Body (Article 20) ........................................................................... 62  
  E.3.1 Nuclear Safety and Security Commission (NSSC) ..................................... 62  
  E.3.2 Korea Institute of Nuclear Safety (KINS) .................................................... 66  

F. Other General Safety Provisions ......................................................................... 69  
F.1 Responsibility of the License Holder (Article 21) ............................................ 71  
  F.1.1 Mechanism for the Regulatory Body to Ensure that the License Holder  
       Meets its Primary Responsibility for Safety .................................................. 71  
  F.1.2 Ultimate Responsibility ............................................................................ 72  

---

D.1 Spent Fuel Management Facilities 
D.1.1 Nuclear Power Plants 
D.1.2 Nuclear Research Facilities 
D.2 Radioactive Waste Management Facilities 
D.2.1 Nuclear Power Plants 
D.2.2 Nuclear Research Facilities 
D.2.3 Nuclear Fuel Fabrication Facilities 
D.2.4 RI Waste Management Facility 
D.2.5 LILW Disposal Facility 
D.2.6 Other Facilities 
D.3 Decommissioning 
D.4 Record Keeping and Reporting 
E.1 Implementing Measures (Article 18) 
E.2 Legislative and Regulatory Framework (Article 19) 
  E.2.1 Legislative Framework of Nuclear Regulation 
  E.2.2 Nuclear Regulatory Framework 
  E.2.3 Licensing Procedure 
  E.2.4 Regulatory Inspection 
  E.2.5 Enforcement 
  E.2.6 Allocation of Responsibilities 
E.3 Regulatory Body (Article 20) 
  E.3.1 Nuclear Safety and Security Commission (NSSC) 
  E.3.2 Korea Institute of Nuclear Safety (KINS) 
F.1 Responsibility of the License Holder (Article 21) 
  F.1.1 Mechanism for the Regulatory Body to Ensure that the License Holder 
       Meets its Primary Responsibility for Safety 
  F.1.2 Ultimate Responsibility
## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.1.3 Inter-Dependence among the Different Steps in Spent Fuel Management</td>
<td>114</td>
</tr>
<tr>
<td>G.1.4 Protective Actions within the Legal Framework</td>
<td>114</td>
</tr>
<tr>
<td>G.1.5 Impacts and Burdens on Future Generations</td>
<td>115</td>
</tr>
<tr>
<td>G.2 Existing Facilities (Article 5)</td>
<td>116</td>
</tr>
<tr>
<td>G.2.1 On-site Spent Fuel Storage Facilities of NPP and PIEF</td>
<td>116</td>
</tr>
<tr>
<td>G.2.2 Spent Fuel Interim Storage Facility</td>
<td>116</td>
</tr>
<tr>
<td>G.3 Siting of Proposed Facilities (Article 6)</td>
<td>117</td>
</tr>
<tr>
<td>G.3.1 On-site Spent Fuel Storage Facilities of NPP</td>
<td>117</td>
</tr>
<tr>
<td>G.3.2 Spent Fuel Interim Storage Facility</td>
<td>118</td>
</tr>
<tr>
<td>G.3.3 Consideration of Neighboring Countries</td>
<td>118</td>
</tr>
<tr>
<td>G.4 Design and Construction of Facilities (Article 7)</td>
<td>119</td>
</tr>
<tr>
<td>G.4.1 Control of Radiological Impact</td>
<td>119</td>
</tr>
<tr>
<td>G.4.2 Decommissioning Planning</td>
<td>120</td>
</tr>
<tr>
<td>G.4.3 Proven Technology</td>
<td>120</td>
</tr>
<tr>
<td>G.5 Assessment of Safety of Facilities (Article 8)</td>
<td>122</td>
</tr>
<tr>
<td>G.5.1 Safety Assessment and Environmental Impact Assessment</td>
<td>122</td>
</tr>
<tr>
<td>G.5.2 Supplementation of Safety Assessment</td>
<td>123</td>
</tr>
<tr>
<td>G.6 Operation of Facilities (Article 9)</td>
<td>124</td>
</tr>
<tr>
<td>G.6.1 Operation License</td>
<td>124</td>
</tr>
<tr>
<td>G.6.2 Operational Limit and Condition</td>
<td>125</td>
</tr>
<tr>
<td>G.6.3 Technical Support for Operation Procedure (operation, maintenance, monitoring, inspection and test) and Safety</td>
<td>126</td>
</tr>
<tr>
<td>G.6.4 Reporting of Events Significant to Safety</td>
<td>127</td>
</tr>
<tr>
<td>G.6.5 Operation Experience Feedback</td>
<td>127</td>
</tr>
<tr>
<td>G.6.6 Decommissioning Plan</td>
<td>128</td>
</tr>
<tr>
<td>G.7 Disposal of Spent Fuel (Article 10)</td>
<td>129</td>
</tr>
<tr>
<td>H. Safety of Radioactive Waste Management</td>
<td>131</td>
</tr>
<tr>
<td>H.1 General Safety Requirements (Article 11)</td>
<td>133</td>
</tr>
<tr>
<td>H.1.1 Standards for Permit of Construction and Operation</td>
<td>133</td>
</tr>
<tr>
<td>H.1.2 Safety Analysis</td>
<td>134</td>
</tr>
<tr>
<td>H.1.3 Safety Requirements to Be Considered</td>
<td>135</td>
</tr>
</tbody>
</table>
## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>H.2</td>
<td>Existing Facilities and Past Practices (Article 12)</td>
<td>139</td>
</tr>
<tr>
<td>H.2.1</td>
<td>Safety Confirmation</td>
<td>139</td>
</tr>
<tr>
<td>H.2.2</td>
<td>Safety Improvement</td>
<td>140</td>
</tr>
<tr>
<td>H.3</td>
<td>Siting (Article 13)</td>
<td>141</td>
</tr>
<tr>
<td>H.3.1</td>
<td>Regulatory Requirements and Permit Procedure</td>
<td>141</td>
</tr>
<tr>
<td>H.3.2</td>
<td>Site Selection for the Proposed Facility</td>
<td>143</td>
</tr>
<tr>
<td>H.4</td>
<td>Design and Construction of Facilities (Article 14)</td>
<td>143</td>
</tr>
<tr>
<td>H.4.1</td>
<td>Regulatory Requirements</td>
<td>145</td>
</tr>
<tr>
<td>H.4.2</td>
<td>Criteria of Design and Construction</td>
<td>146</td>
</tr>
<tr>
<td>H.4.3</td>
<td>Safety Regulation for Design and Construction of Major Nuclear Facilities</td>
<td>149</td>
</tr>
<tr>
<td>H.5</td>
<td>Safety Assessment of Facilities (Article 15)</td>
<td>152</td>
</tr>
<tr>
<td>H.5.1</td>
<td>Safety Analysis and Environmental Impact Assessment</td>
<td>152</td>
</tr>
<tr>
<td>H.5.2</td>
<td>Renewal of Safety Analysis and Reassessment of Safety</td>
<td>154</td>
</tr>
<tr>
<td>H.5.3</td>
<td>Implementation of Safety Assessment on Major Facility</td>
<td>155</td>
</tr>
<tr>
<td>H.6</td>
<td>Operation of Facilities (Article 16)</td>
<td>156</td>
</tr>
<tr>
<td>H.6.1</td>
<td>Regulatory Requirements</td>
<td>156</td>
</tr>
<tr>
<td>H.6.2</td>
<td>Safety Management of Operation of a Disposal Facility</td>
<td>157</td>
</tr>
<tr>
<td>H.6.3</td>
<td>Limiting Conditions of Operation of a Disposal Facility</td>
<td>158</td>
</tr>
<tr>
<td>H.6.4</td>
<td>Operation Procedures</td>
<td>158</td>
</tr>
<tr>
<td>H.6.5</td>
<td>Engineering and Technical Support</td>
<td>159</td>
</tr>
<tr>
<td>H.6.6</td>
<td>Procedure for Characterization and Categorization of Radioactive Waste</td>
<td>159</td>
</tr>
<tr>
<td>H.6.7</td>
<td>Event Reporting and Record Management</td>
<td>160</td>
</tr>
<tr>
<td>H.6.8</td>
<td>Analysis and Feedback of Operating Experience</td>
<td>161</td>
</tr>
<tr>
<td>H.6.9</td>
<td>Establishment of a Decommissioning Plan and Regulatory Review</td>
<td>161</td>
</tr>
<tr>
<td>H.6.10</td>
<td>Establishment of a Closure Plan and Review of the Regulatory Authority</td>
<td>161</td>
</tr>
<tr>
<td>H.6.11</td>
<td>Safety Regulation on Operation of Major Facilities</td>
<td>162</td>
</tr>
<tr>
<td>H.7</td>
<td>Institutional Measures after Closure (Article 17)</td>
<td>164</td>
</tr>
<tr>
<td>H.7.1</td>
<td>Record Keeping</td>
<td>164</td>
</tr>
<tr>
<td>H.7.2</td>
<td>Institutional Control</td>
<td>165</td>
</tr>
<tr>
<td>H.7.3</td>
<td>Intervention in Case of Unplanned Release</td>
<td>166</td>
</tr>
</tbody>
</table>
I. Transboundary Movement (Article 27) ................................................................. 167
   I.1 Domestic Transportation Regulations ............................................................. 169
   I.2 Safety Requirements ...................................................................................... 171
      I.2.1 General Safety Requirements ................................................................. 171
      I.2.2 Safety Requirements for Transportation Containers ............................... 171
      I.2.3 Safety Requirements for Transportation .................................................... 171
   I.3 Approval and Administrative Action ............................................................... 172
      I.3.1 Design Approval ...................................................................................... 172
      I.3.2 Report on Transportation ....................................................................... 172
      I.3.3 Cases of Trans-boundary Movement ....................................................... 172

J. Disused Sealed Sources (Article 28) ................................................................. 173
   J.1 Management System ..................................................................................... 175
   J.2 Management of Disused Sealed Sources ....................................................... 176
      J.2.1 Requirements for Facilities and Handling .............................................. 176
      J.2.2 Management ......................................................................................... 176
      J.2.3 Return .................................................................................................... 177

K. Safety Improvement Activities ......................................................................... 179
   K.1 Establishment of Spent Fuel Management Policy ........................................ 181
   K.2 Improvement of Regulatory Systems for Radioactive Waste Management ... 183
   K.3 Improvement of Regulatory Systems for Decommissioning of Nuclear Facility 185
   K.4 Improvement of Safety in Operation Stage of LILW Disposal Facility .......... 187
      K.4.1 Safety Assurance in Consideration of Changes in External Environment 187
      K.4.2 Periodic Update of Safety Assessment ................................................... 187
   K.5 Transparent Disclosure of Information on Radioactive Waste .................... 189

Annex .................................................................................................................... 191
   Annex A. List of Spent Fuel Management Facilities .......................................... 193
   Annex B. List of Radioactive Waste Management Facilities .............................. 196
   Annex C. List of Nuclear Facilities under Decommissioning ............................. 202
   Annex D. Notices of the NSSC Applicable to Radioactive Waste Management ... 203
   Annex E. Notices of the MOTIE Applicable to Radioactive Waste Management ... 208
List of Tables

| Table A.4-1 Overview Matrix of Radioactive Waste and Spent Fuel | 14 |
| Table D.1-1 Inventory of Spent Fuel Stored at NPP Sites | 38 |
| Table D.1-2 Inventory of Spent Fuel in Storage Pool of Research Facilities | 39 |
| Table D.2-1 Inventory of Radioactive Waste Stored at NPP Sites | 40 |
| Table D.2-2 Inventory of Radioactive Waste Stored at KAERI | 41 |
| Table D.2-3 Inventory of Radioactive Waste Stored at Nuclear Fuel Fabrication Facility | 42 |
| Table D.2-4 Inventory of RI Waste at KORAD | 42 |
| Table D.2-5 Inventory of Radioactive Waste at Gyeongju LILW Disposal Facility | 43 |
| Table D.3-1 Inventory of Decommissioning Radioactive Waste from KRR-1 and 2 | 44 |
| Table E.2-1 Laws Concerning Nuclear Safety Regulation | 49 |
| Table E.2-2 Contents of Nuclear Safety Act | 52 |
| Table F.4-1 Dose Limits | 87 |
| Table F.4-2 Annual Radioactivity in Liquid and Gaseous Radioactive Effluents Released from Nuclear Power Plants and Calculated Off-site Dose | 94 |
| Table F.4-3 Annual Radioactivity in Liquid and Gaseous Radioactive Effluents Released from Daejeon Nuclear Site and Calculated Off-site Dose | 95 |
List of Figures

- Figure A.1-1 Locations and Operational Status of Nuclear Facilities Including Radioactive Waste Management Facilities ........................................ 5
- Figure B.2-1 Spent Fuel Management Practices .................................................. 21
- Figure E.2-1 Legal Framework for Nuclear Safety Regulation ................................ 51
- Figure E.2-2 Legal Hierarchy of the Radioactive Waste Management Act (RWMA) .... 55
- Figure E.2-3 Government Organizations Related to Radioactive Waste Management .... 57
- Figure E.3-1 Organization Chart of the NSSC ......................................................... 64
- Figure E.3-2 Organization Chart of KINS ............................................................... 68
- Figure F.2-1 Organization Chart of KORAD ......................................................... 74
- Figure F.2-2 Organization Chart of KHNP ............................................................. 75
- Figure F.2-3 Organization Chart of Nuclear Power Plant Sites ................................ 76
- Figure F.2-4 Organization Chart of KEPCO NF ..................................................... 78
- Figure F.2-5 Radioactive Waste Related Organization Chart of KAERI ..................... 80
- Figure F.5-1 National Radiological Emergency Response Scheme .......................... 99
- Figure F.5-2 Atomic Computerized Technical Advisory System
  for the Radiological Emergency (AtomCARE) ..................................................... 101
- Figure F.5-3 National Environmental Radioactivity Monitoring Network .................. 104
- Figure H.4-1 Bird’s Eye View of the Wolsong LILW Disposal Center ....................... 150
- Figure H.4-2 Cross Section View of Underground Disposal Facilities ..................... 150
- Figure H.4-3 Layout of the 2nd Phase Disposal Facility for LILW ............................ 151
- Figure J.2-1 RI Waste Management Framework .................................................. 177
- Figure K.1-1 Schedule for Long-term Management of SF and HLW .......................... 182
- Figure K.5-1 Role and Function of Nuclear Safety Information Center ...................... 189
- INTENTIONAL BLANK -
A. Introduction

A.1 Preface

Since nuclear power plant started commercial operation in April 1978, the number of nuclear power plants in operation has continued to grow up to 24 units as of June 30, 2017.

Kori Unit 1, Korean 1st nuclear power plant was permanently shut down in June 2017 and is now under preparation for decommissioning.

The Korean government established the Nuclear Safety and Security Commission under the President in October 2011 to enhance the independence and transparency of nuclear safety regulations.

The Korea Radioactive Waste Agency (KORAD) was founded in January 2009 for the safe and efficient management of radioactive waste in accordance with the Radioactive Waste Management Act.

The KORAD has been operating the 1st phase rock-cavern type disposal facility for low-and intermediate-level radioactive waste since December 2014 after passing the regulatory body’s preoperational inspection. The KORAD also submitted an application for the construction permit (CP) and operation license (OL) for the 2nd phase engineered vault type disposal facility to the regulatory body in December 2015, which is now under regulatory review.

In the 253rd meeting of Atomic Energy Committee (AEC) held in December 2004, the Korean government decided to construct a LILW disposal facility, separately from a spent fuel interim-storage facility by 2008. It was also decided to determine a national policy for spent fuel management after due consideration of technology development at domestic and overseas and to implement the policy based on public consensus from the mid- to long-term perspective. The Korean government held the 2nd meeting of Atomic Energy Promotion Committee (AEPC) in November 2012 and decided on the Execution Plan for Spent Fuel Management which called for establishment of a Public Engagement
Commission on Spent Nuclear Fuel Management (PECOS) as an independent advisory body to carry out public engagement activities. In June 2015, a set of 10 recommendations on spent fuel management and host community support was submitted to the government by PECOS.

Based upon the recommendations, the government established the Basic Plan on High-level Radioactive Waste Management in July 2016 and based on which, the Legislative Bill on the Site Selection Process and Host Community Support for High-level Radioactive Waste Management Facilities was submitted to the National Assembly in November 2016.

Spent fuel generated from nuclear power plants has been stored in wet storage facilities and dry storage facilities (only applies to PHWRs) at on-site. Low- and intermediate-level radioactive waste generated from nuclear power plants has been stored at on-site storage facilities and transported to the disposal facility after on-site inspection carried out by KORAD.

Low- and intermediate-level radioactive waste generated from the 30 MWth research reactor, High-flux Advanced Neutron Application Reactor (HANARO) of the Korea Atomic Energy Research Institute (KAERI) in Daejeon has been either stored on-site or transported to the disposal facility of the KORAD. The spent fuel generated during operation of the HANARO has been stored at a spent fuel pool. Two research reactors, the Korea Research Reactor 1 and 2 (KRR-1 and 2), located at the former KAERI site in Seoul, were permanently shut down, and their decommissioning is currently underway. In addition, an application was submitted for a construction permit of a 15 MWth research reactor at Gijang-gun, Busan in November 2014 to produce radioactive isotopes for medical and industrial purposes as well as power semiconductor devices, and is currently under regulatory review.

Nuclear fuel for nuclear power plants is fabricated by the Korea Electric Power Corporation Nuclear Fuel Co., Ltd. (KEPCO NF) in Daejeon, and radioactive waste generated during the fabrication process is stored at the radioactive waste storage facility of KEPCO NF.

The number of radioisotope users in the medical, research and industrial areas has steadily increased to around 7,000 as of March 2017, generating various types of radioactive waste. Radioisotope waste was stored at the radioisotope waste management facility of KORAD in Daegyoan until June 2015 and is now transported to the low- and intermediate-level radioactive waste disposal facility in Gyeongju since July 2015.

As of July 2017, the locations and operational status of nuclear facilities and radioactive waste management facility in Korea are shown in Figure A.1-1.
Figure A.1-1 Locations and operational status of nuclear facilities including radioactive waste management facilities (As of July 31, 2017)
The government completed an amendment of the NSA and subordinate statutes related to the decommissioning of nuclear facilities in 2015. The amended act and subordinate statutes stipulate matters regarding submission of a decommissioning plan at the time of application for construction permit (CP) and operation licence (OL) for a nuclear facility, periodic renewal of the plan, approval of decommissioning, review and inspection of decommissioning progress, inspection of decommissioning completion, etc. In addition, technical standards regarding decommissioning were established in 2015 and 2016. The technical standards stipulate details to be stated in the decommissioning plan, methods for review and inspection of the status of decommissioning reported by the licensee on a biannual basis, and radiological criteria for reuse of the site and buildings after completion of decommissioning (unrestricted reuse when less than 0.1 mSv/y, restricted reuse when less than 0.1 mSv/y under ALARA conditions and less than 1 mSv/y when fails to control). The Notices regarding decommissioning enacted by the NSSC are as follows.

- Standard Format and Content of Decommissioning Plan for Nuclear Facilities
- Regulation on Verification and Inspection for Decommissioning Status of Nuclear Facilities
- Reuse Criteria for Site and Remaining Structures after Completion of Decommissioning of Nuclear Facilities

Detailed information on legislation and amendment of the NSA and subordinate statutes are described in K.3 and Annex D.

Kori Unit 1, Korean 1st commercial reactor started its operation in April 1978 with a design life of 30 years and was re-licensed to extend its operation for another 10 years till 2017 by the Ministry of Science of Technology (MOST, currently the NSSC) in December 2007.
Kori Unit 1 was permanently shut down in June 2017 and steps are being taken for its decommissioning. Since an immediate decommissioning was determined as a policy for Kori Unit 1, it will undergo decommissioning phases of preparation and approval of a decommissioning plan, cooling and discharge of spent fuel, decommissioning and site restoration. More details on the decommissioning of Kori Unit 1 are described in F.6.

The government established the Basic Plan on High-level Radioactive Waste Management in late July 2016. Based on the plan, the government is now preparing legal grounds and detailed plans such as submission of a legislative bill to the National Assembly on site selection process and host community support for HLW (including spent fuel) management facilities. More details on the basic plan are presented in K.1.

The government plans to enact a law that stipulates the methods and procedures of site investigation and decision-making of local residents for a transparent site selection of HLW management facilities. The purpose of the *Legislative Bill on Site Selection Process and Host Community Support for High-level Radioactive Waste Management Facilities* is to enhance the transparency and the public acceptance of site selection, through stipulating organization of the Site Selection Committee and detailed procedures including the volunteering of the local governments and decision-making of local residents for the site investigation.

As part of efforts to raise public trust and understanding of HLW management, the government also plans to foster various communication programs with local residents by providing them with information about the safety of management facilities such as the status of HLW management and off-site radiation level as well as by operating a Host Community Support Committee to develop the community and improve the quality of the residents’ lives.

The government is working on to improve the independence and expertise of the NSSC as part of the policy to strengthen nuclear safety regulations. As one of the national
policy goals of the new administration announced in July 2017, the government is pushing forward with a plan to promote the NSSC from a Prime Ministerial-level commission to a Presidential-level one.

With the growing public interest recently, the NSSC has newly established Radioactive Waste Safety Division in February 2017 to thoroughly conduct regulations on radioactive waste and to be well prepared for the future demand for regulations on the construction of HLW management facilities. The details are described in E.3.

As a special judicial police system was introduced in June 2017, the officials of the NSSC are authorized to conduct investigations such as urgent arrest, search and confiscation, request for arrest warrant, etc. This allows consistent and prompt actions from investigation to transfer to the prosecutor’s office, thereby contributing to efficient investigation and enforcement against violations of nuclear and radiation safety regulations.
A.3 Implementation of the Challenges and Proposed Good Practices

A.3.1 Implementation Status of Challenges from 5th Review Meeting

The government established the Basic Plan on High-level Radioactive Waste Management in July 2016 which mainly defines options and strategies for a safe management of spent fuel. The basic plan outlines constructing a site-specific underground research laboratory, an interim storage facility of spent fuel, and a HLW repository at the same site; developing core management technologies timely to enhance stakeholder trust on the safety of spent fuel management; striving to raise public acceptance based on transparent and objective approach in spent fuel management and better communication with local residents; and constructing additional on-site spent fuel storage facilities. In order to implement the basic plan, the government is presently working on the legislation of a bill on the site selection process, the establishment of High-level Radioactive Waste Management Committee and Host Community Support Committee, and so on. More details are described in K.1.

Various efforts have been made to increase the storage capacity of the spent fuel generated from the nuclear power plants and to delay its saturation.

In PWRs, methods such as installation of high-density storage racks and transfer of spent fuel to neighboring units in efforts were applied to increase the storage capacity of the spent fuel pool. In PHWRs at Wolsong site, additional on-site dry storage silos and high-density dry storage facilities (MACSTOR) have been installed to expand their storage capacity. As per the Basic Plan on High-level Radioactive Waste Management, spent fuel will be managed in the above-mentioned ways until an off-site centralized spent fuel interim storage facility is in operation. Details are described in K.1.
The Korean government amended relevant Acts and subordinate statutes to prepare decommissioning of nuclear facilities. Also, the government amended the NSA in 2015, which is the supreme law on nuclear safety, and accordingly its subordinate statutes in 2016 by referring to the IAEA GSR Part 6 (Decommissioning of Facilities). According to the amended NSA, it is mandated to submit a decommissioning plan from the stage of construction permit (CP) and operation license (OL) for nuclear facilities, and renew it on a periodic basis. Detailed information is described in K.3.

A.3.2 Proposed Good Practices

As part of efforts to establish a national policy on spent fuel management, the Korean government set up PECOS in October 2013 to gather opinions of various stakeholders at all levels of the society. PECOS analyzed the estimated inventories of spent fuel and based on which, submitted a set of recommendations on options and strategies for safe management of spent fuel to the government in June 2015. Based upon the recommendations, the government established the Basic Plan on High-level Radioactive Waste Management in July 2016, and then subsequently submitted the Legislative Bill on the Site Selection Process and Host Community Support for High-level Radioactive Waste Management Facilities to the National Assembly in November 2016 so as to implement the Basic Plan effectively in the long-term. The outline of the Bill is as follows:

The High-level Radioactive Waste Management Committee, consisting of less than 20 experts including the minister of Ministry of the Trade, Industry and Energy (MOTIE), decides matters regarding site investigation planning, preliminary and in-depth site investigations, selection of candidate sites, development of generic underground research laboratory, information disclosure, and so on. The committee's activities enable to secure expertise and transparency of the site selection process.

In addition, the procedures for site investigations and decision-making of local residents will be legislated and based on which the final candidate site will be selected through multiple stages such as planning of site investigation, preliminary and in-depth site investigations.
To improve public acceptance of site selection process, efforts will be made such as establishing an effective pan-governmental support system and programs for booming up the economy of the host community of HLW management facilities.

The Host Community Support Committee to be chaired by the Prime Minister will consist of less than 20 members including ministers of related government ministries, heads of local governments in the host area, and representatives of the operator of the management facilities. The committee will decide on key issues regarding the principle, direction, and strategies for the host community support.

Establishment of Safety Requirements for HLW including Spent Fuel

As a regulatory body, the NSSC is working on the amendments of the NSA, legislation of related Notices, and development of regulatory verification technology to be fully prepared for the safety of long-term management of HLW. Technical standards (e.g. NSSC Notices) on interim storage of spent fuel and disposal of HLW, which have been legislated and/or amended after the 5th Review Meeting, are as follows:

- Guidelines for Preparation of Safety Analysis Report for Interim Storage Facilities of Spent Fuel
- Technical Standards for the Structure and Equipment of Interim Storage Facilities of Spent Fuel
- General Standards for Deep Geological Repository for High-level Radioactive Waste

Information Disclosure and Transparency

With the growing public concern on nuclear safety, the NSSC operates the Nuclear Safety Information Center (NSIC) in accordance with Article 103-2 of the NSA to disclose the information in a transparent and timely manner and to encourage active communication with the public. The Nuclear Safety Consultative Council (NSCC), organized by the NSSC, delivers the information on nuclear safety to local residents of NPPs and other nuclear facility sites and gathers opinions from residents. The NSCC consists of local residents, experts recommended by local residents, officials of local governments and the NSSC, and experts from KINS.

KINS established the WASTE Comprehensive Information Database (WACID) to provide the public and stakeholders with information on radioactive waste safety including the
inventories of LILW stored and disposed of, status of spent fuel management, transportation of radioactive waste, discharge of radioactive effluent, and so forth.

In addition, KINS, KORAD, KAERI, KEPCO NF and the KHNP have opened Q&A pages on their websites to answer various questions about safe management of radioactive waste and spent fuel in an attempt to ensure transparency in safety regulation and management. More details are described in K.5.
Korean overview matrix on radioactivity waste and spent fuel is depicted in Table A.4-1.
<table>
<thead>
<tr>
<th>Type of Liability</th>
<th>Long-term Management Policy</th>
<th>Funding of Liabilities</th>
<th>Current Practice/Facility</th>
<th>Future Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spent fuel</td>
<td>• Securing interim storage facility, site specific URL repository on the same site</td>
<td>Generators’ pay (Generators bear the charges for management of spent fuel which are deposited to the Radioactive Waste Management Fund)</td>
<td>Wet/dry storage in generators’ sites</td>
<td>• Planning of interim storage, URL and repository construction</td>
</tr>
<tr>
<td></td>
<td>• On site storage prior to the operation of centralized interim storage facility</td>
<td></td>
<td></td>
<td>• On site storage capacity expansion prior to the operation of centralized interim storage facility</td>
</tr>
<tr>
<td>Nuclear fuel cycle</td>
<td>Disposal at a LILW disposal facility</td>
<td>Generators’ pay (Generators bear the expenses for management of radioactive waste which are deposited to the Radioactive Waste Management Fund)</td>
<td>Disposal at a LILW disposal facility</td>
<td>Under the licensing review of regulatory body for 2nd phase construction</td>
</tr>
<tr>
<td>Non-Nuclear fuel cycle (Application Waste)</td>
<td>Disposal at a LILW disposal facility</td>
<td>As above</td>
<td>• RI waste (including disused unsealed sources) : received at LILW disposal site</td>
<td>Under the licensing review of regulatory body for 2nd phase construction (engineered vault type)</td>
</tr>
<tr>
<td>Decommissioning</td>
<td>Immediate dismantling of NPP</td>
<td>• Decommissioning cost of NPPs is accumulated by KHNPC</td>
<td>• Under decommissioning KRR-1 and 2</td>
<td>Kori Unit 1 shut down and under the decommissioning preparations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Decommissioning cost for research reactor is funded by the government</td>
<td>• Decommissioning of UCF completed</td>
<td></td>
</tr>
<tr>
<td>Disused sealed sources</td>
<td>Research ongoing on management options</td>
<td>Generators’ pay</td>
<td>Stored in LILW disposal site</td>
<td>Under the licensing review of regulatory body for 2nd phase construction (engineered vault type)</td>
</tr>
</tbody>
</table>
B. Policies and Practices
B. Policies and Practices
[Article 32, Paragraph 1]

ARTICLE 32. REPORTING
In accordance with the provisions of ARTICLE 30, each Contracting Party shall submit a national report to each Review Meeting of Contracting Parties. This report shall address the measures taken to implement each of the obligations of the Convention. For each Contracting Party the report shall also address its:
- spent fuel management policy;
- spent fuel management practices;
- radioactive waste management policy;
- radioactive waste management practices;
- criteria used to define and categorize radioactive waste.

B.1 Policy for Radioactive Waste and Spent Fuel Management

B.1.1 Basic Policy

LILW

The basic policy defined in the Low-and intermediate-level Radioactive Waste Management Plan which was adopted in the 4th meeting of Atomic Energy Promotion Committee (AEPC) held on January 30, 2015, is as follows:

- Direct management by the government
  - Radioactive waste, which needs long-term safe management, shall be managed under the responsibility of the government.
- Safety on top priority
  - Radioactive waste shall be safely managed in due consideration of the ecological and environmental impact so as to protect human health and the environment from the harmful effects.
- Execution under the public trust
  - Radioactive waste shall be managed transparently and openly so as to improve
the understanding and trust of the general public.
- Radioactive waste management project shall be executed in such a way to contribute to harmony and development of local communities.

**Generators’ pay principle**
- The cost incurred in managing radioactive waste shall be borne by the generator at the point of generation, without imposing undue burdens on future generations.

**Enhancement of radioactive waste management efficiency**
- The generation of radioactive waste shall be minimized and disposal facility shall be operated efficiently.

---

**Spent Fuel**

The basic policy defined in the Basic Plan on High-level Radioactive Waste Management which was adopted in the 6th meeting of AEPC held on July 25, 2016, is as follows:

- **Direct management by the government**
  - HLW which needs long-term safe management, shall be managed safely under the responsibility of the government, in compliance with the domestic and international laws and regulations on the safe management of the waste.

- **Safety of the public and protection of the environment on the highest priority**
  - HLW shall be managed in an ecologically and environmentally safe manner so as to protect human health and the environment from the harmful effects.

- **Execution under the public trust**
  - Information on the HLW management shall be disclosed transparently to the public.
  - HLW management shall be executed in such a way to contribute to the development of local community and sustainable use of nuclear energy.

- **Due burden on present generation**
  - Present generation who benefits from nuclear energy shall take the responsibility of HLW management.
  - cost for HLW management shall be payed by the generators

- **Efficient management of HLW**
  - Technologies necessary for an efficient management of HLW with regard to transportation, storage and disposal, and reduction of volume and radio-toxicity shall be continuously developed.
B.1.2 Strategy and Management Plan

Low- and Intermediate-level Radioactive Waste

The AEC decided on construction of a LILW disposal facility with the capacity of 800,000 drums (100,000 drums in the 1st phase) according to the decision of the 249th and 253rd meetings. Accordingly, the construction of the 1st phase facility was completed in December 2014. In January 2015, the 4th AEPC approved the Basic Plan on Low- and Intermediate-level Radioactive Waste Management which includes the plan for construction of the 2nd phase engineered vault type disposal facility with a capacity of 125,000 drums and construction of near surface disposal facilities from the 3rd phase in principle. However, the timings for construction of the 3rd and the next phases disposal facilities will be decided later in consideration of the usage and efficiency of the existing disposal facilities.

Based on that, the Implementation Plan on Low- and Intermediate-level Radioactive Waste Management was established which is outlined as follows: gaining public trust based on the safe operation of the 1st phase rock cavern disposal facility; timely initiating the 2nd phase construction for efficient disposal of radioactive waste; enhancing public acceptance of radioactive waste management based on mutual growth with local communities; and developing core technologies for safe management of radioactive waste.

Spent Fuel

Discussion on spent fuel management options and strategies started in the AEC in 1988. In the 253rd meeting held on December 2004, the AEC changed its position that a national policy on spent fuel management plan including a centralized spent fuel interim storage facility should be established considering domestic and international progress in technology development and be based on public consensus reached.

The government formed a dedicated commission for public engagement in October 2013 to establish the basic plan for spent fuel management. The PECOS submitted a set of recommendations to the government in June 2015 which presented a detailed procedure and a plan for safe management of spent fuel.

Based upon the recommendations, the government established the Basic Plan on High-level Radioactive Waste Management in July 2016 which defines methods and procedures on the safe management of spent fuel. The basic plan is outlined as follows:
constructing an underground research laboratory, an centralized interim storage facility and repository at a same site; making efforts to raise public acceptance based on transparent and objective management of spent fuel and communication with local residents; and constructing additional on-site storage facilities.

Details on the Basic Plan on High-level Radioactive Waste Management are described in Section K.1.
The majority of spent fuel in Korea has been generated from 25 NPPs and a research reactor, HANARO. The spent fuel management practices are summarized in Figure B.2-1.

Figure B.2-1 Spent Fuel Management Practices

B.2.1 Nuclear Power Plants

Spent fuel generated from NPPs is stored and managed on site. The diverse methods have been implemented to increase on-site storage capacity or to postpone the saturation of on-site facilities.

Pressurized Water Reactor (PWR)

Spent fuel generated from the Pressurized Water Reactors (PWRs) is stored in a spent fuel pool at each unit. Almost all PWR plants continue to implement measures to address the lack of wet storage capacity such as installing high-density storage racks or transshipping spent fuel to the storage pool of the neighboring units.
Spent fuel generated from Pressurized Heavy Water Reactors (PHWRs) which are Wolsong Units 1, 2, 3 and 4, is cooled down in spent fuel pools for longer than six years and then transferred to the dry storage facility on site. Since the construction of the first 60 dry storage canisters (silos) at the Wolsong site in 1992, silos have been additionally built two times, and currently there is a total of 300 silos (with the total capacity of 162,000 bundles or 3,061.8 tons) in place. Additionally, seven modules of high-density dry storage facility (MACSTOR/KN-400) with the capacity of 168,000 bundles were constructed at Wolsong site in February 2011 and are currently in operation. Besides, an application for an amendment of operation license was submitted in April 2016 to build additional 7 modules of dry storage facilities with the same capacity of existing one and the regulatory review is underway.

B.2.2 Nuclear Research Facilities

All of the 299 spent fuel rods from KRR-1 and 2 were sent back to the USA in June 1998 when the decommissioning project of the research reactors was undertaken.

Spent fuel from operation of HANARO and irradiated test fuel from HANARO are stored in the spent fuel pool connected to the reactor pool of HANARO.

Spent fuel generated and transported from PWRs for post-irradiation examination is stored in the storage pool of the Post-Irradiation Examination Facility (PIEF) which is currently run by KAERI. Post-irradiation examination is carried out in the PIEF hot cells, and the remaining part of the fuel rods after examination is packaged in rod-cut containers and stored in the spent fuel pool.
B.3 Radioactive Waste Management Practices

B.3.1 Nuclear Power Plants

Gaseous Radioactive Waste Management

Gaseous radioactive waste is mainly generated in the deaeration or ventilation process during the operation of NPPs. Gaseous waste generated in the deaeration process are treated using a gas decay tank or charcoal delay bed to reduce radioactivity and released into the atmosphere after confirming radioactivity levels through sampling analysis. Gaseous waste from the ventilation systems is discharged into the environment through High-Efficiency Particulate Air (HEPA) filters and charcoal filters, and its radioactivity levels are also under continuous monitoring. Radionuclide concentrations and estimated off-site doses due to the gaseous effluents released to the atmosphere should satisfy the Effluent Control Limit (ECL) of each radionuclide and the annual dose constraints at the Exclusion Area Boundary (EAB) defined in the Notice of the NSSC. The NPP operators submit quarterly reports on radiation safety including effluent discharge to the regulatory body.

Liquid Radioactive Waste Management

Liquid radioactive waste is mainly generated from the cleanup or maintenance process of the reactor coolant and related systems. In general, liquid radioactive waste is treated with evaporators, demineralizers, filters and/or reverse osmosis (RO) equipment. The effluent is released to the sea when measured radioactivity level is below ECL, which is also under continuous monitoring. Radionuclide concentrations and estimated off-site dose due to the liquid effluents discharged to the sea should satisfy the ECLs and annual dose constraints at the EAB as set forth in the NSSC Notice. The compliance with the relevant technical standards is demonstrated in the regular reports on radiation safety including effluent discharge submitted to the regulatory body every quarter.

Solid Radioactive Waste Management

Solid radioactive waste consists mostly of Dry Active Wastes (DAWs, used parts, papers,
clothes, gloves, shoes, etc.), spent resins and spent filters. The DAWs are compacted by a conventional compactor (capacity: 30 ton) into drums. For Hanul Units 5 and 6, combustible miscellaneous solid waste is vitrified using a LILW Vitrification Facility. Spent resin is dried and packaged into the High-Integrity Containers or equivalent containers. Spent filters are stored in properly designed shielding containers.

B.3.2 Nuclear Research Facilities

Gaseous Radioactive Waste Management

The ventilation system of each nuclear facility is equipped with filters to treat off-gas prior to its release into the atmosphere. The stacks of each facility have a continuous monitoring system. Radionuclide concentration and estimated off-site dose due to the gaseous effluents released into the atmosphere should satisfy the ECL and annual dose limit at the EAB defined in the Notice of the NSSC. The research facility operator submits quarterly reports on radiation safety including effluent discharge to the regulatory body.

Liquid Radioactive Waste Management

Liquid radioactive waste generated from research facilities is collected in the tanks of the facilities and delivered to an evaporator for concentration. The evaporation condensate is processed in the solar evaporation facility and the residue such as evaporator concentrates is bituminized.

Solid Radioactive Waste Management

Solid radioactive waste is transported to the radioactive waste treatment facilities and then the radioactive waste storage facilities. Solid radioactive waste with high radiation dose is packaged in 50-liter stainless steel canister, and kept in a concrete monolith providing adequate shielding. Solid radioactive waste with low radiation dose is compacted and packaged in 200-liter steel drums, and kept in storage buildings. Combustible waste generated from the decommissioning process of KRR-1 and 2 and the Uranium Conversion Facility (UCF) was incinerated.
B.3.3 Nuclear Fuel Fabrication Facilities

### Gaseous Radioactive Waste Management

Radioactive material from gaseous effluent should be treated through filters in the ventilation system before its release into the environment through the stack. Gaseous radioactive effluent is continuously monitored. Radionuclide concentration and estimated off-site dose due to the gaseous effluents released to the atmosphere should satisfy the ECL and annual dose limit at the EAB defined in the Notice of the NSSC. The facility operator submits quarterly reports on radiation safety including effluent discharge to the regulatory body.

### Liquid Radioactive Waste Management

Liquid waste is categorized into two types: the waste from PWR fuel fabrication process and that from PHWR fuel fabrication process. Liquid waste is treated by treatment systems such as evaporation, reverse osmosis or centrifugation depending on its characteristics. Radionuclide concentration and estimated off-site dose due to the liquid effluents released to the environment should satisfy the ECL and annual dose limit defined in the Notice of the NSSC. The facility operator submits quarterly reports on radiation safety including effluent discharge to the regulatory body.

### Solid Radioactive Waste Management

Solid wastes from fuel fabrication facilities are categorized into DAWs (protective equipment such as clothes and gloves), metals, synthetics, wood and glass, and packaged in 200-liter drums, which are then stored in a waste storage facility after measuring their radioactivity, weight, surface contamination level, and radiation dose rate.
B.3.4 RI Waste Management Facility

Gaseous Radioactive Waste Management

Gaseous radioactive waste generated from the facility operation is released into the atmosphere through radioactive discharge monitor after treatment by HEPA and charcoal filters. Radionuclide concentration and estimated off-site dose due to the gaseous effluents released into the atmosphere should satisfy the ECL and annual dose limit at the site boundary defined in the Notice of the NSSC. The facility operator submits quarterly reports on radiation safety including effluent discharge to the regulatory body.

Liquid Radioactive Waste Management

Liquid radioactive waste generated from facility operation is collected in the collection tanks and treated after sampling and analysis.

Solid Radioactive Waste Management

Solid radioactive waste has been delivered to the RI Waste Management Facility until June 2015, and to LILW disposal facility since July 2015. Solid radioactive waste consists mostly of DAWs generated from segregation process and is packaged into 200L drums and stored.

B.3.5 LILW Disposal Facility

Gaseous Radioactive Waste Management

Gaseous radioactive waste generated from facility operation is released into the atmosphere through radioactive discharge monitor after treatment by HEPA and charcoal filters. Radionuclide concentration and estimated off-site dose due to the gaseous effluents released to the atmosphere should satisfy the ECL and annual dose limit at the EAB defined in the Notice of the NSSC. The facility operator submits quarterly reports on radiation safety including effluent discharge to the regulatory body.
Liquid radioactive waste generated from facility operation is collected through an active drainage system and then treated using a demineralizer system. Radionuclide concentration and estimated off-site dose due to the liquid effluents released to the environment should satisfy the ECL and annual dose limit at the EAB defined in the Notice of the NSSC. The facility operator submits quarterly reports on radiation safety including effluent discharge to the regulatory body.

Solid radioactive waste generated from facility operation consists mostly of DAWs (papers, clothes, gloves, shoes, etc.), spent resins and spent filters. The waste is segregated into waste streams aforementioned, treated by compaction or solidification, packaged into 200L drums, and stored thereafter.
The NSA defines “Radioactive Waste” as radioactive material(s) or materials contaminated by radioactive material(s) which is subject to disposal, including spent fuel declared to be disposed of in accordance with Article 35 (License for nuclear fuel cycle projects, etc.) of the same Act as well. The Enforcement Decree of the NSA defines HLW as the radioactive waste, of which the radioactive concentration and the heat generation rate are higher than levels prescribed by the NSSC. LILW means the radioactive waste other than HLW. HLW should meet both criteria on radioactivity and heat generation rate specified in the NSSC Notice Standards for Radiation Protection, etc. as follows:

- radioactivity concentration: $\geq 4,000$ Bq/g for $\alpha$-emitting radionuclide having a half-life longer than 20 years
- heat generation rate: $\geq 2$ kW/m$^3$

LILW is to be categorized by radioactivity concentration criteria and the details of sub-categorization are described in the NSSC Notice Regulations on the Radioactive Waste Classification and Clearance of Radioactive Waste. According to the Notice, LILW is classified into three sub-categories: very low level radioactive waste (VLLW), low level radioactive waste (LLW) and intermediate level radioactive waste (ILW). This classification system of LILW and its radioactivity concentration limit are developed considering the current status of the radioactive waste management in Korea, the plan for radioactive waste disposal facility development, and the IAEA Safety Standards Series No. GSG-1 (Classification of Radioactive Waste).

The subordinate statutes of the NSA allow radioactive waste with radioactivity concentration below the lower limit of VLLW to apply the clearance. The dose criteria for the clearance are less than 10 $\mu$Sv/y for individual dose and less than 1 person-Sv for collective dose which are values developed considering IAEA General Safety Requirements (GSR) Part 3(2014).
C. Scope of Application
C. Scope of Application (Article 3)

ARTICLE 3. SCOPE OF APPLICATION

i. This Convention shall apply to the safety of spent fuel management when the spent fuel results from the operation of civilian nuclear reactors. Spent fuel held at reprocessing facilities as part of a reprocessing activity is not covered in the scope of this Convention unless the Contracting Party declares reprocessing to be part of spent fuel management.

ii. This Convention shall also apply to the safety of radioactive waste management when the radioactive waste results from civilian applications. However, this Convention shall not apply to waste that contains only naturally occurring radioactive materials and that does not originate from the nuclear fuel cycle, unless it constitutes a disused sealed source or it is declared as radioactive waste for the purposes of this Convention by the Contracting Party.

iii. This Convention shall not apply to the safety of management of spent fuel or radioactive waste within military or defense programmes, unless declared as spent fuel or radioactive waste for the purposes of this Convention by the Contracting Party. However, this Convention shall apply to the safety of management of spent fuel and radioactive waste from military or defense programmes if and when such materials are transferred permanently to and managed within exclusively civilian programmes.

iv. This Convention shall also apply to discharges as provided for in Articles 4, 7, 11, 14, 24 and 26.

C.1 Radioactive Waste within the Scope of the JC

The scope of this national report according to the Joint Convention is the radioactive waste defined in accordance with the NSA and subordinate statutes. Spent fuel and radioactive waste generated from NPPs and nuclear research facilities as well as radioactive waste generated from nuclear fuel cycle facilities and RI users are covered in this national report.

The definition and classification of radioactive waste are specified in Section B.4.
C.2 Reprocessing of Spent Fuel

In accordance with Article 3 (Scope of Application) of the Joint Convention, reprocessing of spent fuel is out of the scope of this National Report because spent fuel is not reprocessed in Korea.

C.3 Naturally Occurring Radioactive Materials

Pursuant to Article 3.2 of the Joint Convention, this National Report includes the naturally occurring radioactive waste generated from the industrial use of fertile material.

C.4 Radioactive Waste within Military or Defense Programs

Pursuant to Article 3 (Scope of Application) of the Joint Convention, the RI waste transported to the RI management facilities from military or defense facilities is incorporated in the inventories mentioned in this National Report.
D. Inventories and Lists
- INTENTIONAL BLANK -
ARTICLE 32. REPORTING

This report shall also include:

i. a list of the spent fuel management facilities subject to this Convention, their location, main purpose and essential features;

ii. an inventory of spent fuel that is subject to this Convention and that is being held in storage and of that which has been disposed of. This inventory shall contain a description of the material and, if available, give information on its mass and its total activity;

iii. a list of the radioactive waste management facilities subject to this Convention, their location, main purpose and essential features;

iv. an inventory of radioactive waste that is subject to this Convention that:
   (a) is being held in storage at radioactive waste management and nuclear fuel cycle facilities;
   (b) has been disposed of; or
   (c) has resulted from past practices
      This inventory shall contain a description of the material and other appropriate information available, such as volume or mass, activity and specific radionuclides;

v. a list of nuclear facilities in the process of being decommissioned and the status of decommissioning activities at those facilities.

D.1 Spent Fuel Management Facilities

D.1.1 Nuclear Power Plants

Spent fuel discharged from NPPs is stored in a spent fuel pool at each unit for a certain period, and efforts to avoid saturation of the pool have been made through the expansion of on-site storage capacity and transshipment of spent fuel to the spent fuel pools of neighboring units. Annex A-1 shows the location, characteristics, and inventory of spent fuel storage facilities at each plant. The inventories and types of spent fuel stored at NPP sites are given in Table D.1-1.
Table D.1-1 Inventory of Spent Fuel Stored at NPP Sites
(As of March 31, 2017)

<table>
<thead>
<tr>
<th>Site</th>
<th>Reactor Type</th>
<th>Storage Type</th>
<th>Inventory [MTU]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kori</td>
<td>PWR</td>
<td>wet</td>
<td>2,380.6</td>
</tr>
<tr>
<td>Saeul</td>
<td>PWR</td>
<td>wet</td>
<td>0</td>
</tr>
<tr>
<td>Hanbit</td>
<td>PWR</td>
<td>wet</td>
<td>2,487.9</td>
</tr>
<tr>
<td>Hanul</td>
<td>PWR</td>
<td>wet</td>
<td>2,184.1</td>
</tr>
<tr>
<td>Wolsong</td>
<td>PWR</td>
<td>wet</td>
<td>105.68</td>
</tr>
<tr>
<td></td>
<td>PHWR</td>
<td>wet / dry</td>
<td>8,187.0</td>
</tr>
</tbody>
</table>

D.1.2 Nuclear Research Facilities

HANARO is a multi-purpose research reactor designed for fuel performance testing, material irradiation testing, RI production, and basic science and research. It is currently in use for various research and development activities.

The spent fuel pool of HANARO has the capacity to store fuel loaded into the reactor core as well as spent fuel generated during normal operation HANARO for 20 years. Annex A-2 provides details of the spent fuel pool of HANARO. Table D.1-2 shows the inventory of spent fuel generated from HANARO.

The PIEF was constructed for performance testing and evaluation of spent fuel including damaged fuel from NPPs. It consists of three pools (for reception, unloading and testing), four concrete hot cells, two lead hot cells, and supporting installations. Annex A-2 shows the details of the spent fuel storage pool in the PIEF.

As of the end of March 2017, spent fuel transported from NPPs is stored at the PIEF in the form of assemblies, spent fuel rods, and specimens to carry out post-irradiation examinations. Table D.1-2 shows the inventory of spent fuel stored at the PIEF.
Table D.1-2 Inventory of Spent Fuel in Storage Pool of Research Facilities
(As of March 31, 2017)

<table>
<thead>
<tr>
<th>Facility</th>
<th>Inventory (MTU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HANARO</td>
<td>0.888</td>
</tr>
<tr>
<td>PIEF</td>
<td>3.320</td>
</tr>
</tbody>
</table>
D.2 Radioactive Waste Management Facilities

D.2.1 Nuclear Power Plants

NPPs, which are currently in operation, are equipped with gaseous, liquid, and solid waste treatment facilities and storage facilities on-site to ensure the safe management of radioactive waste generated during the operation. The gaseous waste treatment system consists of gas decay tanks and/or charcoal delay beds. The liquid waste treatment system is equipped with a liquid waste evaporator, ion exchanger or reverse osmosis equipment. The solid waste treatment facility is composed of spent resin drying system, polymer solidification system, spent filter treatment system, packaging system and waste compactor. The on-site radioactive waste storage facility is a concrete slab-type building with separate storage spaces for solid wastes according to radiation level, and is equipped with radiation monitoring systems. The location and characteristics of these on-site facilities are listed in Annex B-1 and B-2.

Solid radioactive waste generated from NPPs as of the late March 2017 is 100,696 drums (in equivalent to 200L drum). Among these, 9,272 drums of radioactive waste from Hanul (3,000 drums), Hanbit (3,000 drums) and Wolsong (3,272 drums), compliant with the requirements of the NSSC Notice *Acceptance Criteria for Low- and Intermediate-level Radioactive Waste*, were transported to the disposal facility operated by KORAD. The remaining 91,424 drums (in equivalent to 200L drum) are stored and managed at the on-site storage facilities. As of the late March 2017, the inventory of and major radionuclides in solid radioactive waste are given in Table D.2-1.

Table D.2-1 Inventory of Radioactive Waste Stored at NPP Sites
(As of March 31, 2017)

<table>
<thead>
<tr>
<th>Site</th>
<th>Inventory [200-L drum equivalent]</th>
<th>Major Radionuclide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kori</td>
<td>44,057</td>
<td>$^{60}$Co, $^{137}$Cs, etc.</td>
</tr>
<tr>
<td>Saeul</td>
<td>23</td>
<td>$^{60}$Co, $^{137}$Cs, etc.</td>
</tr>
<tr>
<td>Wolsong</td>
<td>10,339</td>
<td>$^{60}$Co, $^{137}$Cs, etc.</td>
</tr>
<tr>
<td>Habit</td>
<td>20,763</td>
<td>$^{60}$Co, $^{137}$Cs, etc.</td>
</tr>
<tr>
<td>Hanul</td>
<td>16,242</td>
<td>$^{60}$Co, $^{137}$Cs, etc.</td>
</tr>
<tr>
<td>Total</td>
<td>91,424</td>
<td>-</td>
</tr>
</tbody>
</table>
D.2.2 Nuclear Research Facilities

KAERI operates a radioactive waste treatment facility as well as storage facilities for the safe management of liquid and solid radioactive waste generated from research facilities. Annex B-3 and B-4 show the radioactive waste storage and treatment facilities of KAERI.

Liquid radioactive waste generated from KAERI is treated with an evaporation process. The resulting concentrate is solidified by a bituminization process, whereas the condensate is treated by a solar evaporation process. Solid waste is treated for volume reduction with a compactor and stored on-site.

Radioactive waste generated from KRR-1 and 2 in Seoul, former KAERI site, was packaged in 200-liter drums and transported to KAERI facility in Daejeon in 1985. Since then, they have been stored at the storage facility there. Table D.2-2 shows the inventory of radioactive waste at KAERI's storage facilities along with major radionuclides as of the late of March 2017.

KAERI has been operating a combustible waste treatment facility since 2011, in order to reduce the volume of combustible waste generated from the UCF, KRR-1 and 2 decommissioning process. Table D.2-2 shows the inventory of combustible waste stored in the storage building of the combustible waste storage facility with major radionuclides and Annex B-5 lists the location and capacity of this facility.

Table D.2-2 Inventory of Radioactive Waste Stored at KAERI
(As of March 31, 2017)

<table>
<thead>
<tr>
<th>Facility</th>
<th>Inventory [200-L drum equivalent]</th>
<th>Major Radionuclide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational radioactive waste storage facilities</td>
<td>9,601</td>
<td>$^{54}\text{Mn}$, $^{60}\text{Co}$, $^{238}\text{U}$, $^{137}\text{Cs}$, etc.</td>
</tr>
<tr>
<td>Decommissioning waste storage facilities</td>
<td>11,545</td>
<td>$^{60}\text{Co}$, $^{137}\text{Cs}$, Natural Uranium, etc.</td>
</tr>
</tbody>
</table>

D.2.3 Nuclear Fuel Fabrication Facilities

Two nuclear fuel fabrication plants are operated by KEPCO NF. The 1st plant started its commercial operation in 1989 and the 2nd plant started in 1998. The solid waste treatment and storage concept of the two fabrication plants are almost identical, and
details of the storage facilities are listed in Annex B-6. However, the liquid waste treatment process for the PWR fuel fabrication plant is different from that of the PHWR fuel fabrication plant as shown in Annex B-7. As of the end of March 2017, the amount of solid waste generated from the nuclear fuel fabrication facilities is up to 8,251 drums as shown in Table D.2-3. All of them are stored and managed at the on-site waste storage facilities.

Table D.2-3 Inventory of Radioactive Waste Stored at Nuclear Fuel Fabrication Facilities
(As of March 31, 2017)

<table>
<thead>
<tr>
<th>Facility</th>
<th>Inventory [200-L drum equivalent]</th>
<th>Major Radionuclide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear fuel fabrication storage facilities</td>
<td>8,251</td>
<td>$^{234}\text{U}$, $^{235}\text{U}$, $^{238}\text{U}$</td>
</tr>
</tbody>
</table>

D.2.4 RI Waste Management Facility

The RI waste generated from a variety of RI users was received and has been stored at the RI Waste Management Facility operated by KORAD in Daejeon. There are 1,569 drums of RI waste in the facility as of the end of March 2017, as shown in Table D.2-4. Annex B-8 lists the location and main characteristics of the RI Waste Management Facility.

Table D.2-4 Inventory of RI Waste at KORAD
(As of March 31, 2017)

<table>
<thead>
<tr>
<th>Facility</th>
<th>Inventory [200-L drum equivalent]</th>
<th>Major Radionuclides</th>
</tr>
</thead>
<tbody>
<tr>
<td>RI Waste Management Facility</td>
<td>1,291 (unsealed sources)</td>
<td>$^{125}\text{I}$, $^{99m}\text{Tc}$, etc.</td>
</tr>
<tr>
<td></td>
<td>278 (sealed sources)</td>
<td>$^{60}\text{Co}$, $^{137}\text{Cs}$, $^{241}\text{Am}$, etc.</td>
</tr>
</tbody>
</table>

It is noted that reception of RI waste at the RI Waste Management Facility in Daejeon was stopped in June 2015, and KORAD has been receiving RI waste at the LILW Disposal Facility in Gyeongju since July 2015.
**D.2.5 LILW Disposal Facility**

For the disposal of LILW, the construction of the 1st phase of LILW disposal facility with a capacity of 100,000 drums was completed and it is currently in operation. The regulatory review for CP/OL is underway for the 2nd phase disposal facility (engineered vault type). The location and characteristics of these disposal facilities are listed in Annex B-9.

As of the late March 2017, 6,848 drums (in equivalent to 200L drum) of LILW are stored and managed in the receipt/storage building and 6,920 drums (200L) are disposed in silos. In addition, 35 drums of RI waste have been received at the disposal site of KORAD and stored in the receipt/storage building. The inventory of LILW which has been stored or disposed of at LILW Disposal Facility is listed in Table D.2-5.

<table>
<thead>
<tr>
<th>Facility</th>
<th>Storage/Disposal Inventory [200-L drum equivalent]</th>
<th>Major Radionuclides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receipt/storage building</td>
<td>6,848</td>
<td>$^{60}$Co, $^{137}$Cs, etc.</td>
</tr>
<tr>
<td></td>
<td>12 (sealed source)</td>
<td>$^{125}$I, $^{99}$Tc, etc.</td>
</tr>
<tr>
<td></td>
<td>23 (unsealed source)</td>
<td>$^{60}$Co, $^{137}$Cs, $^{241}$Am, etc.</td>
</tr>
<tr>
<td>Silo</td>
<td>6,920</td>
<td>$^{60}$Co, $^{137}$Cs, etc.</td>
</tr>
</tbody>
</table>

**D.2.6 Other Facilities**

Taekwang Industrial Co., Ltd. in Ulsan generated radiologically contaminated byproducts in the process of producing synthetic fiber using licensed depleted uranium, as a catalyst. Nuclear materials have not been used since they were replaced with a non-radioactive chemical catalyst in 2004. The total inventory of radioactive waste stored in this facility is 8,634 drums, as of March 31, 2017.

Taegutec Co. in Daegu generated radiologically contaminated byproducts in the process of producing wire. Since the closure of their production facilities in 2004, contaminated byproducts have not been generated from the facility (decontamination and decommissioning of the facility were carried out from October 2004 to May 2005). The total inventory of radioactive waste stored in this facility is 52 drums, as of March 31, 2014.
D.3 Decommissioning

The research reactors, KRR-1 and 2, are under decommissioning and the generated radioactive waste is stored at the KRR-2 reactor building which was permitted for a temporary storage. The major radionuclides and the inventory of radioactive waste as of late March 2017 are listed in Table D.3-1. 516 drums of decommissioning waste were transported to the disposal facility in 2015 and 248 drums were transported to the radioactive waste storage facility at KAERI in Daejeon in 2016. Annex C shows the list of nuclear facilities under decommissioning.

Table D.3-1 Inventory of Decommissioning Waste at KRR-1 and 2 Site
(As of March 31, 2017)

<table>
<thead>
<tr>
<th>Facility</th>
<th>Inventory [200-L drum equivalent]</th>
<th>Major Radionuclides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary storage building</td>
<td>482</td>
<td>$^{60}$Co, $^{137}$Cs, $^{152}$Eu, etc.</td>
</tr>
</tbody>
</table>

D.4 Record Keeping and Reporting

Nuclear licensees maintain records on radioactive waste in accordance with the *Enforcement Regulations of the NSA*. They also report radiation safety-related data (e.g. quarterly amount of radioactive waste and spent fuel generated and cumulatively stored) to KINS within one month after the end of every quarter pursuant to the reporting requirements of the *Enforcement Regulations of the NSA*. KINS reviews and manages the operation data submitted by each licensee, and verifies the reported information through periodic inspections, etc.
E. Legislative and Regulatory Framework
E. Legislative and Regulatory Framework

E.1 Implementing Measures [Article 18]

ARTICLE 18. IMPLEMENTING MEASURES
Each Contracting Party shall take, within the framework of its national law, the legislative, regulatory and administrative measures and other steps necessary for implementing its obligations under this Convention.

The legislative, regulatory and other measures to fulfill the obligations of the Joint Convention are discussed in relevant sections of this report.

E.2 Legislative and Regulatory Framework [Article 19]

ARTICLE 19. LEGISLATIVE AND REGULATORY FRAMEWORK
1. Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management.

2. This legislative and regulatory framework shall provide for:
   i. the establishment of applicable national safety requirements and regulations for radiation safety;
   ii. a system of licensing of spent fuel and radioactive waste management activities;
   iii. a system of prohibition of the operation of a spent fuel or radioactive waste management facility without a license;
   iv. a system of appropriate institutional control, regulatory inspection and documentation and reporting;
   v. the enforcement of applicable regulations and of the terms of the licenses;
   vi. a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management.

3. When considering whether to regulate radioactive materials as radioactive waste, Contracting Parties shall take due account of the objectives of this Convention.
E.2.1 Legislative Framework of Nuclear Regulation

E.2.1.1 Nuclear Safety Related Act and Subordinate Statutes
National laws on the management and the safety of spent fuel and radioactive waste are the NSA, the RWMA, *Environmental Impact Assessment Act* and others as shown in Table E.2-1. Articles on the management and the safety of spent fuel and radioactive waste are stipulated in the NSA. Thus, the NSA was enacted as a main law concerning the safety regulations for spent fuel and radioactive waste management.

Laws concerning nuclear regulation consist of the NSA, its Enforcement Decree (a Presidential Decree), its Enforcement Regulations (an ordinance of the Prime Minister), the Regulation of the NSSC (*Regulations on Technical Standards for Nuclear Reactor Facilities, Etc.* and *Regulations on Technical Standards for Radiation Safety Management, Etc.*), and the Notices of the NSSC as shown in Figure E.2-1.

The NSA is composed of a total of 11 chapters including General Provision, Establishment and Execution of Comprehensive Nuclear Safety Plan, Construction Permit (CP) and Operation License (OL) of the radioactive waste management facilities, etc. (e.g. facilities for storage, treatment and disposal of radioactive waste and associated facilities). The *Enforcement Decree of the NSA* provides the articles entrusted in the NSA and stipulates other administrative details including the procedures and methods necessary for enforcement of the NSA. The *Enforcement Regulations of the NSA* and the Regulation of the NSSC provide the articles, including detailed procedures, format of documents and technical standards, as entrusted by the same Act and the same Decree. The Notices of the NSSC prescribe the regulatory requirements, technical standards and guidelines, as entrusted by the NSA, its Decree and Regulation.
### Table E.2-1 Laws concerning Nuclear Safety Regulation

<table>
<thead>
<tr>
<th>Title</th>
<th>Major Contents</th>
<th>Competent Authorities</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear Safety Act</td>
<td>Basic law on the nuclear safety regulations</td>
<td>NSSC</td>
<td>-</td>
</tr>
<tr>
<td>Act on Physical Protection and Radiological Emergency</td>
<td>Establishes more effective system for physical protection of nuclear material and nuclear facilities, and provides legal and institutional basis for preventing radiological disaster and preparing countermeasures against radiological emergency</td>
<td>NSSC</td>
<td>-</td>
</tr>
<tr>
<td>Nuclear Liability Act</td>
<td>Provides the procedures and the extent of compensation for any damages which an individual has suffered from a nuclear accident</td>
<td>NSSC</td>
<td>-</td>
</tr>
<tr>
<td>Act on Indemnification Agreement for Nuclear Liability</td>
<td>Provides the particulars on a contract between the government and the operator to make up any compensation not covered by insurance</td>
<td>NSSC</td>
<td>-</td>
</tr>
<tr>
<td>Act on Establishment and Operation of the NSSC</td>
<td>Provides the particulars on establishment and operation of the NSSC</td>
<td>NSSC</td>
<td>-</td>
</tr>
<tr>
<td>Radiation and Radioisotope Use Promotion Act</td>
<td>Provides the particulars on research, development, and promotion of utilization of radiation and radioisotopes</td>
<td>MSIT</td>
<td>-</td>
</tr>
<tr>
<td>Atomic Energy Promotion Act</td>
<td>Provides the particulars on research, development, production, and utilization of nuclear energy</td>
<td>MSIT</td>
<td>-</td>
</tr>
<tr>
<td>Electricity Business Act</td>
<td>Provides the basic system of electricity business</td>
<td>MOTIE</td>
<td>-</td>
</tr>
<tr>
<td>Electric Source Development Promotion Act</td>
<td>Provides special cases relevant to the development of electric sources</td>
<td>MOTIE</td>
<td>-</td>
</tr>
<tr>
<td>Radioactive Waste Management Act</td>
<td>Provides the framework for radioactive waste management and basic elements therefor</td>
<td>MOTIE</td>
<td>-</td>
</tr>
<tr>
<td>Basic Act of Environmental Policy</td>
<td>Mother law of the environmental preservation policy</td>
<td>MOE</td>
<td>-</td>
</tr>
<tr>
<td>Act on Assessment of Impacts of Works on Environment</td>
<td>Provides the extent and procedures to assess environmental impact according to the Basic Act of Environmental Policy</td>
<td>MOE</td>
<td>Assessment of environmental impacts excluding radiological impacts</td>
</tr>
<tr>
<td>Title</td>
<td>Major Contents</td>
<td>Competent Authorities</td>
<td>Remark</td>
</tr>
<tr>
<td>-------</td>
<td>----------------</td>
<td>-----------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Traffic, Disasters, Etc.</td>
<td>Provides for general matters on the prevention, precaution and the extinguishment of fires</td>
<td>NFA</td>
<td>The requirements for safety management of inflammables</td>
</tr>
<tr>
<td>Framework Act on Fire Services</td>
<td>Provides for general matters on the prevention, precaution and the extinguishment of fires</td>
<td>NFA</td>
<td>The requirements for safety management of inflammables</td>
</tr>
<tr>
<td>Industrial Accident Compensation Insurance Act</td>
<td>Provides insurance to compensate workers in case of an industrial disaster</td>
<td>MOEL</td>
<td>Nuclear workers are to be compensated in accordance with the compensation standards in the NSA</td>
</tr>
<tr>
<td>Basic Act on Civil Defense</td>
<td>Provides for general matters on the civil defense system</td>
<td>MOIS</td>
<td>Preparedness against disasters due to nuclear accidents is included in the basic civil defense plan</td>
</tr>
<tr>
<td>Basic Act on Management of Disasters and Safety</td>
<td>Provides for general matters on the control of man-made disasters</td>
<td>MOSPA</td>
<td>It prescribes corrective or complementary measures for violations in the implementation of the basic civil defense plan</td>
</tr>
<tr>
<td>Industrial Safety and Health Act</td>
<td>Provides for the preservation and enhancement of workers' health and safety</td>
<td>MOEL</td>
<td>The NSA is entrusted with the particulars on radiological safety</td>
</tr>
<tr>
<td>Building Act</td>
<td>Provides for general matters on construction</td>
<td>MOLIT</td>
<td>When the sites of disposal facilities have obtained prior approval, they are to be seen as having obtained construction permission in accordance with Building Act</td>
</tr>
</tbody>
</table>
Figure E.2-1 Legal Framework for Nuclear Safety Regulation
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Contents</th>
<th>Main Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General Provisions</td>
<td>Purpose of Nuclear Safety Act and Definitions of Terms</td>
</tr>
<tr>
<td></td>
<td>Article 1 (purpose)</td>
<td>Purpose of Nuclear Safety Act</td>
</tr>
<tr>
<td></td>
<td>Article 2 (definitions)</td>
<td>Definition of radioactive waste</td>
</tr>
<tr>
<td>2</td>
<td>Establishment and Execution of Comprehensive Nuclear Safety Plan</td>
<td>Establishment and enforcement of Comprehensive Nuclear Safety Plan and the implementation of nuclear safety research and development projects</td>
</tr>
<tr>
<td>3</td>
<td>Construction and Operation of Nuclear Reactor and Related Facilities</td>
<td>Describes overall matters related to the construction and operation of nuclear power reactors and related facilities</td>
</tr>
<tr>
<td></td>
<td>Article 28 (Decommissioning of Nuclear Power Reactor and Related Facilities)</td>
<td>Specifies the contents that must be included in the decommissioning plan</td>
</tr>
<tr>
<td>4</td>
<td>Nuclear Fuel Cycle Business and Use of Nuclear Material, Etc.</td>
<td>Permission procedure and criteria for nuclear fuel cycle enterprise</td>
</tr>
<tr>
<td></td>
<td>Article 42 (Decommissioning of Nuclear Fuel Cycle Facility)</td>
<td>Specifies the contents that must be included in the decommissioning plan</td>
</tr>
<tr>
<td></td>
<td>Use of Nuclear Material</td>
<td>Permission procedure and criteria for the use of nuclear material</td>
</tr>
<tr>
<td>5</td>
<td>Radioisotope and Radiation Generating Device</td>
<td>Permission procedure and standard, inspection procedure and method</td>
</tr>
<tr>
<td></td>
<td>Article 54 (Registration of Business Agent)</td>
<td>Specifies that those who wish to collect, treat, and transport radioactive isotopes, Etc. and radioactive waste must register with the NSSC</td>
</tr>
<tr>
<td>6</td>
<td>Disposal and Transport</td>
<td>Construction and operation permit and inspection of disposal facilities, Etc.</td>
</tr>
<tr>
<td></td>
<td>Article 63 (Permit for Construction and operation of Disposal Facilities, Etc.)</td>
<td>Specifies that those who wish to construct and operate a radioactive waste disposal facility, Etc. must obtain the permission from the NSSC</td>
</tr>
<tr>
<td></td>
<td>Article 70 (Restrictions on Disposal of Radioactive Wastes)</td>
<td>Describes matters related with disposal method, disposal restriction and sea dumping prohibition</td>
</tr>
<tr>
<td>7</td>
<td>Dosimeter Reading, Etc.</td>
<td>Registration and inspection of dosimeter reading service provider</td>
</tr>
<tr>
<td>8</td>
<td>License and Examination</td>
<td>Examination of license and issue of license, Etc.</td>
</tr>
<tr>
<td>9</td>
<td>Regulation and Supervision</td>
<td>Set up of a restricted area and radiation hazard protection measures, Etc.</td>
</tr>
<tr>
<td>10</td>
<td>Supplementary Provisions</td>
<td>Conditions for permit or designation, approval of topical report, etc.</td>
</tr>
<tr>
<td></td>
<td>Article 103 (Gathering Residents’ Opinion)</td>
<td>Specifies that those who wish to obtain a construction and operation permit for a radioactive waste disposal facility or spent fuel storage facility must gather residents’ opinions</td>
</tr>
<tr>
<td></td>
<td>Article 104 (Preservation of Environment)</td>
<td>Specifies that the constructor and operator of a radioactive waste disposal facility must conduct an environmental radiation survey and a radiological environmental impact assessment</td>
</tr>
<tr>
<td>11</td>
<td>Penal Provisions</td>
<td>Penal provisions, fine for negligence, and joint penal provisions</td>
</tr>
<tr>
<td>Addenda</td>
<td></td>
<td>Enforcement date, relationship to other acts, etc.</td>
</tr>
</tbody>
</table>
The NSA prescribes articles on safety to be applied to a radioactive waste management facility, etc. as follows:

- articles concerning CP and OL of a radioactive waste management facility, etc.;
- articles concerning safety inspections with respect to the installation and operation of a radioactive waste management facility, etc.;
- articles concerning limitations on disposal of radioactive waste including prohibition of dumping into the sea; and
- articles concerning safe transport and packaging of radioactive material, etc.

The Enforcement Decree of the NSA (Presidential Decree) specifies the detailed requirements necessary for implementing articles in the NSA as follows:

- requirements concerning application for CP and OL of a radioactive waste management facility, etc. and application for change permit of permitted matters;
- requirements concerning nuclear material accounting and security in a disposal facility, etc.;
- requirements concerning implementation of regulatory inspections such as preoperational inspection, periodic inspection, disposal inspection, Quality Assurance (QA) inspection applicable to a radioactive waste management facility, etc.;
- requirements concerning procedures and methods for clearance of radioactive waste; and
- requirements concerning transport and packaging of radioactive materials, etc.

The Enforcement Regulations of the NSA (an ordinance of the Prime Minister) and the Regulations of the NSSC (Regulations on Technical Standards for Nuclear Reactor Facilities, etc. and Regulations on Technical Standards for Radiation Safety Management, etc.) specify below contents;

- requirements entrusted in the NSA and its Enforcement Decree, and others
necessary for implementing the Act and the Decree, and requirements concerning control and management of radioactive waste as well as packaging and transportation of radioactive materials, etc. (Enforcement Regulations of the NSA);

- requirements concerning structure, equipment and performance of radioactive waste treatment and storage facilities for nuclear reactors and related facilities, and nuclear fuel cycle facilities (Regulations on Technical Standards for Nuclear Reactor Facilities, etc.);
- requirements concerning radioactive waste management during operation of reactors and related facilities, and nuclear fuel cycle facilities (Regulations on Technical Standards for Nuclear Reactor Facilities, etc.);
- requirements concerning siting, structure, equipment and performance of near surface disposal facility, deep geological repository, spent fuel interim storage facilities (Regulations on Technical Standards for Radiation Safety Management, etc.); and
- requirements concerning storage, treatment or disposal of radioactive waste (Regulations on Technical Standards for Radiation Safety Management, etc.).

Notices of the NSSC

The Notices of the NSSC present the detailed technical standards for radioactive waste management specified in the NSA and its Enforcement Decree, its Enforcement Regulations and NSSC Regulations. Annex D lists the Notices applicable to the management of radioactive waste.

- Regulations on the Radioactive Waste Classification and Clearance of Radioactive Waste
- General Standards for Deep Geological Repository for High-level Radioactive Waste
E.2.1.2 Radioactive Waste Management Related Act
Articles concerning radioactive waste management are defined in the Radioactive Waste Management Act (RWMA). As shown in Figure E.2-2, the RWMA is composed of four levels: RWMA, its Enforcement Decree, its Enforcement Regulation and Notices of the MOTIE, and provides particulars regarding management of LILW, establishment of KORAD, and establishment of radioactive waste management fund. The Notices of the MOTIE prescribe the standards and procedures necessary for implementation, requirements entrusted by the higher legislation and regulations. Major Notices of the MOTIE regarding radioactive waste management are listed in Annex E.

![Figure E.2-2 Legal Hierarchy of the Radioactive Waste Management Act (RWMA)](image)

E.2.1.3 Laws related to Physical Protection and Radiological Emergency of Nuclear Facilities, etc.
The Act on Physical Protection and Radiological Emergency (APPRE) was enacted in May 2003 to strengthen the physical protection system for nuclear materials and facilities and the radiological emergency preparedness and response system. This Act inherits the articles related to physical protection and radiological disaster prevention as previously specified in the NSA as well as specifies various requirements for strengthening physical protection and radiological disaster prevention measures. Also, the emergency planning zone (EPZ) was further classified into the Precautionary Action Zone (PAZ) up to 3~5 km from a NPP and the Urgent Protective Action Planning Zone.
E.2.1.4 Laws related to Nuclear Damage Compensation

For the civil liabilities of the license or permit holder due to a nuclear accident, the 
Nuclear Liability Act (1969) and the Act on Indemnification Agreement for Nuclear Liability (1975) were enacted to prescribe the internationally accepted general principles for civil liabilities concerning nuclear damage. The Nuclear Liability Act was amended in January 2001 to reflect on domestic laws the contents of the Vienna Convention revised in 1997. The amendment of the Act concretized the concept of nuclear damage, set the limit of liability of the business operator to 300 million Special Drawing Rights\(^1\) (SDRs) and set the upper limit of the compensation amount also to 300 million SDR.

E.2.2 Nuclear Regulatory Framework

In the Korean framework for nuclear safety regulation, the NSSC has absolute authority with regard to overall nuclear safety regulations. The government gives the NSSC the authority in relation to nuclear safety regulations such as establishment of a nuclear safety policy and licensing under the provision of nuclear safety related laws such as the NSA. Likewise, Ministries of the government deal with nuclear safety management related operations in fulfilling their own duties according to the Government Organization Act by forming an organic system with the NSSC. For example, the Ministry of Security and Public Administration (National Fire Agency), which implements national disaster prevention and management measures is in charge of the safety of combustible materials in nuclear facilities. Figure E.2-3 shows the government sectors that are related with the safety management concerning nuclear facilities and activities.

The government separately operates the Ministry of Government Legislation which has absolute authority over government legislation to ensure neither overlapping nor omission of safety regulations when laws related to the operations of these government sectors are established or amended. The Regulation on Legislative Operation Management (Presidential Decree) also stipulates that related sectors must consult with each other through overall legislative activities. Article 89 of the Constitution of the Republic of Korea prescribes that bills for the establishment or amendment of laws, confirmation of authorities between administrative branches and major policy adjustments must be reviewed by the Cabinet Meeting presided by the President to

---

\(^1\) It is the Special Drawing Rights of the International Monetary Fund (IMF) and a type of international reserve currency exercised since 1970.
prevent the overlapping or omission of safety regulation requirements. For nuclear safety regulation requiring professional expertise, the Korean government is operating KINS as a professional regulatory agency under the provision of the NSA and *Korea Institute of Nuclear Safety Act*, in order to strengthen expertise in nuclear safety regulation. Based on the expertise in nuclear safety regulations and the accumulated experiences, KINS is in charge of regulatory services concerning nuclear safety entrusted by the NSSC such as safety review, safety inspection, verification and examination, R&D for standards (including technical standards), and management of records and reporting.

![Figure E.2-3 Government Organizations related to Radioactive Waste Management](image)

**E.2.3 Licensing Procedure**

An applicant, who wishes to construct a certain range of radioactive waste management facility, etc. prior to CP and OL, should submit to the NSSC an application for early site approval together with the Radiological Environmental Report (RER) and the Site Investigation Report (SIR). KINS conducts safety review with respect to the RER and the SIR. After review by KINS, the NSSC may grant the early site approval for a construction to the applicant.

![Early Site Approval for Construction](image)

An applicant, who wishes to obtain CP and OL of a radioactive waste management facility, etc., should submit to the NSSC an application which is attached with the RER,
the Safety Analysis Report (SAR), regulations on safety control, specifications of design and work process, and Quality Assurance Program (QAP) with respect to its construction and operation. After review by KINS, the NSSC may grant CP and OL to the applicant.

The safety review of application documents for CP and OL of radioactive waste management facility, etc. is conducted to confirm that the site and the design of a radioactive waste management facility, etc. are in conformity with the relevant regulatory requirements and technical standards. It includes safety reviews of the principles and concepts of design, implementation of regulatory criteria in due course, assessment of environmental impacts resulting from the construction and operation of radioactive waste management facility, etc., and proposal on minimizing those impacts. The RER, to be submitted at the time of application for early site approval for the construction or application for CP and OL of a radioactive waste disposal facility or an interim storage facility for spent fuel, shall contain the opinion of the residents of the area surrounding the site.

In case of any change in license such as design or technical specifications that affect or can affect the safety of radioactive waste management facility, etc., license amendments shall be granted by the NSSC.

**E.2.4 Regulatory Inspection**

Regulatory inspections for radioactive waste management facility, etc. under construction or in operation consist of preoperational inspection for construction and performance, disposal inspection, periodic inspection, QA inspection, and daily inspection by site office.

The preoperational inspection is conducted to verify whether the construction work has been progressed according to the content of CP and to check whether the structure, equipment and performance of radioactive waste disposal facility, etc. are in conformity with the technical standard. The preoperational inspection consists of inspection for construction and performance.
Disposal Inspection

The disposal inspection is conducted to verify whether the disposal of radioactive waste is in conformity to all related technical standards stipulated in the NSA and subordinate statutes when the operator of the disposal facility, etc. intends to dispose of radioactive waste.

Periodic Inspection

The periodic inspection is conducted to verify whether the operation of radioactive waste management facility, etc. is maintained properly according to the technical standards referred to the NSA, whether storage, treatment and disposal of radioactive waste are in conformity with the technical standards referred to in the NSA and whether the performance of the facility is maintained in a state which a radioactive waste management facility, etc. has passed the preoperational inspection.

QA Inspection

The QA inspection is conducted to check whether a constructor and operator of a management facility, etc. carries out QA activities according to the QAP submitted to the regulatory body.

Daily Inspection by Site Office

The daily inspection by site inspector office for LILW Disposal Center in Gyeongju is to check radioactive waste management facility, etc. under construction or in operation on a daily basis. It may include observation of periodic testings, investigation of the measures taken when the radioactive waste management facility, etc. is in an abnormal state, and verification of the adequacy of radiation safety control activities.

E.2.5 Enforcement

After a safety review of application for CP and OL, the NSSC may grant a certificate of permit to the applicant. The NSSC may impose minimum conditions thereon, if deemed necessary for safety. If violation has turned out as a result of inspection, the NSSC may order the licensee of radioactive waste management facility, etc. to take corrective or
complementary measures in accordance with the NSA.

If it is deemed necessary for enforcement of nuclear safety, the NSSC may order the nuclear licensee to submit necessary documents on its business and to supplement all submitted documents. The NSSC may also conduct regulatory inspections to verify that the documents conform to the actual conditions, and order the nuclear licensee to take corrective or complementary measures, if any, in accordance with the inspection results. The NSSC may order the revocation of license or the suspension of business by specifying a period not exceeding one year, in a case where the constructor and operator of radioactive waste management facility, etc. falls under any of the below items.

- in case of obtaining the CP/OL by fraudulent or other illegal means;
- in case of not commencing the permitted/licensed business within the period set by the Presidential Decree or suspended the permitted/licensed business for more than one year without good reasons;
- in case of changing matters which require a permission for amendment in the CP/OL without due process;
- in case of not meeting the requirements in licence;
- in case of violating the order of the NSSC to conduct a corrective or complementary action as a result of safety regulatory inspection on the installment and operation of radioactive waste management facilities, etc.; and,
- in case of violating the regulations and conditions permitted/licensed on safety measures on operation of other radioactive waste management facilities, etc.

The NSSC may impose a penalty or surcharge depending on the extents of inconvenience or detriment caused by such violations.

E.2.6 Allocation of Responsibilities

The NSA and the RWMA prescribe definitely where the responsibility lies for each stage of radioactive waste management.

The NSSC is responsible for the inspection at the stage of CP and OL, and the one related to the safety of radioactive waste management facilities, etc. (refer to E.2.4) in accordance with the NSA. KINS performs safety-related regulatory activities as entrusted by the NSSC.

MOTIE takes the responsibility of formulating and performing a basic plan that includes basic policies, estimated amount of generation and facility-related plans regarding radioactive waste management pursuant to the RWMA. KORAD is responsible for
radioactive waste management such as transportation, storage, and disposal, etc. of radioactive waste.
ARTICLE 20. REGULATORY BODY
1. Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in ARTICLE 19, and provided with adequate authority, competence and financial and human resources to fulfill its assigned responsibilities.

2. Each Contracting Party, in accordance with its legislative and regulatory framework, shall take the appropriate steps to ensure the effective independence of the regulatory functions from other functions where organizations are involved in both spent fuel or radioactive waste management and in their regulation.

E.3.1 Nuclear Safety and Security Commission (NSSC)

The NSSC is currently under the Prime Minister with an aim to protect people from risk of radiological disasters from generation and use of nuclear energy and to contribute to public safety and environmental conservation pursuant to the Act on the Establishment and Operation of the Nuclear Safety and Security Commission (No. 13546). Accordingly, the NSSC performs overall tasks related with nuclear safety management such as safety regulations on nuclear facilities including radioactive waste management facilities, R&D activities and international cooperation.

E.3.1.1 Composition of the NSSC
The NSSC consists of nine members including the chairperson, with the chairperson and one member as standing members. The members of the NSSC are nominated or appointed among those who have in-depth expertise and experience in nuclear safety but the members are to be evenly selected from various fields such as nuclear, environment, public health, science and technology, public safety, law, and social and human sciences so as to contribute to nuclear safety in an effective and balanced way.

The chairperson is appointed by the President among the nominees referred by the Prime Minister. Four members including the standing member are appointed by the President with the referral of the chairperson of the Commission, while the rest four members are appointed by the President with the referral of the National Assembly. Those who are working or worked as the head or an employee of the nuclear operator,
or the nuclear operator groups within the recent three years; or who are being involved or were involved in the projects performed by the nuclear operator or the nuclear operator groups within recent three years including research and development projects entrusted by the nuclear operator or the nuclear operator groups should not be appointed as a member of the NSSC. The term of the NSSC members should be three years, and they may be reappointed once.

The NSSC convenes meetings upon request by more than two members or the chairperson where they deliberate and decide on key issues such as CP and OL of both nuclear power plants and radioactive waste management facilities, measures and fines to be imposed on nuclear operators for the violation of relevant provisions, and enactment, amendment and abolition of Acts under their jurisdiction and the commission’s rules.

E.3.1.2 Advisory Committee
The Commission has the Advisory Committee under its control for practical consultations, preview of the issues needed to be deliberated and/or decided for efficient implementation of the tasks it entrusts.

The Advisory Committee is composed of maximum 15 expert members including the chairperson. The chairperson is appointed by the chairperson of the NSSC among the Advisory Committee’s members. The expert members are appointed by the chairperson of the NSSC and should have in-depth expertise and experience in nuclear engineering or be the employees of the relevant institutions. The term of office of the Advisory Committee’s members should be two years, and they may be reappointed once.

The NSSC may form a separate advisory (expert) committee for investigation in case of significant accident regarding the safety system of nuclear facilities, environmental contamination accident due to radiation, significant radiation exposure accident, radiological accidents abroad, or spread of radioactive contamination.

E.3.1.3 Organization
The NSSC has the Secretariat which deals with the general affairs of the commission and the standing member holds an additional position of the secretary general. The Secretariat consists of two bureaus, one office, four officers, ten divisions and four site offices as seen in Figure E.3-1.
The Planning and Coordination Office is responsible for performance management, budgeting and settlement, response to the National Assembly and international cooperation. The office is also in charge of public relations, communication, response to the media and provision of information to the public.

The Nuclear Regulatory Bureau has authority over safety regulations, nuclear safety related acts, statutes and regulatory standards on permit and license, inspection, accidents and failure investigation and decommissioning of nuclear power reactors and nuclear fuel cycle facilities.

The Radiation Emergency Bureau is in charge of safety regulations on the use of nuclear materials, RIs and radiation generators (RGs) as well as spent fuel, radioactive waste and radioactive waste management facilities. The bureau also performs duties related with comprehensive safety management for radiation workers, radiological disaster prevention, nuclear damage compensation, environmental radiation monitoring.
and evaluation, physical protection of nuclear materials and nuclear facilities, nuclear security, international nuclear non-proliferation regime, safety management of radiation in the natural environment.

The Site Offices located at the nuclear facilities are responsible for on-site safety regulations for nuclear reactors, nuclear fuel cycle facilities, radioactive waste management facilities, and communication with residents and local governments.

The Radioactive Waste Safety Division has been newly established under the Radiation Emergency Bureau in February 2017 and is responsible for radioactive waste regulations. It takes charge of regulations on storage, transportation, and disposal of radioactive waste and spent fuel, and authorization and regulations of operation, decommissioning, and closure of the storage, treatment, and disposal facilities of radioactive waste and interim storage facilities of spent fuel.

Out of matters concerning radioactive waste and spent fuel, the responsibilities for regulations on decommissioning of NPPs are under Nuclear Safety Division, and standards for permit/license for radioactive waste management facilities are under Safety Standard Division, and on-site regulation of radioactive waste management facilities are under the Site Offices (Wolsong and Hanbit).

E.3.1.4 Human and Financing Resources
The NSSC employs 150 persons as of March 2017 and 33 out of them work at the site offices.

The allocated budget for the NSSC is KRW 176.2 billions (USD 151.8 millions) as of 2016, consisting of the general accounting budget of KRW 91 billions (USD 78.4 millions) and KRW 85.2 billions (USD 73.4 millions) from the Nuclear Power Fund. With the opening of the Safety Regulation Account for the Nuclear Power Fund in 2016, stable financing for conduct of regulatory activities such as review and inspection of nuclear facilities has been secured.

E.3.1.5 Independence of NSSC
The government has separated safety regulations on nuclear power from utilization and promotion of nuclear power, and legally guarantees the independence of the work of the NSSC.

Nuclear power related policies, and supervision of nuclear power operators and radioactive waste management are under the control of MOTIE in accordance with the Electricity Business Act and the RWMA while nuclear power related R&D, its use and
promotion policies are under the Ministry of Science and ICT (MSIT) pursuant to the *Atomic Energy Promotion Act* and the *Radiation and RI Utilization Promotion Act*, and safety regulation policies on nuclear power and radiation, and measures against radiation hazards/disasters are under the NSSC in accordance with the NSA, the *Act on Physical Protection and Radiological Emergency and the Nuclear Liability Act*.

Article 2 (Principles of Operation) of the *Act on Establishment and Operation of the NSSC* provides that independence and fairness are the principles of the operation of the NSSC while Article 3 (Establishment of the NSSC) of the same Act secures the independence of the NSSC by specifying that safety related matters about which decisions need to be made independently such as the permit and license for nuclear operators and corrective measures against them are not subject to the authority or supervision of the Prime Minister.

E.3.1.6 Transparency of NSSC
The NSSC makes its meetings and annual reports public, and operates the Nuclear Safety Information Center in order to promote transparency.

The NSSC makes it a rule to open its meetings to the public and disclose meeting minutes. Those who want to sit in on the meetings are required to sign up at least 24 hours prior to the opening of a meeting with the approval of the chairperson. The meeting minutes taken down are open to the public on the NSSC's website, etc. by the day of the next meeting.

The NSSC shall submit a report on its performance of duties of the relevant year to the National Assembly within three months after the last day of each fiscal year and make it public. In addition, it provides information about the safety of nuclear reactors, radiation, nuclear fuel and radioactive waste to all the people promptly and transparently with the operation of the Nuclear Safety Information Center (NSIC) which is also used as a communication channel to collect suggestions on important matters.

E.3.2 Korea Institute of Nuclear Safety (KINS)

KINS was established in February 1990 as a professional regulatory agency, under the *Act on the Establishment of KINS*. KINS performs tasks on nuclear safety regulation as entrusted by the NSSC in accordance with the NSA. Its major functions in relation to nuclear safety regulation are as follows:

- Nuclear facility safety regulation
  - Review and inspection of NPPs
- Review and inspection of nuclear fuel cycle facility and research reactor, etc.
  • Radiation safety regulation
  - review and inspection of radioactive waste management facility, etc.
  - review and inspection of utilization of RIs and RGs
  • Radiation emergency response
  - emergency response and preparedness for radiological accident and terrorism
  - monitoring of environmental radioactivity throughout the territory and the areas near NPPs
  - detection of nuclear tests and nuclear accidents in neighboring countries
  • Nuclear safety regulation research and development and professionalization
    - development of safety criteria and technologies
    - development of regulatory policy and system
    - cultivation of professional human resources
  • National examination for nuclear-related license and technical qualification
    - license examinations related to operation of nuclear reactors, and handling of radioisotopes and nuclear materials, etc.
    - national technical qualification examinations for engineers and professional engineers in the fields of nuclear engineering and radiation management
  • Enhancement of global leadership and public trust
    - enhancement of contribution and support of regulatory technologies to the international community
    - programs to spread safety culture as well as enhance public trust

KINS is comprised of 523 staff members as of the end of March 2017 and Figure E.3-2 shows the organization chart of KINS. KINS received a budget of KRW 1,140 billions (USD 98.2 millions) from the government as of 2016. To share its safety regulatory technologies and experience with the international community, KINS opened the International Nuclear Safety School (INSS) in January 2008, which has also functioned as the IAEA’s Asian training center since conclusion of a Nuclear Safety Cooperation Agreement with the IAEA.
Figure E.3-2 Organization Chart of KINS (As of March 31, 2017)
F. Other General Safety Provisions
F. Other General Safety Provisions

F.1 Responsibility of the License Holder [Article 21]

**ARTICLE 21. RESPONSIBILITY OF THE LICENCE HOLDER**
1. Each Contracting Party shall ensure that prime responsibility for the safety of spent fuel or radioactive waste management rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.

2. If there is no such licence holder or other responsible party, the responsibility rests with the Contracting Party which has jurisdiction over the spent fuel or over the radioactive waste.

F.1.1 Mechanism for the Regulatory Body to Ensure that the License Holder Meets its Primary Responsibility for Safety

In accordance with Article 5 of the RWMA, radioactive waste management operator should cooperate with nuclear safety regulatory body to manage radioactive waste in a safe and efficient manner. The NSSC takes the responsibility of regulatory inspections as described in E.2.4 of this National Report pursuant to the NSA to ensure that the constructor or the operator of a nuclear facility comply with requirements for CP/OL during the construction period or operational lifetime of the nuclear facility. If violation occurs, the NSSC immediately orders the constructor or the operator to take corrective or complementary measures so as to secure the safety of the nuclear facility. In case the operator of the nuclear facility does not satisfy the requirements of license, the NSSC may revoke the license or order to suspend the business for a certain period of time. In addition, if the performance of the nuclear facility does not meet the technical standards, it may order the operator to strengthen the safety measures.

The license holder of a nuclear facility has the responsibility for safe management of spent fuel and radioactive waste generated during operation in accordance with related regulations until they are transported to a storage, treatment or disposal facility. The operator of a radioactive waste management facility has the responsibility to accept the
radioactive waste from the generators and then to treat (except for spent fuel), store, and dispose of it in a safe manner.

**F.1.2 Ultimate Responsibility**

According to the resolution of the AEPC, the Korean government adopted the State's responsibility for radioactive waste management in light of the fact that radioactive waste needs to be safely managed in the long-term. MOTIE should establish the basic plan for radioactive waste management to manage radioactive wastes safely and efficiently which are deliberated and decided on at the meeting of the AEPC.
ARTICLE 22. HUMAN AND FINANCIAL RESOURCES
Each Contracting Party shall take the appropriate steps to ensure that:

i. qualified staff are available as needed for safety-related activities during the operating lifetime of a spent fuel and a radioactive waste management facility;

ii. adequate financial resources are available to support the safety of facilities for spent fuel and radioactive waste management during their operating lifetime and for decommissioning;

iii. financial provision is made which will enable the appropriate institutional controls and monitoring arrangements to be continued for the period deemed necessary following the closure of a disposal facility.

F.2.1 Korea Radioactive Waste Agency (KORAD)

KORAD is composed of the head office (three divisions), R&D Institute, LILW Disposal Center and Fund Management Center which is responsible for the Radioactive Waste Management Fund as shown in Figure F.2-1. KORAD has a total of 285 staff; 153 in the head office, 79 in LILW Disposal Center, 37 in the R&D Institute and 9 in the Fund Management Center. In the Safety Management Division of the head office, about 25 staffs are in charge of establishment and implementation of spent fuel management plan, and about 40 staffs are responsible for overseeing and supporting the construction and operation of the LILW disposal facility. RI Waste Management Facility are operated and managed by the 7-member RI Waste Management Team of the LILW Disposal Center.

The main duty of the LILW Disposal Center is to operate the LILW disposal facility. The center manages the overall process of the LILW disposal facility from transportation, receipt, inspection to disposal. It is also in charge of radiation safety management, environment assessment, emergency preparedness drills, etc. Other workforce in headquarter and in the LILW Disposal Center is engaged in management, administrative support, public relations, community cooperation, quality assurance, etc.
As per the RWMA, the radioactive waste generators including RI waste generators pay the expenses incurred in radioactive waste management to KORAD at the point of delivery of radioactive waste. KORAD secures the budget necessary for radioactive waste management from the government. KRW 93.59 billions (USD 80.6 millions) for LILW management, KRW 3.64 billions (3.1 millions) for spent fuel management and KRW 240 millions (0.2 millions) for technology development have been earmarked as of 2017.

F.2.2 Korea Hydro & Nuclear Power Co., Ltd. (KHNP)

The KHNP is a nuclear power plants operator, consisting of the head office (8 divisions), 5 sites of NPPs, and special institutes such as Central Research Institute, Human Resources Development Institute and Radiation Health Institute.
The KHNP has the Radiation Safety Team under the Safety Department of the head office staffed with about 11 personnel and charged with management of LILW and radiation safety during operation of NPPs. The operator also has the Emergency Preparedness Team in the head office consisting of about 5 personnel taking charge of radiological emergency preparedness for NPPs and environmental radiation management. The Spent Fuel Management Team in the Backend Management & Decommissioning Department is responsible for temporary on-site storage of spent fuel until it is transported to the repository or the interim storage facility.

Figure F.2-2 Organization Chart of KHNP (As of March 31, 2017)

The Radiation Safety Team at each NPP has approximately 30 personnel who perform duties related with health physics, radiation protection, radioactive waste management, etc., and 5 of them are responsible for radioactive waste management such as treatment
and temporary storage of radioactive waste. Besides, a team to take charge of delivery of LILW to the disposal facility is in place at each NPP site.

Each NPP site also has the Emergency Preparedness Team responsible for radiological emergency preparedness and environmental radiation management such as emergency preparedness drills and training of emergency response personnel. The organization chart of the NPP site is shown in Figure F.2-3.

![Organization Chart of Nuclear Power Plant Site (As of March 31, 2017)](image)

**Financial Resources**

In accordance with the *Electric Utility Act*, the operator of NPPs has paid the costs for disposal of LILW and spent fuel generated during decommissioning and operation of NPPs in installments on a yearly basis to prepare the reserve fund for backend management of NPPs since 1983.

Cost estimates are reviewed by MOTIE every two years pursuant to the RWMA. According to the provision on the standards for calculation of expenses for radioactive waste management and charges for managements of spent fuel, the estimate for LILW
is KRW 12.19 million (USD 10.5 thousand) per drum while that for spent fuel from PWR is KRW 320 millions (USD 275.7 thousand) per assembly and spent fuel from PHWR is KRW 13.2 millions (USD 11.3 thousand) per bundle. The management expenses for LILW is accumulated payable whenever radioactive waste is generated and paid to KORAD whenever radioactive waste is delivered pursuant to Article 14 of the RWMA. The charges for management of spent fuel is accumulated payable when a nuclear reactor is loaded with nuclear fuel and paid to the Radioactive Waste Management Fund when nuclear fuel is unloaded from the nuclear reactor in accordance with Article 15 of the RWMA. Meanwhile, a nuclear power plant operator should accumulate a reserve separately every year for decommissioning of the relevant nuclear power plant pursuant to Article 17 of the RWMA.

F.2.3 KEPCO Nuclear Fuel Co., Ltd. (KEPCO NF)

KEPCO NF is a designer and manufacturer of nuclear fuel that is used in NPPs. KEPCO NF consists of 3 divisions, Overseas Business Group and Quality Management Office as of March 2017 as shown in Figure F.2-4. KEPCO NF has the Nuclear Power Safety Office under the Fuel Production Division to be in charge of disaster safety, radiation safety, and management of radioactive waste and nuclear materials. The Nuclear Power Safety Office is composed of Emergency Management Team, Radiation Safety Team, Radioactive Waste Management Team, and Safeguards Team.

The Disaster Safety Management Team has 11 personnel who perform disaster safety management such as radiation safety, firefighting, environmental and industrial safety, occupational health, etc. while the Nuclear Power Safety Team staffed with 16 personnel is responsible for health physics, exposure control, transport and measurement of radioactive materials and management of environmental radiation/radioactivity. The Safety Measures Team with 9 personnel performs duties of nuclear material accounting and safeguards measures. In addition, the Nuclear Power Environment Team with 9 personnel is responsible for development of radioactive waste management technology and delivery of radioactive waste to the disposal facility. The team also oversees safe treatment and storage of radioactive waste generated from nuclear fuel processing facilities, and radiation safety management.
Figure F.2-4 Organization Chart of KEPCO NF (As of March 31, 2017)

The management expenses for LILW is reserved pursuant to Article 14 of the RWMA. A generator of radioactive waste should pay the management expenses at the point of delivery of radioactive waste to KORAD. KEPCO NF has reserved the management expenses based on the quantity of drums of radioactive waste generated on a quarterly basis in preparation for disposal. A total of KRW 108.01 billions (USD 93.1 millions) has been accumulated as of June 2017.

**F.2.4 Korea Atomic Energy Research Institute (KAERI)**

KAERI has several facilities related to management of spent fuel and radioactive waste, including HANARO, PIEF, radioactive waste treatment facilities and storage facilities, and combustible waste treatment facility. Figure F.2-5 presents KAERI’s operation and management organization.
- HANARO -
With 65 personnel, the HANARO Management Division under HANARO Operation and Utilization is responsible for operation and maintenance of the research reactor. Radioactive waste generated from HANARO is transferred to and managed at KAERI’s radioactive waste treatment facility and storage facility. Spent fuel generated from the reactor is managed by the HANARO Management Division.

- PIEF -
The Post Irradiation Examination Division under the Nuclear Fuel Cycle Technology of KAERI operates the PIEF. This facility is operated and maintained by nine operating and test/maintenance personnel whose work scope is assigned according to their expertise and backgrounds. Operating staff members are responsible for operation of supporting equipment such as electricity and water quality management, and ventilating equipment as well as internal and external inspections including nuclear material accounting and licensing, whereas examining/managing staff are in charge of post-irradiation examination for spent fuels and management of the relevant examination facilities. Radiation safety management, environmental radiation monitoring, water supply control, and nuclear material accounting, physical protection, radiological emergency preparedness with regard to the PIEF are performed in cooperation with related departments of KAERI.

- Radioactive Waste Treatment Facility and Storage Facility -
12 personnel in the Radwaste Management Center under the Nuclear Fuel Cycle Technology of KAERI operate radioactive waste treatment and storage facilities, which include equipment related to evaporation, bituminization, solar evaporation, LILW storage facilities, and a radionuclide assay facility to conduct non-destructive radionuclide assay for the radioactive waste drums to be transported to the disposal facility. Environmental radiation monitoring, and QA are performed in cooperation with related departments of KAERI.

- Combustible Waste Treatment Facility -
Beginning in 2011, the Radwaste Management Center under Nuclear Fuel Cycle Technology of KAERI operates a combustible waste treatment facility with 5 personnel to reduce the volume of combustible waste generated from decommissioning of KRR-1 and 2, and the UCF. In addition, radiation safety management, environmental radioactivity management, and QA are provided through the support and cooperation of the related KAERI departments.
The management expenses of spent fuel related facilities and radioactive waste treatment facilities and storage facilities of KAERI is financed by the government budget. In accordance with the RWMA, KRW 5.898 billions (USD 5.1 millions) has been accumulated for disposal of radioactive waste as of 2017 and KRW 2.1 billions (USD 1.8 millions) has been earmarked for preparation for treatment and analysis of radioactive waste to be disposed of so as to meet the acceptance criteria at the disposal facility.
ARTICLE 23. QUALITY ASSURANCE
Each Contracting Party shall take the necessary steps to ensure that appropriate quality assurance programs concerning the safety of spent fuel and radioactive waste management are established and implemented.

F.3.1 Quality Assurance Policy

The NSA stipulates that the constructor and operator of the radioactive waste management facility etc. should establish and implement QAP, so as to ensure planned and systematic QA activities at the stages of site characterization, design, construction, operation, closure, and post-closure monitoring of the facility.

The NSSC Notice *Quality Assurance Standards for Radioactive Waste Management Facilities* should be applied to establish a QA system of a LILW Disposal Facility. Another Notice of the NSSC *Technical Requirements for the Operation and Control of Low and Intermediate Level Radioactive Waste Disposal Facilities* also specifies overall requirements to be observed by the constructor and operator for operation and management of a LILW Disposal Facility.

According to the provisions, an applicant for CP/OL of a LILW Disposal Facility should submit a QAP plan for construction and operation of the radioactive waste disposal facility. The applicant has the ultimate responsibility of complying with the QAP during construction and operation of the facility.

In case that the QAP plan is to be amended after grant of CP/OL, the constructor and operator should notify the amendment to the NSSC, except the constructor and operator should obtain early approval from the NSSC if related with changes in QA organization.

The licensee has the responsibility to abide by the approved QAP in the design, construction and operation of the radioactive waste management facilities and the regulatory authority audit the status and effectiveness of QAP implementation by the licensee according to the NSA.
F.3.2 Framework of Quality Assurance Program (QAP)

As for the framework of the QAP applicable to a LILW disposal facility and an interim storage of spent fuel, the NSSC Notice *Quality Assurance Standards for Radioactive Waste Management Facilities* stipulates 18 criteria as follows:

1) Organization, 2) QAP, 3) Design control, 4) Procurement document control, 5) Instructions, procedures, and drawings, 6) Document control, 7) Control of purchased items and services, 8) Identification and control of items, 9) Control of special process, 10) Inspection, 11) Test control, 12) Control of measuring and test equipment, 13) Handling, storage, and shipping, 14) Inspection, test, and operating status, 15) Control of nonconforming items, 16) Corrective action, 17) QA records, and 18) Audit, supervision and business management.

F.3.3 Implementation and Assessment of QAP

The licensee of a LILW disposal facility, and all contractors participating in site characterization, design, manufacture, construction, commissioning, operation, maintenance, closure, and post-closure monitoring are required to prepare and implement a QAP pursuant to the NSA. The licensee is responsible for establishing an integrated system so that all participants implement the QAP.

All contractors participating in the LILW disposal project have conducted QA activities in the applicable areas of site characterization, design, fabrication, construction, commissioning, management and maintenance in operation, closure and post closure monitoring in accordance with detailed procedures based on the QAP. The QAP should be established and implemented for each contractor.

Evaluation for implementation and effectiveness of this QAP is periodically conducted by the licensee itself, as well as by the contractors. The method of assessing implementation of the QAP includes quality control inspection, QA audit, QA trend analysis, and effectiveness evaluation of the QAP.

- Quality control inspection is conducted by a qualified inspector on the basis of the pre-established inspection plan. Before starting the quality control inspection, the inspector selects inspection points (witness point and hold point) in the inspection plan and then executes the inspection.

- QA audits for the licensee and contractors are periodically performed by an auditor independent from the tasks to be audited.
Quality trend analysis is conducted to analyze the trends and causes of conditions adverse to quality such as failures, malfunctions, deficiencies, deviations, defective material and equipment, non-conformances. Based on the results of trend analysis, measures to prevent recurrence and to incorporate them into the QAP are developed so as to improve QA activities.

Assessment of QAP effectiveness is periodically conducted by the QA organization to maintain the QAP suitable for the characteristics of facilities within the scope of the QAP. Major considerations for assessment of QAP effectiveness are given to incorporate legislation and revision of related laws and regulations, corrective actions or recommendations made by the regulatory body, modifications to the QAP, and revision of applicable technical standards into QAP documents.

The responsible person of the QA organization ensures that important issues resulting from the evaluation of implementation and effectiveness of the QAP are reported to the top management so that proper actions are taken in a timely manner, and if needed, the QAP and related procedures are revised based on the results of assessment of QAP effectiveness to maintain the QAP in the best possible condition.

F.3.4 Regulatory Activities

Regulatory control on QA of radioactive waste disposal is conducted through reviews and inspections by KINS, as entrusted by the NSSC. Reviews of the QAP of the licensee of a disposal facility and inspections of the appropriateness of implementation the QAP are performed. The purpose of regulatory activities for radioactive waste disposal is to ensure that the licensee performs quality related activities in accordance with the approved QAP and each contractor participating in design, construction and/or operation of a radioactive waste disposal facility establishes and implements the QAP properly suitable for the NSA. These regulatory activities are conducted as per provisions of the NSA and subordinate statute, guidance for safety review of the radioactive waste disposal facilities, and the technical standards for QA.

The safety review is conducted to verify whether the QAP of the licensee complies with the NSA and subordinate statute as well as the safety review guidelines. It also verifies whether the QA procedures for implementation of the QAP are properly established and are practicable.

KINS performs a periodic inspection to confirm the appropriateness of implementation of the QAP with regard to the radioactive waste treatment, discharge and storage facilities at NPPs, and the radioactive waste management facilities at research reactor and nuclear fuel fabrication facility. In the same manner, the same regulations are applied
to the LILW disposal facility.

In order to encourage the operator to conduct performance-based QA activities voluntarily, KINS has developed and utilized the Inspection Guidelines for the Operator's Quality Assurance Activities (QAA). According to the guideline, the results of regulatory inspection of QA activities of the operator is quantified and graded, and based on which, KINS has implemented a graded approach to regulatory inspection of QA activities of the operator. Under the QA Auditor Qualification Program for regulatory personnel established by KINS, qualified auditors who have completed the specified educational and training courses, conduct the QA inspections.

---

**Quality Management System within the Regulatory Body**

As part of efforts to improve reliability and fairness as an organization entrusted with regulatory activities, KINS has developed and implemented the quality management plan in accordance with IAEA Safety Standards Series No. GS-R-3 (The Management System for Facilities and Activities). The quality management plan describes overall quality management system to ensure that standardized tasks regarding regulatory work quality are performed such as policy, objectives, responsibilities, quality plan within the quality system, management, assessment and improvement, thereby achieving the government’s nuclear safety regulatory policy.
ARTICLE 24. OPERATIONAL RADIATION PROTECTION

1. Each Contracting Party shall take the appropriate steps to ensure that during the operating lifetime of a spent fuel or radioactive waste management facility:
   i. the radiation exposure of the workers and the public caused by the facility shall be kept as low as reasonably achievable, economic and social factors being taken into account;
   ii. no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection; and
   iii. measures are taken to prevent unplanned and uncontrolled releases of radioactive materials into the environment.

2. Each Contracting Party shall take appropriate steps to ensure that discharges shall be limited:
   i. to keep exposure to radiation as low as reasonably achievable, economic and social actors being taken into account; and
   ii. so that no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection.

3. Each Contracting Party shall take appropriate steps to ensure that during the operating lifetime of a regulated nuclear facility, in the event that an unplanned or uncontrolled release of radioactive materials into the environment occurs, appropriate corrective measures are implemented to control the release and mitigate its effects.

F.4.1 Regulations and Requirements

Regulations and requirements related to radiation protection applicable to nuclear and radiation facilities that generate spent fuel and radioactive waste are specified in the NSA, its Enforcement Decree, its Enforcement Regulation, and Notices of the NSSC. These regulations and requirements meet IAEA standards and they are summarized as follows:
The Nuclear Safety Act (NSA) prescribes articles concerning radiation protection to be applied to nuclear and radiation facilities, as follows:

- articles concerning protective measures against radiation hazards to keep quantities of released radioactive material, etc. and exposure dose as low as reasonably achievable (ALARA);
- articles concerning safety measures necessary to protect human, materials and the public from radiation hazard that may accompany the operation of nuclear and radiation facilities;
- articles concerning establishment of exclusion area to protect human, materials, and the public from radiation hazards, when installing nuclear and radiation facilities,
- articles concerning registration of dosimetry reading service provider for a person who is employed by nuclear and radiation facilities or who has occasional access to radiation control area; and
- articles concerning training and education of radiation workers.

The Enforcement Decree of the NSA prescribes articles entrusted by the NSA and other details necessary to implement each item stipulated in NSA as follows:

- articles concerning dose limits in related to radiation exposure (see Table F.4-1);
- articles concerning measures necessary to protect human, materials and the public from radiation hazard that may accompany the operation of nuclear and radiation facilities;
- articles concerning measures necessary to minimize radiation exposure to radiation workers in nuclear and radiation facilities, persons who frequently access to radiation control area and residents in adjoining areas of the facilities;
- articles concerning medical checkup and exposure control for radiation workers in nuclear and radiation facilities and persons who frequently access to radiation control area;
- articles concerning measurement of radiation dose and contamination levels for radiation hazard areas of nuclear and radiation facilities, and concerning about performance inspection of dosimetry service providers;
- articles concerning implementation of protective measures against radiation hazards, such as action or report with regard to a person who are over exposed;
and,

- articles concerning education and training of a radiation worker and a person with access to radiation control area.

### Table F.4-1 Dose Limits

<table>
<thead>
<tr>
<th>Item</th>
<th>Effective dose limit</th>
<th>Equivalent dose limit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lens of the eye</td>
<td>hands and feet, skins</td>
</tr>
<tr>
<td>Radiation Worker</td>
<td>100 mSv for five consecutive years and not exceeding 50 mSv/y</td>
<td>150 mSv/y</td>
</tr>
<tr>
<td>Persons with occasional access(^1); Personnel engaging in transport(^2); and Persons under 18 with the purpose of education and training, etc. as recognized by the NSSC</td>
<td>6 mSv/y</td>
<td>15 mSv/y</td>
</tr>
<tr>
<td>Public</td>
<td>1 mSv/y</td>
<td>15 mSv/y</td>
</tr>
</tbody>
</table>

1. “Persons with occasional access” are those who access radiation control areas for work such as cleaning and facility management other than radiation workers (excluding persons with temporary access for visit or field trip).
2. “Personnel engaging in transport” are those who, other than radiation workers, transport radioactive materials, etc. outside the radiation control areas.

---

**Enforcement Regulations of NSA and Regulations of NSSC**

The *Enforcement Regulations of the NSA* and the *Regulations of the NSSC* (the *Regulations on Technical Standards for Nuclear Reactor Facilities, etc.* and the *Regulations on Technical Standards for Radiation Safety Management, etc.*) prescribes detailed procedures and methods necessary for implementing the NSA and its *Enforcement Decree*, and detailed technical standards thereof:

- detailed provisions on assessment and control of exposure dose for radiation workers or persons with occasional access (*Enforcement Regulations of the NSA*);
- detailed provisions on place and object for measuring radiation dose and contamination level (*Enforcement Regulations of the NSA*);
- detailed provisions on technical capabilities for external and internal dosimetry (*Enforcement Regulations of the NSA*);
- detailed provisions on contents and time of education and training for radiation workers, or persons who have access to radiation control area (*Enforcement Regulations of the NSA*);
- details of medical check-up for radiation workers (Enforcement Regulations of the NSA).
- detailed provisions on radiation protection equipment for protection against radiation exposure in the reactor and related facilities, and nuclear fuel cycle facilities (Regulations on Technical Standards for Nuclear Reactor Facilities, etc.);
- detailed provisions on the particulars about and the actions taken for radiation control area within nuclear and radiation facilities (Regulations on Technical Standards for Nuclear Reactor Facilities, etc.; Regulations on Technical Standards for Radiation Safety Management, etc.);
- detailed provisions on radiation protection for radiation workers, or persons with occasional access (Regulations on Technical Standards for Nuclear Reactor Facilities, etc.); and
- detailed provisions on measures related to radiation protection programs for reactor and related facilities, and nuclear fuel cycle facilities (Regulations on Technical Standards for Nuclear Reactor Facilities, etc.).

**Notices of the NSSC**

Notices of the NSSC present detailed technical standards of radiation protection specified in the NSA, its Enforcement Decree, and Enforcement Regulation. The principal Notices related to radiation protection are as follows:

- Standards on Radiation Protection, etc.
- Standard Format and Content of Radiological Environmental Report for Nuclear and Radiation Facilities
- Regulation on Survey of Radiation Environment and Assessment of Radiological Impact on Environment in Vicinity of Nuclear and Radiation Facilities
- Regulation on Registration Standard and Inspection of Dosimetry Service Provider
- Regulations on Assessment and Control of External Radiation Dose
- Regulations on Measurement and Calculation of Internal Radiation Dose
- Regulation on the Education and Training for Radiation Safety Management, etc.
- Regulations for the Packaging and Transport of Radioactive Materials, etc.
- Regulation on Reporting and Public Announcement of Accidents and Incidents for Nuclear and Radiation Facilities

The Standards on Radiation Protection, etc. concretely defines not only the reference and limit values with regard to radiation protection such as permissible surface contamination, ECL, Annual Limit on Intake (ALI), Derived Air Concentration (DAC), and design standards for shielding materials, but also the details of the method to apply dose limits and the dose limitation and working procedures under the radiological
emergency situation. Additionally, in order to prevent any environmental hazard, the criteria applicable to the design and operation of the corresponding facilities are specified. The NSA was amended and went into force on October 13, 2016 to strengthen the safety management level of persons with occasional access to that of radiation workers which includes medical check-up and radiation exposure dose record-keeping.

F.4.2 Radiation Protection Framework at Each Stage of Management of Nuclear Facilities

The below radiation protection principles are incorporated into the design and construction of nuclear power and radiation facilities, for assuring ALARA and maintaining the operational exposure doses to radiation workers and the general public below the applicable limits:

- **Optimization of Radiation Protection**
  Consideration should be properly made in the design of nuclear and radiation facilities, to keep radiation exposure as low as reasonably achievable based on assessment of the expected dose received by radiation workers and public during operation.

- **Radiation protection equipment**
  Nuclear and radiation facilities should be installed with equipment to control the access of radiation workers to radiation and contamination areas. The areas of which radiation level is required to be lowered to protect radiation workers are equipped with shielding equipment. In addition, radiation monitoring devices are installed to monitor radiation level and release, and then provide collected information to the control room and other relevant areas. Besides, the surface of the areas with potential radiation contamination should be even and impermeable so as to facilitate decontamination if necessary. Decontamination equipment should be properly available in case that person(s) and/or equipment are radiologically contaminated. Ventilation systems with proper filtration capacity are installed to ventilate contaminated air and to limit radioactive materials in the air. The facilities are designed such that contaminated air flows from low level contaminated areas to high level areas and radiologically contaminated areas have lower pressures than clean areas to ensure the contaminated air is not leaked or does not flow back.
Radiation Protection Training
It is required that radiation workers and persons with occasional access to radiation control area should take appropriate radiation protection training in accordance with the NSA and subordinate statutes.

Radiation Work Management
It is required that any person who intends to have access to radiation control area and to perform a radiation work should obtain approval in advance in the form of a radiation work permit (RWP). This is prepared separately in consideration of the type of radiation work, radiation level, and working area conditions. For issuance of the RWP, a radiation safety personnel evaluates the expected dose of an applicant after due consideration of the environment and characteristics of the workplace as well as records of exposure dose, radiation protection training and medical checkup. In addition, the radiation safety personnel may permit a radiation work under special requirements if necessary. Mock-up training is conducted for specified radiation work in which high radiation exposures are expected.

Dose Reduction
As part of efforts to reduce radiation exposure, feedback of radiation safety management experience, research and introduction of exposure reduction technologies and provision of radiation protection training to workers prior to radiation work have been implemented. In addition, target doses are set for unit work, outage dose and collective dose, and managed as indicators of the optimization of radiation protection. In addition to a primary dosimeter, an electronic dosimeter is given to each worker to monitor exposure during a work to ensure effective exposure control.

Individual Dose Control

Occupational Dose Control
Exposure of a radiation worker in a nuclear and radiation facility is controlled with dose constraints established by the operator which are lower than legal dose limits. It is prescribed in the procedure that any person whose annual exposure dose reaches the operational dose constraints should not perform any more radiation work during which said worker is expected to be additionally exposed above the operational dose constraints, unless the approval of the person responsible for the operation of the facility is given or proper measures are taken.

Dosimetry Service Provider and Performance Inspection
With approval of the NSSC, the dosimetry service providers perform the following tasks: monthly or quarterly distribution, collection, and reading of personal dosimeter,
notification of personal dose results; quarterly reporting of dose results to the government; and semiannual calibration and performance verification of dosimeter reader. The dosimetry service provider undergoes a performance inspection from the regulatory body periodically according to the international standards in order to secure objectivity and reliability in external dose assessment. In addition, the regulatory body conducts periodic inspection on dosimetry service providers on a yearly basis to review and confirm their technical capability needed for installation and operation of radiation dosimetry systems and their activities to maintain the quality assurance of the system

- **Radiation Workers Information System and National Safety Management Center for Radiation Workers**

  The NSSC developed the Radiation Workers Information System (RIS) to manage exposure dose, medical checkups, training & education of radiation workers at nuclear and radiation facilities comprehensively and the system is currently run by the Korea Foundation of Nuclear Safety (KoFONS). KINS runs the National Safety Management Center for Radiation Workers to manage exposure dose records in a more systematic way and to reflect on regulatory decision-making. The Korea Information System on Occupational Exposure (KISOE) of this center is an internet-based expert system that enables the analysis and evaluation of occupational exposures and lifetime tracking of individual worker dose. The main functions of KISOE are as follows:

  - to produce data necessary for optimization of radiation protection through analysis of individual exposure dose;
  - to feedback matrix information on radiation dose into regulatory activities;
  - to develop quantitative indicators for radiation control according to the type of radiation use; and
  - to establish an information network system related to international database such as the International Commission on Radiological Protection (ICRP), the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), and the Information System on Occupational Exposure (ISOE) of the OECD/NEA.

---

**Preventive Measures for Unplanned/Uncontrolled Release**

- **Legal Requirements**

  The Enforcement Decree of the NSA and the Regulations of NSSC stipulates that direct or indirect measuring equipment that can monitor the concentration of radioactive materials should be installed in the drainage and air vents of the nuclear
reactor, nuclear fuel cycle facilities, and radioactive waste management facility, etc. When the concentration of the radioactive materials released exceeds established set points, an alarm is annunciated automatically, thus making appropriate countermeasures possible. Regarding radioactive effluent control, airborne or liquid radioactivity concentration at the EAB must be less than the limiting value such as the ECL and radioactive effluents must not be released in other than air vents or drainage.

● Measures in the Design Stage
In the design stage for implementation of legal requirements to prevent any unplanned/uncontrolled release, there is necessary to classify each system as a radioactive system, non-radioactive system, or potentially radioactive system, and to install a process radiation monitor for checking the radioactivity levels or leakage in the systems. The effluent radiation monitor and sampling equipment should be installed in the main release path, if any, and the environmental release of effluents whose radioactivity exceeds the limiting value should be controlled through securing of an interlock function to suspend release automatically in case an alarm is triggered. Additionally, in the design stage, there is a need to check every effluent release path and release point, and to create a design that enables the prevention of possible effluent release in any other path and point other than intended, during the operation of a nuclear facility.

● Measures in the Operation Stage
Before starting the operation of a nuclear facility, the operator formulates an effluent control program in due consideration of the characteristics of the facility. This includes detailed procedures for effluent monitoring and control, sampling schemes, etc. Nuclear facilities must release all liquid and gaseous effluents under proper monitoring and control in accordance with the pre-established program.

According to the Notice of the NSSC, when radioactive materials are released under unplanned and uncontrolled conditions due to equipment malfunction or human error, the operator must verbally report the event to the NSSC within four hours and submit detailed reports to the regulatory body within 60 days. When radioactivity released into the environment from the facility concerned exceeds the ECL, the operator likewise must report the event to the regulatory body within eight hours and submit reports to the regulatory body within 60 days. Information on such unplanned/uncontrolled release must also be included in the quarterly reports submitted to the regulatory body.
F.4.3 Discharge Control Scheme at Nuclear Facilities

The NSA prescribes that CP and OL of a nuclear facility should be given on the condition that the prevention of radiological hazards to the public health and the environment is ensured.

Accordingly, the *Enforcement Decree of the NSA* stipulates that the concentration of radioactive materials released from a facility should meet the limits defined by the NSSC. In the Regulation of the NSSC, it is stipulated that the amount of radioactive material released should be minimized with the formulation of the radioactive waste management program, and that environmental impacts should be controlled to maintain ALARA.

The *Enforcement Decree of the NSA* and the NSSC Notice *Standards for Radiation Protection, etc.* prescribe the discharge limits of gaseous and liquid radioactive material to be released from nuclear facilities into the environment, along with annual off-site dose constraints per unit or site.

- **Annual dose constraints for gaseous effluents per unit of nuclear facilities at the EAB are as follows:**
  - air absorbed dose by gamma ray: 0.1 mGy/y
  - air absorbed dose by beta ray: 0.2 mGy/y
  - effective dose from external exposure: 0.05 mSv/y
  - skin equivalent dose from external exposure: 0.15 mSv/y
  - organ equivalent dose from internal exposure due to particulate radioactive substances, $^3$H, $^{14}$C, and radiiodine: 0.15 mSv/y

- **Annual dose constraints for liquid effluents per unit of nuclear facilities at the EAB are as follows:**
  - effective dose: 0.03 mSv/y
  - organ equivalent dose: 0.1 mSv/y

- **Annual dose constraints at the EAB of a multi-unit site as follows:**
  - effective dose: 0.25 mSv/y
  - thyroid equivalent dose: 0.75 mSv/y

In practice, nuclear facilities operate with operational limits which are stricter than the legal limits. In addition, some facilities also apply the Derived Release Limits (DRLs) based on a small fraction of the legal dose constraints in consideration of convenience in a field application. In addition, pursuant to the NSA amended in December 2015,
discharge plan for liquid and gaseous radioactive materials including total amount of radioactive materials for each site and for each nuclide group was added to the list of licensing documents submitted to apply an operating license for NPPs and related facilities (effective from December 2, 2016). Accordingly, the management of liquid and gaseous effluents has been much strengthened. The compliance with the aforementioned discharge limits is verified with periodic inspection or review of regular reports submitted to the regulatory body. Tables F.4-2 and F.4-3 present the annual release of gaseous and liquid effluents discharged from NPPs and KAERI site in Daejeon, and their off-site dose estimations for the recent five years. The radiation dose to the individual in the vicinity of nuclear facilities are assessed on a quarterly basis using the Off-site Dose Calculation Manual (ODCM). The assessments are based on the radioactivity of the released liquid and gaseous effluents, atmospheric conditions, food ingestion rate, and social data including agricultural and marine products of the local community within an 80 km radius.

Table F.4-2 Annual Radioactivity in Liquid and Gaseous Radioactive Effluents Released from Nuclear Power Plants Sites and Calculated Off-site Dose

<table>
<thead>
<tr>
<th>Site</th>
<th>Year</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Other</td>
<td></td>
<td>8.19E+08</td>
<td>4.84E+08</td>
<td>1.43E+08</td>
<td>4.13E+08</td>
</tr>
<tr>
<td></td>
<td>Gaseous</td>
<td>$^3$H</td>
<td>1.50E+13</td>
<td>1.81E+13</td>
<td>1.54E+13</td>
<td>1.76E+13</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td></td>
<td>2.39E+12</td>
<td>3.29E+12</td>
<td>5.43E+12</td>
<td>5.63E+12</td>
</tr>
<tr>
<td></td>
<td>Annual dose(mSv)</td>
<td>4.18E-03</td>
<td>4.55E-03</td>
<td>2.68E-03</td>
<td>6.68E-03</td>
<td>6.56E-03</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td></td>
<td>4.49E+08</td>
<td>3.44E+08</td>
<td>2.42E+09</td>
<td>2.82E+08</td>
</tr>
<tr>
<td></td>
<td>Gaseous</td>
<td>$^3$H</td>
<td>1.00E+13</td>
<td>1.76E+13</td>
<td>1.72E+13</td>
<td>1.41E+13</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td></td>
<td>7.88E+11</td>
<td>3.67E+11</td>
<td>1.43E+12</td>
<td>3.13E+11</td>
</tr>
<tr>
<td></td>
<td>Annual dose(mSv)</td>
<td>1.61E-02</td>
<td>5.84E-03</td>
<td>8.10E-03</td>
<td>8.34E-03</td>
<td>1.74E-02</td>
</tr>
<tr>
<td>Hanul</td>
<td>Liquid</td>
<td>$^3$H</td>
<td>4.44E+13</td>
<td>3.37E+13</td>
<td>5.40E+13</td>
<td>5.09E+13</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td></td>
<td>2.05E+07</td>
<td>4.69E+07</td>
<td>1.02E+08</td>
<td>8.30E+07</td>
</tr>
<tr>
<td></td>
<td>Gaseous</td>
<td>$^3$H</td>
<td>1.15E+13</td>
<td>1.25E+13</td>
<td>1.21E+13</td>
<td>1.27E+13</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td></td>
<td>1.27E+12</td>
<td>6.27E+11</td>
<td>5.84E+11</td>
<td>8.51E+11</td>
</tr>
<tr>
<td></td>
<td>Annual dose(mSv)</td>
<td>1.56E-02</td>
<td>1.21E-02</td>
<td>2.61E-02</td>
<td>2.10E-02</td>
<td>2.23E-02</td>
</tr>
<tr>
<td>Wolsong</td>
<td>Liquid</td>
<td>$^3$H</td>
<td>1.23E+14</td>
<td>6.91E+13</td>
<td>4.84E+13</td>
<td>2.58E+13</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td></td>
<td>1.59E+09</td>
<td>9.87E+08</td>
<td>7.89E+08</td>
<td>7.46E+08</td>
</tr>
<tr>
<td></td>
<td>Gaseous</td>
<td>$^3$H</td>
<td>1.50E+14</td>
<td>1.33E+14</td>
<td>1.25E+14</td>
<td>1.41E+14</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td></td>
<td>1.39E+13</td>
<td>1.54E+13</td>
<td>2.78E+13</td>
<td>2.28E+13</td>
</tr>
<tr>
<td></td>
<td>Annual dose(mSv)</td>
<td>2.24E-02</td>
<td>2.86E-02</td>
<td>1.05E-01</td>
<td>4.46E-02</td>
<td>3.29E-02</td>
</tr>
</tbody>
</table>
Table F.4-3 Annual Radioactivity in Liquid and Gaseous Radioactive Effluents Released from Daejeon Site and Calculated Off-site Dose

<table>
<thead>
<tr>
<th>Site</th>
<th>Year</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daejeon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid</td>
<td>$^3$H</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>4.61E+07</td>
<td>2.93E+07</td>
<td>1.86E+07</td>
<td>2.15E+07</td>
<td>1.02E+07</td>
</tr>
<tr>
<td>Gaseous</td>
<td>$^3$H</td>
<td>4.22E+12</td>
<td>5.11E+12</td>
<td>6.44E+12</td>
<td>2.03E+12</td>
<td>2.23E+12</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>1.59E+12</td>
<td>6.76E+11</td>
<td>6.67E+11</td>
<td>1.75E+12</td>
<td>1.34E+11</td>
</tr>
<tr>
<td>Annual dose(mSv)</td>
<td>1.79E-03</td>
<td>1.09E-03</td>
<td>1.04E-03</td>
<td>3.94E-04</td>
<td>4.30E-04</td>
<td></td>
</tr>
</tbody>
</table>

* The gaseous radioactivity in this table is the sum of radioactivity in the gaseous effluents released from KAERI's HANARO, the PIEF, and radioactive waste treatment facility, and conversion facility, KEPCO NF's fuel fabrication facility, and KORAD's RI waste management facility, all of which are located in Daejeon site.
F.4.4 Implementation of Complementary Measures against Unplanned/ Uncontrolled Releases from Nuclear Facilities

Monitoring Plan

Radioactive effluents undergo monitoring to keep the release within the dose limits specified by the *Enforcement Decree of the NSA* (concerning the dose limit for the general public) and the *Notices of the NSSC* (concerning the prevention of hazards to the environment), through sampling, radioactivity analysis, and off-site dose calculation prior to its release.

Action Plan

The radioactive waste treatment facility of a nuclear facility, which is furnished with a proper radiation monitoring system in the identified release path of radioactive material, is subject to formulate and implement programs to take appropriate measures in the event that an uncontrolled release of radioactive materials occurs. A report should be made under the event reporting scheme, when any unplanned/uncontrolled release occurs, and proper actions should be taken with the support of the operator and the emergency response organization. Subsequently, necessary actions should be taken after evaluation of the individuals/public dose and the amount of released radioactive materials using available radiological data from the process radiation monitoring and environment radiation monitoring system with reasonable scenarios. The existing action procedures must be complemented through analysis of the release pathways and cause of the uncontrolled/unplanned release of radioactive materials.
ARTICLE 25. EMERGENCY PREPAREDNESS
1. Each Contracting Party shall ensure that before and during operation of a spent fuel or radioactive waste management facility there are appropriate on-site and, if necessary, off-site emergency plans. Such emergency plans should be tested at an appropriate frequency.
2. Each Contracting Party shall take the appropriate steps for the preparation and testing of emergency plans for its territory insofar as it is likely to be affected in the event of a radiological emergency at a spent fuel or radioactive waste management facility in the vicinity of its territory.

F.5.1 Regulations and Requirements

Radiological emergency preparedness is based on the Basic Act on Management of Disasters and Safety which addresses disasters and safety management at a national level, the Basic Act on Civil Defense, and the APPRE which considers the uniqueness of nuclear accidents and radiological disasters. In particular, the APPRE stipulates matters regarding radiological disaster management such as prevention, preparedness and response of radiological disasters, radiological emergency medical service, and related international cooperation.

Pursuant to the APPRE, the NSSC is responsible for developing a National Radiological Emergency Preparedness Plan in association with the Basic Plan for National Safety Management which is prepared according to the Basic Act on Management of Disasters and Safety every five years. To implement the plan, a National Radiological Emergency Preparedness Execution Plan is developed in detail and implement every year. The local government having the jurisdiction over the emergency planning zone (EPZ) develops and implements Local Radiological Emergency Preparedness Plan in accordance with the two national plans and the licensee prepares and executes a Radiological Emergency Plan under the approval of the NSSC.

As part of protective actions for residents in case of radiological emergency, the APPRE was amended in May 2014 to subdivide the emergency planning zone (EPZ) into the precautionary action zone (PAZ) and the urgent protective action planning zone (UPZ). This was to incorporate the IAEA Safety Standards which recommend designating the PAZ up to 3~5 km from a NPP and the UPZ within a 20~30 km radius of the NPP.
Accordingly, subordinate statutes have been amended to allow the NPP operator to designate the PAZ and the UPZ taking into account characteristics of the site such as road and topography within the framework of the APPRE.

F.5.2 National Radiological Emergency Response

The radiological emergency response scheme involves the National Emergency Management Committee (NEMC) chaired by the chairperson of the NSSC, the Off-site Emergency Management Center (OEMC), the Local Emergency Management Center (LEMC), the Radiological Emergency Technical Advisory Center (operated by KINS), the National Radiation Emergency Medical Center (operated by the Korea Institute of Radiological and Medical Science (KIRAMS)), and the Emergency Operating Facility (EOF) operated by the KHNP as shown Figure F.5-1.

The NSSC has the responsibility of controlling and coordinating countermeasures against a radiological disaster. When a radiological emergency occurs, the NSSC operates the NEMC, which consists of experts from 18 central government ministries and 2 expert institutes, launching a government-wide response system. In addition, the OEMC is put in place at the site of the radiological disaster with the Secretary General of the NSSC as the head of the Center as well as experts from central government ministries, local governments, related local institutes, expert organizations for nuclear safety and radiological emergency medical service. The OEMC coordinates emergency response activities at the disaster site.

The LEMC to be established in the local government performs emergency response activities to implement decisions made by the OEMC regarding measures to protect local residents. In addition, the LEMC controls and coordinates matters on urgent rescue activities in the local area in cooperation with fire-fighting, police, and military organizations.

In the event of an accident, the nuclear operators launch the EOF to perform on-site emergency response actions such as prevention of spread of accident in the affected nuclear facilities, restoration of the facilities and protective measures for on-site employees.

The Korean government establishes the national radiation emergency medical system for coordination and control of radiological medical services under the radiological emergency situation. The system consists of the National Radiation Emergency Medical Center of KIRAMS, and 24 primary and secondary radiological emergency medical hospitals designated for each region.
In case of radiological emergency, KIRAMS initiates the National Radiation Emergency Medical Center (NREMC) which controls and coordinates radiological emergency medical services such as consulting on medical rescue, technical support, and medical treatment of patients with actual or probable radiation injury. The center sends a local medical support group to install and operate a joint radiological emergency medical service center, and supports the installation of operation of the on-site radiation emergency medical center.

Figure F.5-1 National Radiological Emergency Response Scheme
In the event of radiological accident, KINS launches a Radiological Emergency Technical Advisory Center which provides technical support necessary for coping with radiological accident such as accident analysis and evaluation, emergency operation of 160 radiation monitors across the country, assessment of environmental radiation/radioactivity and the radiological impact therefrom, and dispatch of technical support group to the site. In addition, KINS runs the Atomic Computerized Technical Advisory System for a Radiological Emergency (AtomCARE) to perform technical support activities effectively so as to protect the residents and the environment when a radiological emergency occurs in NPPs. AtomCARE enables to analyze and assess radiological accident and radiological impact promptly and to manage information on protective measures for residents in a systematic manner. The diagram of AtomCARE is shown in Figure F.5-2.

AtomCARE is provided with key operating parameters of NPPs from the Safety Information Display System (SIDS), meteorological data from the Radiological Emergency Management Data Acquisition System (REMDAS), environmental radioactivity data from the Integrated Environmental Radiation Network (IERNet). Using the data provided, AtomCARE sends the Automatic Information Notification System (AINS) related alarms and information necessary for emergency response personnel. In the event of core damage occurring at a NPP, the Source Term Evaluation System (STES) estimates radioactive source terms and assesses radiation doses within the radius of 100 km from the NPP using the Accident Dose Assessment Model (ADAMO). The Geographic Information System (GIS) uses dose assessment results from the Radiation Impact Evaluation System, metrological data from REMDAS, and environmental radioactivity data from IERNet so that the GIS provides related authorities with information regarding geographical data, wind field for each site, evacuation route and status, local emergency preparedness facilities, demographic distribution and vehicle distribution. In the meantime, the nuclear operators, the local governments and the regulatory body are able to make prompt response and share related information immediately and effectively using the Emergency Response Information eXchange system (ERIX) when an accident occurs.
- SIDS : Safety Information Display System
- IERNet : Integrated Environmental Radiation Network
- REMDAS : Radiological Emergency Management Data Acquisition System
- AINS : Automatic Information Notification System
- STES : Source Term Evaluation System
- ADAMO : Accident Dose Assessment Model
- GIS : Geographic Information System
- ERIX : Emergency Response Information eXchange System
- KMA : Korea Meteorological Administration
- GTS : Global Telecommunication System
- LEMC : Local Emergency Management Center
- NEMC : National Emergency Management Committee
- EOF : Emergency Operations Facility
- NSSC : Nuclear Safety and Security Commission

Figure F.5-2 Atomic Computerized Technical Advisory System for the Radiological Emergency (AtomCARE)
F.5.3 Training and Exercises

Since the enactment of the APPRE, the radiological emergency training is managed at a central government level. To ensure that radiological emergency training is delivered in a comprehensive and systematic manner, details of the emergency training including designation and notification of emergency preparedness personnel, development of training programs, and training delivery methods are defined in the NSSC Notice “Regulations on Education for Radiological Emergency Preparedness”. Accordingly, the operators of NPPs have developed training programs for each position of radiological emergency preparedness and delivered training and education periodically to ensure emergency response personnel is fully aware of their roles and to improve their skills and competencies. KIRAMS has conducted education and training on radiological emergency medical service for radiological emergency medical staff designated by the heads of KIRAMS and 24 primary and secondary radiological emergency medical hospitals across the country.

As follow-up actions on EPZ expansion that results from amendment of the APPRE in May 2014, the NSSC revised the Enforcement Decree of the same Act in November 2014 to adjust the frequency of radiological emergency preparedness drill led by local governments from every four years to every two years per nuclear site and to create area-specific intensive drills (e.g. protective actions for residents). Furthermore, the NSSC is working on to revise the Act again to adjust the frequency of national radiological emergency preparedness drill led by the central government from every five years to every year as part of efforts to strengthen emergency preparedness drill.

Nuclear power facilities conduct radiological emergency preparedness drills that must be participated in by on-site or off-site emergency preparedness organizations as follows:

- the unified drill with participation of on-site emergency response organizations, emergency preparedness authorities, the central government and local governments is conducted under the charge of the NSSC in accordance with the schedule for radiological EP drills.
- the integrated drill with participation of on-site emergency response organizations and off-site emergency preparedness authorities should be conducted every two years under the charge of the local government for each nuclear site.
- the on-site emergency drill with attendance of all emergency organizations in nuclear reactor facilities should be conducted at least once a year for two units of NPPs.
- the emergency team exercise is conducted every quarter for each emergency response team.
- for newly constructed reactor facilities, the on-site emergency drill is conducted to
verify emergency preparedness prior to 5% of initial rated thermal power. However, the integrated drill should be conducted for the NPP constructed at a new site.

**F.5.4 Environmental Radioactivity Monitoring**

The constructor and operator of nuclear facilities must take the primary responsibility for preserving the environment around the corresponding facilities and report to the NSSC the results of environmental radiation monitoring and radiological environmental impact assessment due to operation of the facilities. The NSSC and KINS monitor environmental radioactivity around the facilities as part of efforts to oversee and supervise the environmental radioactivity monitoring activities of the constructor and operator of the facilities.

The legal basis for the environmental radioactivity monitoring of the adjoining areas of nuclear facilities is Article 104 of the NSA. The constructor and operator of the corresponding facilities must establish an environmental monitoring program in accordance with the NSSC Notices *Regulation on Survey of Radiation Environment and Assessment of Radiological Impact on Environment in Vicinity of Nuclear Facilities* and report implementation results of the plan to the NSSC. As entrusted by the NSSC, KINS conducts environmental monitoring independently from the constructor and operator of nuclear facilities and checks the appropriateness of the monitoring activities through the comparison and evaluation of the monitoring data of the corresponding facilities’ constructor and operator and also objectively confirms and evaluates the radioactive contamination of the environment around the facilities through regulatory review.

Apart from the above, KINS monitors in real time the variations of the environmental radioactivity and the gamma radiation dose rate in the air according to Article 105 of the NSA, and also continuously measures the radioactive contamination of airborne dust, fallout, rainwater, agricultural products, soil, service water and milk so as to detect abnormal circumstances or signs due to radiological impact in an early stage and respond appropriately. KINS has run a national environmental radiation monitoring network since 1997. On the occasion of the Fukushima Daiichi Accident in 2011, KINS has strived to expand the national monitoring network and as a result, the whole monitoring network is established with manned monitoring stations and unmanned monitoring posts which totals 160 locations combined across the country, as shown in Figure F.5-3. KINS also trains monitoring personnel from local monitoring stations every year and routinely conducts a cross analysis of domestic and foreign environmental
radioactivity samples for quality control of the environmental radioactivity monitoring results.

KINS has developed and operated the System for Identifying Radiation in Environments Nationwide (SIREN) to monitor environmental radioactivity and radiation after the release of radioactive materials in the event of nuclear emergency, and to determine the protective actions for residents depending on the monitoring results.

SIREN combines the monitoring results of fixed radiation monitoring station and mobile monitoring stations to confirm contaminated areas, to calculate spatial radiation dose rate, and to determine the protective actions for residents in accordance with the Operational Intervention Level (OIL).

Figure F.5-3 National Environmental Radioactivity Monitoring Network
F.5.5 International Arrangements

The notification of an accident and the request for assistance from international organizations and nations concerned, are made in accordance with the procedures specified in the Convention on the Early Notification of Nuclear Accidents and the Convention on Support during Nuclear Accidents or Radiological Emergencies. In addition, the Republic of Korea joined the Response and Assistance Network (RANET) in April 2015 and provides international support such as technical support and dispatch of experts when asked by the IAEA for accident response.

Korea, China and Japan also signed an MOC (Memorandum of Cooperation) on Top Regulators Meeting (TRM) in August 2009 to enhance nuclear safety capacity in Northeast Asia. Based on that, the three nations have established a tri-party system for nuclear accident information exchange, continuously discussing ways for mutual cooperation such as joint exercise for radiological emergency preparedness. In November 2016, the Joint Emergency Drill (JED) was conducted at DAYA Bay NPP in China. The 9th TRM was also held in November 2016, in China.
ARTICLE 26. DECOMMISSIONING
Each Contracting Party shall take the appropriate steps to ensure the safety of decommissioning of a nuclear facility. Such steps shall ensure that:

i. qualified staff and adequate financial resources are available;
ii. the provisions of ARTICLE 24 with respect to operational radiation protection, discharges and unplanned and uncontrolled releases are applied;
iii. the provisions of ARTICLE 25 with respect to emergency preparedness are applied; and
iv. records of information important to decommissioning are kept.

The NSSC specifies the licensing procedures and related articles in the Nuclear Safety related Act and subordinate statute to ensure safety in nuclear facility decommissioning such as approval of the decommissioning plan, verification and inspection of the decommissioning status and obligations for safety measures against the closure of decommissioning activities. Based on the NSA, KINS is implementing safety regulations on decommissioning of KRR-1, 2 and performing R&D for decommissioning as part of nuclear safety R&D projects.

The RWMA requires the NPP operator to reserve fund every year in preparation for the upcoming decommissioning of NPPs and to submit a reservation plan to MOTIE every year. Kori Unit 1, which was permanently shutdown in June 2017, has been operated for about 40 years including 10 years of continued operation. The KHNP will submit the decommissioning plant for Kori Unit 1 for an approval from the NSSC. Decommissioning activities will be initiated in earnest after its approval from the NSSC, accordingly.

KRR-1 and 2 located at the former KAERI site in Seoul are currently under decommissioning after its permanent shutdown. The site will be returned to KEPCO after completion of decommissioning and site release procedure. The characteristics of KRR-1 and 2 are listed in Annex C.

The UCF, which had been used for development of fuel fabrication technologies for PHWRs, was decommissioned completely in 2012 and the land and buildings have been used as a research facility.
F.6.1 Regulations and Requirements

The licensee of NPP, the licensee of research reactor and the nuclear fuel cycle facility when intending to obtain CP, OL or business license, or to decommission thereof should submit a decommissioning plan and obtain decommissioning approval from the NSSC according to the NSA. The decommissioning plan should include the following:

- organization, human and financial resources for the decommissioning of nuclear facilities;
- decommissioning strategy and schedule of nuclear facilities;
- reflections in design and measures in construction and operation to facilitate decommissioning;
- necessary measures against radioactive hazards;
- methods of removing radioactive materials and decontamination;
- radioactive waste treatment, storage and disposal methods;
- assessment of environmental impact and protective measures thereto; and others, as specified by the NSSC.

The operators should revise the preliminary decommissioning plan every 10 years based on experience and information obtained in the process of operation and management of the nuclear facilities as well as the results of assessment related to decommissioning. In addition, the operators should hold public hearing to incorporate public opinion in the decommissioning plan before they submit the plan to the NSSC to apply for decommissioning after permanent shutdown of the facilities.

During the period of decommissioning, the status and progress should be reported to the NSSC every six months (Decommissioning Status Report) and the NSSC should review and inspect the status of decommissioning. When the decommissioning work is completed, the operator should submit to the NSSC a decommissioning completion report and a final site status report, and the NSSC should conduct decommissioning completion inspection to confirm that the decommissioning has been properly performed, and then give written notice to the operator that the license has been terminated.

F.6.2 Human and Financial Resources

The decommissioning organization of the KHNP is composed of the Backend Management and Decommissioning Department, the Central Research Institute, and the...
Decommissioning Preparation Team of the Kori Unit 1 and 2, and takes responsibility of matters regarding decommissioning of NPPs.

As per the RWMA the operator of NPPs has accumulated a reserve for decommissioning approximately KRW 643.7 billions (USD 554.7 millions) per unit as of 2017.

KAERI has developed technologies and conducted demonstration studies for decommissioning of NPPs in parallel with projects for decommissioning of KRR-1 and 2.

KAERI runs the Integrated Management Center for Radioactive Waste with 25 personnel for decommissioning of KRR-1 and 2, and the Decommissioning Technology Division consisting of 30 personnel for decommissioning technology development and demonstration studies for NPPs.

A total of KRW 23.8 billions (20.5 millions) was spent for decommissioning of KRR-1 and 2 which was broken down into KRW 19.7 billions (USD 16.9 millions) for decommissioning of KRR-2 and KRW 4.1 billions (USD 3.5 millions) for decommissioning of KRR-1 (including transfer of decommissioning waste therefrom). In addition, KRW 11.2 billions (USD 9.6 millions) is being executed for the project to preserve KRR-1 as a monument as well as to release the site from regulatory control. They are all financed by the government.

F.6.3 Radiation Protection

Regulations on radiation protection and safety management as described in Section F.4 are applied for the decommissioning of KRR-1 and 2. Facility status, radiological conditions, and estimated amount of waste generation, required human resources, estimated radiation dose exposure to workers under normal and abnormal conditions, and radiation protection measures were described in the decommissioning plan of KRR-1 and 2, and according to which, the radiation safety control has been conducted.

The radiation protection regulations applied to the decommissioning of nuclear facilities including Kori Unit 1 are the NSSC Notices Standards for Radiation Protection, etc., Regulations on the Packaging and Transport of Radioactive Materials, etc., Regulations on the Preparation, etc. of Radiological Environmental Report of Nuclear Facilities, and Regulations on the Environmental Radiation Survey and Impact Analysis in the Vicinity of Nuclear Facilities, and so forth.
F.6.4 Emergency Preparedness and Response

Regulations for the establishment of radiation emergency plan, in case of the decommissioning of nuclear facilities, comply with the regulations on radiological emergency preparedness of nuclear licensee. Details on the radiological emergency preparedness is described in F.5.

F.6.5 Record Keeping

Under the Enforcement Regulations of the NSA, records with regard to operation of nuclear facilities are to be kept until the decommissioning of the facilities so as to utilize the records for decommissioning. Such records include documents related to design and construction of the facility, records on radiation safety management, accidents, and corrective actions.

In accordance with the NSSC Notice Standard Format and Content of Decommissioning Plan for Nuclear Facilities, the operators should revise their decommissioning plan periodically based on experience and information obtained during operation and management of the corresponding facilities as well as the results of assessment on matters related to decommissioning.

When it comes to management of waste, especially solid waste generated in the process of decommissioning, a database system has been developed and in operation to effectively manage information regarding generation, classification, treatment and storage of waste. This database system enables to identify the accurate amount of radioactive waste from decommissioning.
G. Safety of Spent Fuel Management
G. Safety of Spent Fuel Management

G.1 General Safety Requirements [Article 4]

ARTICLE 4. GENERAL SAFETY REQUIREMENTS
1. Each Contracting Party shall take the appropriate steps to ensure that at all stages of spent fuel management, individuals, society and the environment are adequately protected against radiological hazards.

In so doing, each Contracting Party shall take the appropriate steps to:
   i. ensure that criticality and removal of residual heat generated during spent fuel management are adequately addressed;
   ii. ensure that the generation of radioactive waste associated with spent fuel management is kept to the minimum practicable, consistent with the type of fuel cycle policy adopted;
   iii. take into account interdependencies among the different steps in spent fuel management;
   iv. provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;
   v. take into account the biological, chemical and other hazards that may be associated with spent fuel management;
   vi. strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;
   vii. aim to avoid imposing undue burdens on future generations.

G.1.1 Nuclear Criticality, Residual Heat Removal and Hazardous Material

Criticality, residual heat removal and other safety factors to be considered are stipulated in Article 33 of Regulations on Technical Standards for Nuclear Reactor Facilities, etc. for on-site spent fuel storage facilities of the NPPs, and in Article 90 and Article 91 of
the same regulation for the PIEF.

For spent fuel interim storage facility, criticality, residual heat removal and other safety factors to be considered are stipulated in Article 73 of Regulations on Technical Standards for Radiation Safety Management, etc. According to the regulations, major safety factors to be considered in spent fuel management include the following: (1) criticality prevention, (2) residual heat removal, (3) radioactive material containment, and (4) radiation shielding and protection.

G.1.2 Minimization of Radioactive Waste Generation

The amount of radioactive waste generated from nuclear facilities should be minimized in accordance with Article 66 of the Regulations on Technical Standards for Nuclear Reactor Facilities, etc. In particular, it is stipulated in Article 24 of the NSSC Notice Technical Standards for the Structure and Equipment of Interim Storage Facilities of Spent Fuel enacted in January 2016 that nuclear facilities should be designed in such ways to minimize generation of radioactive materials and contamination of equipment during operation, to facilitate dismantling and decontamination of contaminated equipment, and to minimize generation of radioactive waste during decommissioning.

G.1.3 Inter-Dependence among the Different Steps in Spent Fuel Management

Spent fuel should be managed in consideration of interdependences among different stages of spent fuel management ranging from generation to the final disposal such as: on-site wet and dry storage, interim storage, and the ultimate disposal of spent fuel. Especially, the interim storage facilities should be designed in such ways to make it possible to retrieve stored spent fuel safely, when it is needed, pursuant to Article 4 of the NSSC Notice Technical Standards for the Structure and Equipment of Interim Storage Facilities of Spent Fuel.

G.1.4 Protective Actions within the Legal Framework

Regulatory provisions to ensure the safety of spent fuel management facilities and to take necessary safety measures are stipulated in the NSA and subordinate statutes. Section G.4.1 provides in detail the structure of the NSA, its subordinate statutes and technical standards in relation to the control of radiological impact caused by spent fuel management facilities.
G.1.5 Impacts and Burdens on Future Generations

The potential risk of radiation exposure that spent fuel management facilities may pose to future generations should be limited to the level equivalent to the radiation protection that is applied today. In relation to this, Article 4 of the NSSC Notice General Standards for Deep Geological Repository for High-level Radioactive Waste which was enacted in 2016, stipulates that “the hazard to the public health caused by a deep geological disposal facility shall be sufficiently below an acceptable level and its possible radiological impact on future generations shall not be greater than that is acceptable today”.

In addition, the expenses required for spent fuel management are collected from spent fuel generators, and deposited and managed in the radioactive waste management fund not to impose undue burdens on future generations in managing spent fuel generated by current generations.

MOTIE imposes and collects a charge for the management of spent fuel from NPP operator, and the collected charge is deposited into the RWMF in order to conduct spent fuel management properly in accordance with Article 15 of the RWMA.
ARTICLE 5. EXISTING FACILITIES
Each Contracting Party shall take the appropriate steps to review the safety of any spent fuel management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility.

G.2.1 On-site Spent Fuel Storage Facilities of NPP and PIEF

Currently on-site spent fuel storage facilities (AR-RS or AFR-RS) of NPPs are within the scope of periodic inspection of the reactors as well as subject to daily inspection by resident inspectors. Those facilities are also within the scope of the PSR of the NPPs in accordance with Article 20 of the Enforcement Regulations of the NSA. If the cases not in compliance with license requirements are identified in the process of periodic inspection or PSR, appropriate corrective actions should be taken. Periodic inspection is conducted for a PIEF in accordance with Article 65 of the Enforcement Decree of the NSA.

On the occasion when this Joint Convention went into effect, no significant findings were identified as a result of periodic inspection of on-site spent fuel facilities of the NPPs and the PIEF in operation in Korea.

G.2.2 Spent Fuel Interim Storage Facility

There have been no off-site interim storage facilities for spent fuel in operation or under construction at the time and since this Joint Convention entered into force in Korea.
ARTICLE 6. SITING OF PROPOSED FACILITIES

1. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed spent fuel management facility:

   i. to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime;
   ii. to evaluate the likely safety impact of such a facility on individuals, society and the environment;
   iii. to make information on the safety of such a facility available to members of the public;
   iv. to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.

2. In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of ARTICLE 4.

G.3.1 On-site Spent Fuel Storage Facilities of NPP

On-site spent fuel storage facility at an NPP is defined as a part of “a nuclear power reactor and relevant facilities”, and detailed technical standards for the location of a reactor and a nuclear fuel cycle facility are stipulated in Article 3 to Article 10 of the Regulations on Technical Standards for Nuclear Reactor Facilities, etc. Major factors to be considered pursuant to the technical standards include geology, earthquake, limitations on siting, meteorological condition, hydrology and ocean, impact of human-induced accident, feasibility of emergency plan and construction of multiple facilities at the same site.

When a nuclear power reactor including spent fuel storage facilities is constructed, a draft of the RER should be open to the local residents or public hearing should be held to collect public opinions in accordance with Article 103 of the NSA. Furthermore,
information on the safety of major nuclear facilities including NPPs is released to the public through the NSIC of the NSSC.

G.3.2 Spent Fuel Interim Storage Facility

Since effectuation of the Joint Convention, no site has been selected for spent fuel interim storage and no permit for a spent fuel interim storage facility has been granted. However, the NSSC Notice Technical Standards for the Location and Siting of a Spent Fuel Interim Storage Facility are stipulated in Article 67 of the Regulations on Technical Standards for Radiation Safety Management, etc., the NSSC Notice Siting Criteria for Interim Storage Facilities of Spent Fuel and the Guidelines for Preparation of Safety Analysis Report for Interim Storage Facilities for Spent Fuel.

When a spent fuel interim storage facility is constructed, a draft of the RER should be open to the local residents or public hearing should be held to collect public opinions in accordance with Article 103 of the NSA. To make the site selection process for high level radioactive waste management facility transparent and fair, the Legislative Bill on the Site Selection Process and Host Community Support for High-level Radioactive Waste Management Facilities was submitted to the National Assembly in 2016 for legislation. As per the Bill, opinions of the public living nearby the site for HLW management facilities should be collected in attempt to improve public acceptance.

G.3.3 Consideration of Neighboring Countries

The notification of an accident and the request for assistance from international organizations and nations concerned, are made in accordance with the procedures specified in the Convention on Early Notification of a Nuclear Accident (CENNA) and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (CANARE). More details are provided in F.5.5.
ARTICLE 7. DESIGN AND CONSTRUCTION OF FACILITIES
Each Contracting Party shall take the appropriate steps to ensure that:

i. the design and construction of a spent fuel management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;

ii. at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a spent fuel management facility are taken into account;

iii. the technologies incorporated in the design and construction of a spent fuel management facility are supported by experience, testing or analysis.

G.4.1 Control of Radiological Impact

The NSA and its subordinate statutes specify the standards for restriction of radiological impact caused by operation of nuclear facilities. The radionuclide concentration limit for ventilation or drainage (ECL) and the radiological impact on residents near the facilities caused by operation of the facilities should meet the dose constraint that is set lower than dose limit for the general public in accordance with Article 6 and Article 16 of the NSSC Notice *Standards for Radiation Protection, etc.*.

The radiological discharge limits are specified in Article 6 and Article 16 of the NSSC Notice *Standards for Radiation Protection etc.*. Standards for prevention, detection or minimization of uncontrolled release of radioactive materials are also stipulated.

Measuring equipment that can monitor the concentration of radioactive materials during ventilation or drainage at/or near outlet of ventilation hood or drainage hole should be installed in accordance with Article 20 of *Regulations on Technical Standards for Nuclear Reactor Facilities, etc.*. In addition, ventilation monitoring equipment and drainage monitoring equipment, and radiation protection equipment to provide protection...
from radiation exposure should be installed in accordance with Article 10 and Article 34 of *Regulations on Technical Standards for Radiation Safety Management, etc.*, respectively.

Article 34 of *Regulations on Technical Standards for Nuclear Reactor Facilities, etc.* is applicable to a PEIF.

Control of radiological impact caused by a spent fuel interim storage facility are specified in the Regulations on *Technical Standards for Radiation Safety Management, etc.*. It is stipulated in Article 4 of the NSSC Notice *Technical Standards for the Structure and Equipment of Interim Storage Facilities of Spent Fuel* that a spent fuel interim storage facility should be designed such that the amount of radioactive materials released to the environment and radiation dose to radiation workers and the public should be kept below the allowable limits in normal operation, anticipated operational occurrence and design basis accident.

**G.4.2 Decommissioning Planning**

Nuclear facilities should be designed in such ways to minimize generation of radioactive materials and contamination of equipment during operation, to facilitate dismantling and decontamination of contaminated equipment, and to minimize generation of radioactive waste during decommissioning pursuant to Article 24 of NSSC Notice *Technical Standards for the Structure and Equipment of Interim Storage Facilities of Spent Fuel*.

**G.4.3 Proven Technology**

A spent fuel management facility should be designed and constructed under the basic principle that the technologies incorporated into the design of a spent fuel management facility be the one proven by domestic and oversea experience and tests.

Therefore, it is stipulated in Article 4 of the NSSC Notice *Technical Standards for the Structure and Equipment of Interim Storage Facilities of Spent Fuel* that the interim
storage facility should be designed and constructed based on proven engineering practice and if a new design and construction method is applied, its safety should be demonstrated with valid evidence.
ARTICLE 8. ASSESSMENT OF SAFETY OF FACILITIES
Each Contracting Party shall take the appropriate steps to ensure that:

i. before construction of a spent fuel management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;

ii. before the operation of a spent fuel management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).

G.5.1 Safety Assessment and Environmental Impact Assessment

Safety assessment of an on-site spent fuel wet storage facility is incorporated into the Preliminary Safety Analysis Report (PSAR) (Article 4 of the Enforcement Regulations of the NSA) and the Final Safety Analysis Report (FSAR) (Article 16 of the Enforcement Regulations of the NSA). Radiation environmental impact assessment is described in RER in accordance with Article 4 of Enforcement Regulations of the NSA. The safety assessment of the an on-site spent fuel dry storage facility is described the FSAR of relevant NPP.

The RER should be submitted in accordance with Article 35 of the NSA, and a series of documents including the contents of a SAR should be submitted in accordance with Article 44 of the Enforcement Regulations of the NSA.
The contents of safety assessment of a spent fuel interim storage facility are presented in a RER and a SAR in accordance with Article 87 of the Enforcement Regulations of the NSA. The attached Table 2 of the NSSC Notice Standard Format and Content of Radiological Environmental Report for Nuclear Facilities describes detailed information on how to prepare a RER for the spent fuel interim storage facility. It is also required by the NSSC Notice Guidelines for Preparation of Safety Analysis Report for Interim Storage Facilities of Spent Fuel that the SAR should be written objectively and logically based on scientific facts. The survey and analysis of data and the estimation and evaluation of safety should be done using objectively accepted methods and technologies so that the safety assessment is performed in a systematic manner.

G.5.2 Supplementation of Safety Assessment

A spent fuel management facility should undergo preoperational inspection in accordance with Article 27, Article 63, Article 101 of Enforcement Decree of the NSA. During the period of construction or preoperational inspection, any change of matters already permitted or designated should be made with a change permit from the regulatory body or a notification to the regulatory body.
ARTICLE 9. OPERATION OF FACILITIES
Each Contracting Party shall take the appropriate steps to ensure that:

i. the license to operate a spent fuel management facility is based upon appropriate assessments as specified in ARTICLE 8 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;

ii. operational limits and conditions derived from tests, operational experience and the assessments, as specified in ARTICLE 8, are defined and revised as necessary;

iii. operation, maintenance, monitoring, inspection and testing of a spent fuel management facility are conducted in accordance with established procedures;

iv. engineering and technical support in all safety-related fields are available throughout the operating lifetime of a spent fuel management facility;

v. incidents significant to safety are reported in a timely manner by the holder of the license to the regulatory body;

vi. programs to collect and analyses relevant operating experience are established and that the results are acted upon, where appropriate;

vii. decommissioning plans for a spent fuel management facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body.

G.6.1 Operation License

The construction and operation of a spent fuel pool at a NPP are approved as a part of CP and OL of the NPP (Refer to Article 10 and 20 of the NSA). The construction and operation of a spent fuel dry storage facility, additionally introduced at a NPP site after issuance of an OL for NPP requires a permit change (Article 20 of the NSA).
Safety review and preoperational inspection (Article 27 of the NSA) are conducted to confirm whether the construction and operation of a spent fuel storage facility of NPP are in compliance with safety requirements.

The PIF, operated by KAERI is a designated facility in accordance with Article 35 of the NSA. Safety review on the construction and operation of the PIF is conducted in accordance with Article 61 of Enforcement Decree of the NSA, and the PIF can be used only after completion of preoperational inspection on construction and performance of the facility in accordance with the Article 63 of Enforcement Decree of the NSA.

Article 63 of the NSA and Article 101 of the Enforcement Decree of the NSA clearly stipulate the requirements for safety review and preoperational inspection of a spent fuel interim storage facility.

G.6.2 Operational Limit and Condition

For NPP, operating limit and limiting conditions of operation should be established and operated in accordance with Article 48 of Regulations on Technical Standards for Nuclear Reactor Facilities, etc. and the NSSC Notice Standard Format and Content of Technical Specifications for Operation.

For a PIF, operating limits and limiting conditions of operation are prescribed in Section 3 and Section 4 of “Safety Management Regulation” in accordance with Article 44 of Enforcement Decree of the NSA.
For a spent fuel interim storage facility, Limiting Conditions of Operation (LCOs) are prescribed in Section 8 of the SAR that is required in accordance with Article 87 of the Enforcement Regulations of the NSA. Application of technical specifications and matters to be described for each LCO are described in detail in the NSSC Notice *Guidelines for Preparation of Safety Analysis Report for Interim Storage Facilities of Spent Fuel*.

**G.6.3 Technical Support for Operating Procedure (operation, maintenance, monitoring, inspection and test) and Safety**

Technical standards for test, monitoring, inspection and maintenance of NPPs are stipulated in Article 41 of *Regulations on Technical Standards for Nuclear Reactor Facilities, etc.*, and Article 54 Paragraph 4 of the same regulation requires the establishment of organization for engineering and technical support to review safety-related issues that may occur during operation. The Article 56 of the same regulation requires that operating procedures necessary for operation of NPPs including administration, operation, test and maintenance should be prepared in written forms and provided before the commencement of operation.

Article 72 of *Regulations on Technical Standards for Nuclear Reactor Facilities, etc.* stipulates that methods for implementing activities that have an impact on quality should be described in documented instructions, procedures and drawings.

**PIEF**

As per Article 36 Subparagraph 1 of the NSA, securing technical capability is one of the criteria for designation as a spent fuel processing operator, and specific details are stipulated in Article 34 of the *Enforcement Regulations of the NSA*. In addition, the same QA requirements applicable to NPPs are applied to the PIEF.
The requirements for technical capability necessary for construction and operation of a spent fuel interim storage facility are described in Article 64 of the NSA.

A more specific description is found in Article 34 of the *Enforcement Regulations of the NSA* as follows: an organization and department necessary for construction and operation should be formed and the responsibility and authority required for performance of duties should be specifically assigned; there should be an engineering and technical support organization to review safety-related matters that arise in the process of refining; a person engaged in construction and operation should possess the qualifications and experience commensurate with the responsibility and authority thereof; and test and inspection programs shall be formulated pertaining to major safety-related structures and equipment.

**G.6.4 Reporting of Events Significant to Safety**

All nuclear facilities including a spent fuel management facility should report and disclose incidents and failures in accordance with Article 97 of the NSA and the NSSC Notice *Regulation on Reporting and Public Announcement of Accidents and Incidents for Nuclear Facilities*.

**G.6.5 Operation Experience Feedback**

As for on-site spent fuel storage facilities of NPP, the requirements for systematic feedback of operating experience of NPPs include the following: (1) collection, analysis and management of operating experience data, and (2) incorporation of operating experience analysis results into the equipment, safety-related criteria, operating procedures, and education & training in accordance with Article 58 of *Regulations on Technical Standards for Nuclear Reactor Facilities, etc.*

For a spent fuel interim storage facility, feedback of operating experience and lessons-learned is stipulated in accordance with Article 4 of the NSSC Notice *Technical Standards for the Structure and Equipment of Interim Storage Facilities of Spent Nuclear Fuel.*
G.6.6 Decommissioning Plan

Prior to permanently terminating the business, the NSA stipulates that the operators of nuclear facilities including a spent fuel management facility are required to report to the NSSC a plan of necessary measures for protection against radiation hazards including transfer, safe-keeping, discharge, storage, treatment, disposal, and decontamination. The NSSC has an authority to order necessary measures including collection of radioactive materials and decommissioning of any and all contaminated facilities according to Article 95 of the NSA, if needed.

For on-site spent fuel storage facilities of the NPPs and the PIFF, a decommissioning plan should be submitted to the NSSC at the time of application for CP or designation, and afterwards updated periodically during the period of operation. The decommissioning plan should be submitted to and approved by the NSSC after the facilities are permanently shutdown for decommissioning.

Especially for spent fuel interim storage facilities, the contents of decommissioning plan should be described in the SAR in accordance with the attached Table 2 of the NSSC Notice Guidelines for Preparation of Safety Analysis Report for Interim Storage Facilities of Spent Fuel. The decommissioning plan should explain decommissioning strategies to be applied for the corresponding facilities after termination of operation and methods to be applied for safe decommissioning, and describe procedures to review and revise the decommissioning plan periodically.
ARTICLE 10. DISPOSAL OF SPENT FUEL

If, pursuant to its own legislative and regulatory framework, a Contracting Party has designated spent fuel for disposal, the disposal of such spent fuel shall be in accordance with the obligations of Chapter 3 relating to the disposal of radioactive waste.

All spent fuel generated in Korea has been stored in a safe manner and the disposal of spent fuel has not been implemented yet.

Matters regarding disposal of HLW (including spent fuel declared to be disposed of) such as general safety requirements, facility design and construction, safety assessment, and post-closure institutional control are described in Chapter H.

On October 30, 2013, the PECOS was established to collect opinions of the public including various stakeholders and experts with an aim to develop measures for spent fuel management based on public consensus. After gathering public opinions for about 20 months, the PECOS submitted the final recommendations on spent fuel management to the government on June 29, 2015.

Based upon the recommendations, the government established the Basic Plan on High-level Radioactive Waste Management in July 2016 which defines the method and procedure for safe management of spent fuel. The basic plan is outlined as follows: selection of the final candidate site through 12-year-long siting process; construction and operation of a site-specific underground research laboratory (URL) at the selected site; and then expansion of the URL into the permanent repository. Based on the estimated period of 24 years for the demonstration studies at the URL and the expansion work. According to the Basic Plan, 36 years are expected from the start of site selection process to the operation of the repository. More details of the Basic Plan on High-level Radioactive Waste Management are introduced in K.1.
H. Safety of Radioactive Waste Management
ARTICLE 11. GENERAL SAFETY REQUIREMENTS

1. Each Contracting Party shall take the appropriate steps to ensure that at all stages of radioactive waste management individuals, society and the environment are adequately protected against radiological and other hazards.

In so doing, each Contracting Party shall take the appropriate steps to:

i. ensure that criticality and removal of residual heat generated during radioactive waste management are adequately addressed;
ii. ensure that the generation of radioactive waste is kept to the minimum practicable;
iii. take into account interdependencies among the different steps in radioactive waste management;
iv. provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;
v. take into account the biological, chemical and other hazards that may be associated with radioactive waste management;
vi. strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;
vii. aim to avoid imposing undue burdens on future generations.

H.1.1 Standards for Permit of Construction and Operation

The standards for permit to protect the public health and the environment against radiological hazards from construction and operation of a radioactive waste management facility, etc. and those from construction, operation, closure, post-closure institutional
control, and thereafter of a radioactive waste disposal facility are specified in the NSA and its subordinate statutes as follows:

- technical capability necessary for construction and operation of a radioactive waste management facility, etc. as provided for in the Enforcement Regulations of the NSA should be available;
- the location, structure, equipment, and performance of a radioactive waste management facility, etc. should conform to the technical standards as prescribed by the Regulations of the NSSC in such a way that they do not present any impediment to the protection against disasters caused by the radioactive materials, etc. to human, material objects and the public;
- the construction and operation of radioactive waste management facility, etc. should conform to the standards prescribed by the Presidential Decree in order to prevent any harm to the public health and the environment caused by radioactive materials, etc.; and
- it is required to secure equipment and manpower prescribed by the Presidential Decree.
- the post-closure institutional control plan of a disposal facility after its full or partial closure should be in compliance with the standards for institutional control defined in the Regulations of the NSSC.

To ensure that the foregoing standards are satisfied, the permit applicant should perform a comprehensive and systematic safety analysis. The analysis results should then be reported to the NSSC in forms of SAR and RER. More specific regulatory requirements are provided in the NSSC Notices.

**H.1.2 Safety Analysis**

The licensee of a radioactive waste management facility, etc. should prepare a SAR in accordance with the provisions of the NSA, and submit the report to the NSSC to secure safety in the overall construction and operation processes of a radioactive waste management facility.

The Enforcement Regulations of the NSA specifies the items to be included in the SAR, which covers safety-related matters, particularly the outline and description of facility, site characteristics, design, construction, operation and maintenance of facility, site closure and institutional control in the case of disposal facility, safety assessment and accident analysis, radiation protection, technical guidelines, etc.
H.1.3 Safety Requirements to Be Considered

**Criticality Safety and Thermal Safety**

A radioactive waste disposal facility should be designed to prevent nuclear criticality during operation and to withstand the heat from radioactive decay and irradiation. Therefore, it is required to secure cooling function if there is a possibility that radioactive waste is overheated due to decay heat, and to limit the concentration of fissile materials in radioactive waste so as to maintain the criticality safety in accordance with the regulation of the NSSC *Regulations on Technical Standards for Radiation Safety Control, etc.* and the NSSC Notice *Acceptance Criteria for Low and Intermediate Level Radioactive Waste*. A deep geological repository for HLW should be designed such that, in no circumstance, disposed radioactive waste reaches nuclear criticality in the disposal environment and the safety function of disposal systems in association with engineered barriers should be maintained for a long time against decay heat and pressure in accordance with the NSSC Notice *General Standards for Deep Geological Disposal Facilities for High-level Radioactive Waste*.

**Minimization of Generation of Radioactive Waste**

The amount of radioactive waste generated during operation of nuclear facilities should be minimized in accordance with Article 66 of the NSSC *Regulations on Technical Standards for Nuclear Reactor Facilities, etc.* Accordingly, the improvement of radioactive waste treatment systems along with the introduction of a new treatment technology should be considered.

**Inter-dependence among the Steps in Radioactive Waste management**

Taking into account inter-dependencies among all steps in radioactive waste management ranging from generation to disposal, radioactive waste should be managed in such a way that the management method for each stage should consider those for the other stages, especially the suitability for disposal.
One of standards for permit of a radioactive waste management facility, etc. is that the facility should not be impediment to the prevention of hazards to the public health and the environment. The standards for prevention of hazards to the environment regarding a radioactive waste management facility, etc. as determined by the NSA and subordinate statutes are as follows: (1) limits in the concentration of liquid and gaseous radioactive materials released from the facility; (2) radiation dose criteria pertaining to liquid and gaseous discharges in normal operation which are applied to the design of the facility; and (3) constraints of radiation dose and public health risk due to the disposed radioactive waste after the closure of the radioactive waste disposal facility. By complying with the above standards, the hazards caused by the radioactive waste management facility, etc. should be kept sufficiently below an acceptable level.

The predicted future impact on the environment in the vicinity of a disposal facility resulting from the permanent disposal of radioactive waste should be negligible and the future use of natural resources should not be impeded by either radioactive or non-radioactive contaminants disposed therein.

In accordance with the Regulations on Technical Standards on Radiation Safety Management, etc. and the NSSC Notice Technical Standards for the Structure and Equipment of Radioactive Waste Treatment Facilities, a radioactive waste management facility, etc. should be capable of controlling gaseous and liquid effluents properly during normal operation and under abnormal conditions, and ensuring that they are not released to the environment through ventilation or drainage points other than those identified when a construction permit and operating license were issued. Such requirements for a radioactive waste disposal facility are specified in the NSSC Notice Standards for the Structure and Equipment of Low- and Intermediate-Level Radioactive Waste Near-Surface Disposal Facilities. In addition, sampling and monitoring systems should be properly installed to monitor the operating conditions of the waste treatment system and to monitor the radioactivity discharged. Radioactive waste treatment systems should be installed separately from systems not supposed to handle radioactive materials to minimize the possibility of contamination due to backflow of radioactive materials. In case that radiation level exceeds set points or any abnormal condition occurs at the facility, it is required to have a function to terminate the discharges automatically along with an alarm.
In case of LILW disposal facility, waste containing explosive, flammable, and/or pyrophoric materials to be disposed of should be adequately treated so that potential risks by them are eliminated in accordance with the NSSC Notice *Acceptance Criteria for Low and Intermediate Level Radioactive Waste*. In addition, the waste should be controlled in such a way to prevent from generating gas, vapor, or liquid as a result of radiolysis, or biological or chemical reactions which may undermine the integrity of the waste package, the performance of the disposal facility or the safety of workers. With regard to the waste containing corrosive materials to be disposed of, the causticity should be mitigated and the materials should be packaged in such a way to withstand corrosion. Waste that includes toxic, perishable, or contagious materials should be processed so as to remove such hazards. Chelating agents contained in waste should be removed or their contents should be restricted according to the acceptance criteria for a disposal facility. In addition, limits for the concentration of non-radioactive contaminant in air which is potential to be released should be presented in the safety analysis report, one of licensing documents of a disposal facility in accordance with the NSSC Notice *Guidelines for Preparation of Safety Analysis Report for Low- and Intermediate-Level Radioactive Waste Disposal Facilities*.

For a combustible, LILW treatment facility (e.g. incinerator), the incinerator should be capable of preventing fire and explosion in accordance with the NSSC Notice *Incineration Criteria for Low- and Intermediate-Level Radioactive Waste*. In addition, the exhaust gas from the incinerator should be properly treated and then released into the atmosphere and it should comply with the emission limits set forth in the *Clean Air Conservation Act* and its subordinate statutes as well as the previously mentioned Notice of the NSSC.

In accordance with the NSSC Notice *Acceptance Criteria for Low- and Intermediate-level Radioactive Waste*, waste to be disposed of should be packaged in a nonflammable container, and the packaging container should pass the visual inspection. Furthermore, the package should be able to maintain its integrity under circumstances expected in disposal conditions, and withstand the internal pressure increase due to gas generation within the package.
In accordance with the NSSC Notices *Radiological Protection Criteria for Long-term Safety on Low- and Intermediate-level Radioactive Waste Disposal* and *General Standards for Deep Geological Disposal Facilities for High-level Radioactive Waste*, the risk of a disposal facility shall meet the post-closure performance objective to demonstrate the risk is acceptable both for the current and future generations, thereby not imposing undue burdens on future generations.
ARTICLE 12. EXISTING FACILITIES AND PAST PRACTICES

Each Contracting Party shall in due course take the appropriate steps to review:

i. the safety of any radioactive waste management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility;

ii. the results of past practices in order to determine whether any intervention is needed for reasons of radiation protection bearing in mind that the reduction in detriment resulting from the reduction in dose should be sufficient to justify the harm and the costs, including the social costs, of the intervention.

Nuclear facilities in Korea including a radioactive waste management facility, etc. are constructed and operated after adequate safety evaluation and authorization pursuant to the NSA and its subordinate statutes. The maintenance of these facilities according to the conditions authorized is verified through periodic and non-periodic inspections. In addition, when authorized conditions at a specific facility require revision, the legal procedures in pursuant to the NSA and its subordinate statutes, such as permit for significant change or notification of minor change, should be adhered to.

The safety of radioactive waste management facilities and nuclear facilities generating radioactive waste, existing at the time of and since this Joint Convention entered into force in Korea, has been confirmed periodically in compliance with safety regulations for operating facilities.

H.2.1 Safety Confirmation

Radioactive waste management facilities such as combustible waste treatment facility (e.g. incinerator) and RI waste storage facilities, including the radioactive waste disposal facility have been constructed and operated after going through safety review which includes review of adequacy of safety and accident analysis, etc. in accordance with the NSA and its subordinate statutes. Periodic and daily inspections are performed to verify
that the safety and functions of those facilities in operation are maintained under the conditions of the construction permit and operating license. In case of any findings identified in safety or performance as a result of those inspections, proper corrective actions should be taken in due process.

H.2.2 Safety Improvement

In case of natural disaster such as earthquake and flooding, or accident which may affect the isolation function of a LILW disposal facility, the safety of the facility should be re-evaluated, and related licensing documents and procedures should be revised based on the latest available data in accordance with the NSSC Notice *Technical Standards for the Operation, etc. of Low- and Intermediate-level Radioactive Waste Disposal Facilities*.

In addition, the operator of a LILW disposal facility should re-evaluate and supplement, if necessary, conditions related to the safety of a disposal facility based on the experience and data obtained from operation of the disposal facility and results of safety assessment. The above NSSC Notice also stipulates that the followings should be re-evaluated to verify the safety of the radioactive waste disposal facility prior to closure: information and data on the facility, the site and the surrounding areas for the period of performance assessment, total inventory of radioactive waste disposed of, and records of accidents during operation, radiological and non-radiological impacts caused by waste disposal on the public and the surrounding environment for the period of performance assessment.
ARTICLE 13. SITING OF PROPOSED FACILITIES

1. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed radioactive waste management facility:

   i. to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime as well as that of a disposal facility after closure;
   ii. to evaluate the likely safety impact of such a facility on individuals, society and the environment, taking into account possible evolution of the site conditions of disposal facilities after closure;
   iii. to make information on the safety of such a facility available to members of the public;
   iv. to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.

2. In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of ARTICLE 11.

H.3.1 Regulatory Requirements and Permit Procedure

The licensing procedure for site selection of a radioactive waste management facility, etc. is described in section E.2.3. The standards for permit for site selection of a radioactive waste management facility, etc. are stipulated in Regulations on Technical Standards for Radiation Safety Management, etc. and NSSC Notice Technical Standards for the Location of Low and Intermediate Level Radioactive Waste Disposal Facilities. The NSSC Notice Guidelines for the Preparation of Site Characterization Report for Low and Intermediate Level Radioactive Waste Disposal Facilities stipulates that the following items should be included in site characterization report.

- data on the current status of the site such as geography, population, military
facilities, major environmental conditions, natural resources, and ecosystem;
- data of site safety analysis such as the effect of natural disasters and human-induced external events, and design input data; and
- site monitoring and surveillance programs in the phases of pre-operation, operation, and post-closure.

**Factors of Safety Analysis**

Safety assessments for the site of a disposal facility are divided into the radiological environmental impact assessment, safety analysis and general environmental impact assessment. The general environmental impact assessment is performed for approval of the Electric Source Development Project Plan as well as the Radioactive Waste Management Project Implementation Plan which follow notification of the Designation of Prearranged Area for Electric Source Development Business. The safety analysis and radiological environmental impact assessment are conducted at the time of applying for the CP/OL of a radioactive waste disposal facility.

- Radiological Environmental Impact Assessment
  Under the NSA, a radiological environmental impact assessment should be conducted to evaluate the impact of radiation or radioactive materials caused by operation of a radioactive waste disposal facility on the surrounding environment, as one of the fundamental requisites to obtain the CP/OL of radioactive waste disposal facility. The RER contains facility information, environmental status of neighboring regions, predicted radiological impact on the surroundings thereof due to operation of a facility, environmental radiation monitoring program to be implemented during the period of construction and operation, radiological impact on the environment resulting from accidents and incidents during a facility operation, and collected opinions of the public.

- General Environmental Impact Assessment (Non-radiological)
  General environmental impact assessment should be conducted for the purpose of identifying and assessing non-radiological impact on the environment caused by construction and operation of a disposal facility, separately from the radiological environmental impact analysis in accordance with the *Environmental Impact Assessment Act*. The assessment is conducted in the areas of natural environment, living environment and social and economic environment and the report submitted should be approved by the Minister of MOTIE in consultation with the Minister of MOE.
Disclosure of Information

The government consistently maintains a principle for securing transparency in the entire stage of the site selection process of a disposal facility.

The *Electric Power Source Development Promotion Act* prescribes to disclose the details of the project to local residents for a certain period before the notice of designation of the final site and approval of the Electric Source Development Project Plan. In addition, the NSA and the *Environment Impact Assessment Act* also specify that the opinions of the public should be collected through holding public hearings or opening the draft environmental report to the residents prior to preparation of the environmental report.

The *Special Act on Supporting the Local Community around the Low- and Intermediate-level Radioactive Waste Disposal Facility* prescribes that the whole process for site selection should be carried out transparently and openly, and at the same time explanatory meetings or forums regarding selection of the hosting community should be held for the local residents.

In addition, the Civil Environment Monitoring Organization consisting of local residents and Non-Governmental Organization (NGO) representatives are operated during the operation period of a facility as part of efforts to ensure the transparency of information disclosure.

Consultation with Neighboring Countries

The Korean peninsula is surrounded by sea on three sides and is separated from neighboring countries. The Korean government has not concluded specific international agreements with foreign countries on site selection, but on radiological emergency preparedness. The contents of the agreement are described in section F.5.

**H.3.2 Site Selection for the Proposed Facility**

A operator who intends to construct and operate of a LILW disposal facility should conduct a safety analysis under the provisions of the NSA including preliminary surveys and detailed surveys on candidate sites. Based on the analysis results, the RER and the Site Investigation Report (SIR) should be prepared and submitted to the NSSC when filing an application for a early approval of a construction site. After review by KINS,
the NSSC can make a early approval of the proposed site. Site safety can also be evaluated through an application for the CP/OL of a disposal facility without undergoing the early site approval procedure depending on the decision of the operator of the LILW disposal facility.

As for the LILW disposal facility currently in operation, the four local governments such as Gunsan-si, Gyeongju-si, Pohang-si, and Yeongdeok-gun applied for the hosting of a LILW disposal facility through public subscription process in August 2005, and all of these four sites were evaluated as suitable for hosting a disposal facility. Referendums were held by these four local governments. As a result, Gyeongju was finally selected as the site for a LILW disposal facility in November 2005 among them with the highest number of favorable responses from residents (89.5%).
ARTICLE 14. DESIGN AND CONSTRUCTION OF FACILITIES
Each Contracting Party shall take the appropriate steps to ensure that:

i. the design and construction of a radioactive waste management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;

ii. at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a radioactive waste management facility other than a disposal facility are taken into account;

iii. at the design stage, technical provisions for the closure of a disposal facility are prepared;

iv. the technologies incorporated in the design and construction of a radioactive waste management facility are supported by experience, testing or analysis.

H.4.1 Regulatory Requirements


A LILW disposal facility should be designed such that it maintains its structural and functional integrity during normal and abnormal operations. Therefore, the design and construction of a disposal facility should be based on proven engineering practices. In addition, equipment and components installed at a disposal facility should be designed such that they can be regularly tested and inspected to confirm that they can continue to be used safely.

Requirements for design and construction of a deep geological repository for HLW are specified in the NSSC Notice General Standards for Deep Geological Repository for High-level Radioactive Waste. The Notice stipulates general matters to be considered at the time of design and construction of the facility.
**H.4.2 Criteria of Design and Construction**

The radiation exposure of local residents and radiation workers should meet the limits stipulated by the NSSC Notices. These requirements should be considered at each stage of site selection, design, operation, closure, and post-closure institutional control. The design objectives for a disposal facility to protect local residents and radiation workers from radiation effects both during operation and after the closure of the facility are as follows:

- **In-operation design objectives**
  (Annual dose by gaseous radioactive effluents at the EAB)
  - air absorbed dose by gamma ray: 0.1 mGy/y
  - air absorbed dose by beta ray: 0.2 mGy/y
  - effective dose from external exposure: 0.05 mSv/y
  - skin equivalent dose by external exposure: 0.15 mSv/y
  - organ equivalent dose from internal exposure due to particulate radioactive substances, $^{3}$H, $^{14}$C and radiiodine: 0.15 mSv/y

  (Annual dose by liquid radioactive effluents at the boundary of exclusion area)
  - effective dose: 0.03 mSv/y
  - organ equivalent dose: 0.1 mSv/y

- **After closure design objectives**
  (LILW disposal facility)
  - annual dose by normal/natural phenomena: 0.1 mSv/y
  - annual risk by unexpected disruptive events caused by either natural or artificial factors: $10^{-6}$/y
  - radiological impacts due to human intrusion: 1.0 mSv/y

  (HLW disposal facility)
  - annual risk from all exposure scenarios including natural phenomenon and human intrusion: $10^{-6}$/y
  - annual dose by each single scenario due to any unlikely events or human intrusion: 10 mSv/y

In accordance with the NSSC Notices, major design criteria should be established to
minimize the radiological effects on radiation workers and the public during normal operation or in case of accidents

- **Radiological Safety**
  - The design and operation of a disposal facility should be complied with the site closure and stabilization plans; thus, the performance objectives after closure of the facilities should be met.
  - A disposal facility should be designed to meet the radiological criteria stipulated in the NSSC Notice *Standards for radiation protection, etc.* during operation period. Also the facility should be designed to be complied with the performance objectives for the post-closure period as stipulated in the NSSC Notice *Radiological Protection Criteria for Long-term Safety on Low and Intermediate Level Radioactive Waste Disposal* for LILW disposal facility, and the NSSC Notice *General Standards for Deep Geological Repository for High-level Radioactive Waste* for HLW disposal facility.

- **Stability of Site and Structure**
  - A disposal facility should be designed considering site characteristics so as to supplement and improve site characteristics.
  - A disposal facility should be designed considering site characteristic factors such as geology, earthquakes, meteorology, and hydrology as well as other human-induced disasters.
  - A disposal facility should be designed to maintain its structural integrity with minimal maintenance and repair activities during the institutional control period after closure.

---

**Considerations for Construction**

The Notices of the NSSC provides the construction-related factors for a LILW disposal facility in detail. The construction of a disposal facility should be based on proven engineering practices. When new construction methods are applied, their safety should be demonstrated with valid evidence. Detailed construction-related requirements for a LILW disposal facility are specified in NSSC Notice *Standards for the Structure and Equipment of Low- and Intermediate-level Radioactive Waste Near-Surface Disposal Facilities* as follows:

- The construction of a disposal facility should adhere to QA requirements.
- A disposal facility should be constructed such that damage to the functions of natural barriers is minimized.
Regarding the characteristics of natural barriers assumed at the design stage, their validity should be confirmed through comparisons with on-site measurements obtained during construction phase. When the construction and operation stages overlap, construction work should be carried out in such a way to have no adverse effect on the operational safety of a disposal facility.

It is stipulated in the NSSC Notice *General Standards for Deep Geological Repository for High-level Radioactive Waste* that a deep geological disposal facility for HLW should be constructed in such a way that the environment of the site and the safety function of natural barriers which have been confirmed with the safety assessment should be preserved.

### Considerations for Closure

A LILW disposal facility should be designed to enable its closure when the disposal amount considered in its design or the total radioactivity of the waste disposed of has reached the allowable limits or when maintaining their normal functions is deemed no longer possible due to unexpected accidents. Accordingly, the SAR should describe a plan for closure and stabilization of the disposal facility as well as attendant design features to isolate radioactive waste on a long term basis. A final closure plan and a post-closure institutional control plan for the LILW disposal facility will be finalized prior to closure of the facility in consideration of operating experience of the facility and progress made in research and development.

### Considerations for Decommissioning

Design characteristics and provisions for decommissioning of nuclear facilities should be considered from the stages of construction and operation of the facilities, and plans and methods for management of records regarding design, construction and operation of the facilities which may affect decommissioning should be established. The NSSC *Regulations on Technical Standards for Nuclear Reactor Facilities, etc.* stipulates provisions to facilitate decommissioning which should be considered at the time of design, construction and operation, and the NSSC Notice *Regulations on Preparation of Decommissioning Plan for Nuclear Facilities, etc.* stipulates that the facilitation of decommissioning should be incorporated in the decommissioning plan. Measures to be taken for facilitation of decommissioning at the stages of design, construction and operation are as follows:
To minimize the possibility of occurrence of radioactive contamination and leakage of radioactive materials from major systems;
To arrange major structures and components in an easy-to-dismantle way;
To develop plans for decontamination of structures, systems and components which are contaminated with radioactive materials;
To minimize the generation of radioactive waste (in terms of radioactivity and volume) as practicable as possible; and
To preserve records of design, construction and operation of the facilities which may affect decommissioning.

H.4.3. Safety Regulation for Design and Construction of Major Nuclear Facilities

The KHNP conducted site investigations and environment investigations on the finally selected site and submitted to the Ministry of Science and Technology (at present, the NSSC) an application for the CP/OL of the 1st phase LILW disposal facility based on the investigation results in January 2007. At the request of the Ministry of Science and Technology (at present, the NSSC), KINS conducted a safety review of the application attached with licensing documents including RER, SAR, and QAP.

As a result of the review, it was concluded that the application was in compliance with criteria for technical standards for location, structure, equipment and performance and the radiological impact resulting from operation and closure of a disposal facility was in conformity with the standards for protection of public health and the environment as specified in the Enforcement Decree of the NSA. After deliberation and resolution by the nuclear safety committee (the former advisory committee for the Minister of Education, Science and Technology), the Ministry granted the permit to the KHNP on July 31, 2008. The responsibilities of construction and operation of the disposal facility were transferred to the Korea Radioactive Waste Management Corporation (KRMC, later renamed as KORAD in July 2013) when it was established in January 2009 in accordance with the RWMA.

The construction of the 1st phase disposal facility started in August 2008 and the construction work including excavation of construction tunnel, operation tunnel, access shaft, unloading tunnel and disposal units (e.g. silos), and concrete lining was completed in June 2014.

The 1st phase LILW disposal facility is divided into surface and underground facilities (see Figure H.4-1). Surface facilities consist of a receipt and storage building, radioactive waste processing building, service building and other supporting buildings. Here, radioactive waste is received from waste generators such as NPPs and verified to be
consistent with the waste acceptance criteria. On-site conditioning of the waste to be suitable for disposal may be conducted, if necessary.

Underground facilities include construction tunnel, operation tunnel, access shaft, unloading tunnel, and disposal units (e.g. silos). At first, six units of silos were constructed approximately 80-130 meters below the sea level to dispose of approximately 100,000 waste packages (see Figure H.4-2 cross section view of the underground facilities). All disposal silos were reinforced with short concrete and concrete lining. Most waste packages are packed using concrete disposal containers and subsequently disposed of in the disposal units.

Figure H.4-1. Bird’s Eye View of the Wolsong LILW Disposal Center

Figure H.4-2. Cross Section View of Underground Disposal Facilities
The operator of a LILW disposal facility should undergo preoperational inspection in accordance with the NSA. The purpose of the preoperational inspection is to check prior to operation whether the construction of a disposal facility satisfies the related design and safety requirements. The disposal facility, etc. should be deemed to have passed the inspection when the construction work has been progressed according to the content of a permit given under the NSA and when the structure, equipment and performance of the disposal facility, etc. is in conformity with the technical standard set by the NSA.

The preoperational inspection of the 1st phase LILW disposal facility took four steps: (1) inspection on structure, (2) inspection on system installation, (3) inspection on system performance and (4) inspection prior to operation. The preoperational inspection was conducted from September 2008 to August 2014 and the pass of the inspection was notified to the operator on December 12, 2014 through deliberation and resolution by the NSSC. Since then, the disposal facility has been in normal operation.

In December 2015, KORAD filed an application for the CP/OL of the 2nd phase disposal facility to the NSSC and currently, KINS is reviewing the application for the CP/OL as well as 10 kinds of licensing documents such as the RER, the SAR, QAP. The 2nd phase disposal facility is an engineered shallow land disposal type facility which is planned to be capable of disposing of 125,000 drums of LILW (Figure H.4-3).

Figure H.4-3 Layout of the 2nd Phase Disposal Facility for LILW
ARTICLE 15. ASSESSMENT OF SAFETY OF FACILITIES
Each Contracting Party shall take the appropriate steps to ensure that:

i. before construction of a radioactive waste management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;

ii. in addition, before construction of a disposal facility, a systematic safety assessment and an environmental assessment for the period following closure shall be carried out and the results evaluated against the criteria established by the regulatory body;

iii. before the operation of a radioactive waste management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).

H.5.1 Safety Analysis and Environmental Impact Assessment

According to the NSA and its subordinate statutes, an applicant who intends to construct and operate a radioactive waste management facility, etc. should submit to the NSSC an application for permit together with the SAR that includes a separate chapter entitled “Safety Assessment and Accident Analysis” as well as the RER. In other words, safety assessment of a radioactive waste management facility, etc. is conducted by the applicant before construction of the facility, and after review of the safety assessment, the regulatory body may grant a permit to the applicant.

Analysis through SAR

The SAR for a radioactive waste disposal facility mainly includes the results of safety assessment and accident analysis of anticipated issues during the design, construction, operation, closure and post-closure institutional control period of a disposal facility and supplementary facilities. The main contents of the safety assessment and accident analysis are as follows:
- identification of the form, types, and amount of waste: information on waste generated during operation and closure activities;
- infiltration water: analysis during design, safety analysis, operation, institutional control after closure, and thereafter;
- radionuclide leakage: under normal and abnormal conditions and in case of accidents;
- pathways through which radionuclides eventually reach the human body; and
- impact assessment and its compliance with the regulatory criteria.

Radiological dose criteria for a radioactive waste disposal facility are presented during operation and after closure respectively. During operation of a disposal facility, as with other nuclear power facilities in operation, the standards for prevention of hazards to public health and the environment as well as dose limits for the general public are to be applied (see H.4.2).

Radiological performance objectives after the closure of a disposal facility are set in terms of the radiological impact to an individual of the critical group in the future. The annual dose due to normal natural phenomena should not exceed 0.1 mSv as a dose constraint. In addition, the annual risk due to unpredictable phenomena caused by natural or artificial factors should be restricted to $10^{-6}$ or less as a risk constraint.

The performance assessment for the LILW disposal facility after closure should be conducted at least for 1,000 years of time frame. When the predicted risk does not reach its maximum value within this period, however, verification that the leakage of radioactive materials into the surrounding environment will not increase drastically after this period, and that individuals will not be subject to acute radiological risk should be duly presented.

The radiological performance objectives after the closure of the deep geological disposal facility for HLW as follows: The total annual risk for the representative person resulting from the radiation exposure in the scenario which covers both natural phenomena and human intrusion should not exceed $10^{-6}$, and the expected annual radiation dose for the representative person in a single scenario including a low probability natural phenomenon and human intrusion should not exceed 10 mSv.

The performance assessment after closure should be conducted at lest for 10,000 years of time frame. When the predicted risk does not reach its maximum value within this period, however, verification that the leakage of radioactive materials into the surrounding environment will not increase drastically after this period, and that individuals will not be subject to acute radiological risk should be duly presented.
For major scenarios that are deemed to affect the dose assessment results considerably, as a result of the safety assessment of a disposal facility, an uncertainty analysis should be conducted. To increase the reliability of the safety assessment results, QA principles and related detailed procedures for all stages of the safety assessment including the collection and application of input variables, modeling, detailed calculations, and comprehensive assessment should be prepared and applied.

Analysis through a RER

The RER of a radioactive waste disposal facility should address the respective effects to be caused by construction, operation, and closure of the disposal facility. In particular, the impact assessment for closure should describe an analysis of the predicted migration pathways of radionuclides that can be leached from the disposal facility, an assessment of predicted doses of local residents per exposure pathways due to potential radionuclide leakage in areas within 10 km from the relevant site, and an assessment of the predicted radionuclide concentration in groundwater release points located downstream of the site.

H.5.2 Renewal of Safety Analysis and Reassessment of Safety

Renewal of Safety Analysis

The NSSC Notices *Technical Requirements for the Operation and Control of Low- and Intermediate-level Radioactive Waste Disposal Facilities* and *General Standards for Deep Geological Repository for High-level Radioactive Waste* stipulate that in case of an event that can affect the isolation function of a disposal facility due to natural disasters such as earthquake and flood, or human-induced incidents, the safety of the disposal facility should be re-evaluated and related licensing documents should be revised based on the latest data. In addition, conditions related to the safety of the disposal facility should be continuously re-evaluated and supplemented, if necessary, based on the experience and data obtained from operation and management of the disposal facility and the results of safety assessment.

Reassessment of Safety

The NSSC Notices as above also stipulate that the followings should be re-evaluated so
as to demonstrate the safety of the radioactive waste disposal facility prior to closure:

- information and data on facility, site, and surrounding areas for the period of performance assessment.
- total amount of radioactive waste disposed of, records of accidents that have occurred during operation and with possible impact on the disposal safety, radiological and non-radiological impacts of disposal on the public and the surrounding environment, etc.

H.5.3 Implementation of Safety Assessment on Major Facility

In January 2007, the KHNP filed an application for the CP/OL of a LILW disposal facility, attached with SAR, RER, QAP, etc., to the Ministry of Science and Technology (at present, the NSSC) in accordance with the Nuclear Safety related Act and subordinate statutes. The applicant developed scenarios and conducted a safety assessment based on the safety assessment methodology recommended by the IAEA’s Co-ordinated Research Project (CRP) on the Improvement of Safety Assessment Methodologies for Near Surface Disposal Facilities (ISAM).

With an authority delegated by the Ministry of Science and Technology (at present, the NSSC), KINS has conducted the safety review of the 1st phase LILW disposal facility to confirm the adequacy of safety assessment for the construction, operation and post-closure of the disposal facility so as to determine technically whether the legal requirements have been met.

Based on the review results, it was recommended that the applicant, after issuance of the CP/OL, implement follow-up actions during the period of construction and operation to address issues that require safety demonstration or further confirmation in order to reduce uncertainties, and KINS has reviewed the results of implementation. The implementation and review of follow-up actions is to reduce uncertainties over the long-term safety and to secure the objectiveness and transparency of the safety of the disposal facility based on the safety review reflecting site characteristics obtained in the process of construction and operation of the disposal facility. By doing so, it is ultimately possible to develop the safety case for the construction stage of the disposal facility which is in line with the international safety standards including the IAEA SSR-5 (Disposal of Radioactive Waste, 2011), which stipulates establishment of safety case for each stage in development of a disposal facility.
ARTICLE 16. OPERATION OF FACILITIES
Each Contracting Party shall take the appropriate steps to ensure that:

i. the licence to operate a radioactive waste management facility is based upon appropriate assessments as specified in ARTICLE 15 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;

ii. operational limits and conditions, derived from tests, operational experience and the assessments as specified in ARTICLE 15 are defined and revised as necessary;

iii. operation, maintenance, monitoring, inspection and testing of a radioactive waste management facility are conducted in accordance with established procedures. For a disposal facility the results thus obtained shall be used to verify and to review the validity of assumptions made and to update the assessments as specified in ARTICLE 15 for the period after closure;

iv. engineering and technical support in all safety-related fields are available throughout the operating lifetime of a radioactive waste management facility;

v. procedures for characterization and segregation of radioactive waste are applied;

vi. incidents significant to safety are reported in a timely manner by the holder of the licence to the regulatory body;

vii. programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate;

viii. decommissioning plans for a radioactive waste management facility other than a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body;

ix. plans for the closure of a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility and are reviewed by the regulatory body.

H.6.1 Regulatory Requirements

After obtaining the CP/OL for a radioactive waste management facility, the operator of
the facility should undergo preoperational inspection regarding construction and performance of the facility during the period of construction. The inspection is to verify whether the constructed nuclear facility satisfies the design and safety requirements prior to its operation. When the facility meets the criteria for and contents of the CP and OL and the structures, equipment and performance of the facility satisfy the technical standards defined by the NSA and its subordinate statutes, the facility will pass the inspection and start its operation.

The operator of a radioactive waste management facility should undergo periodic inspection every year during the period of operation in accordance with the NSA. The facility will pass periodic inspection when the structures, equipment and performance of the facility satisfy technical standards defined by the NSA and its subordinate statutes, and storage, treatment and disposal of radioactive waste depending on the characteristics of each facility meet technical standards defined by the NSA. In addition to the periodic inspection, a LILW disposal facility should undergo disposal inspection whenever it is to dispose of radioactive waste. The disposal facility will pass disposal inspection when the disposal of radioactive waste satisfies technical standards defined by the NSA.

The NSSC Notices Technical Standards for the Operation, etc. of Low- and Intermediate-Level Radioactive Waste Disposal Facilities and “General Standards for Deep Geological Repository for High-level Radioactive Waste stipulate the regulatory requirements to secure safety during operation of a disposal facility as follows:

- Performance of structures, systems and components (SSCs)
- Periodic surveillance
- Regular surveillance
- Radioactive effluent monitoring
- Radiation protection
- Prevention and measures against contamination
- Repair and modification
- Site monitoring and environmental monitoring
- Emergency preparedness

H.6.2 Safety Management of Operation of a Disposal Facility

- Safety management standards necessary for operation of a disposal facility should be established to prevent radiological hazards to human bodies, material objects, and the public. To this end, such standards should include technical and
administrative matters on radiation safety management necessary to receive, handle, store, transport, treat, and dispose of radioactive waste during operation of a disposal facility and to manage and monitor the facility after closure. For this, the standards describe the following:

- organization, function and duties;
- operation and surveillance of a facility;
- radioactive waste management;
- radiation safety management;
- radiation measurement and management;
- exposure control and evaluation methods;
- monitoring of radiation and radioactivity in surrounding areas;
- protection against radiation hazards;
- education and training;
- measures for emergency situation; and
- preparation and maintenance of records.

H.6.3 Limiting Conditions of Operation of a Disposal Facility

The limiting conditions of operation of a radioactive waste disposal facility should be documented in the technical specifications or safety management regulations in accordance with the Nuclear Safety related Act and subordinate statute. The limiting conditions of operation of a disposal facility are as follows:

- limiting conditions of disposal: type of waste, disposal capacity, total radioactivity, and concentration limit for each radionuclide;
- limiting conditions of operation: waste handling operation, waste treatment operation, waste disposal operation, ventilation system, fire and explosion prevention, power supply system, and effluent monitoring;
- waste acceptance criteria;
- radiation control and monitoring;
- administrative control;
- periodic safety review (PSR); and
- physical protection.

H.6.4 Operation Procedures

The NSSC Notices *Technical Requirements for the Operation and Control of Low- and
Intermediate-level Radioactive Waste Disposal Facilities and General Standards for Deep Geological Disposal Facilities for High-level Radioactive Waste stipulate the detailed technical standards regarding operation of a disposal facility as below in order to ensure safe operation of the facility, prevention of disasters due to the facility, and environmental conservation. In addition, it is required that the licensee of the facility to present the relevant contents in permit application documents such as SAR, RER, safety management regulations, and QAP:

- organization and functions;
- zoning and access control;
- in-operation disposal facility management standards;
- waste management standards;
- disposal facility closure standards; and
- post-closure institutional control standards.

For operation and management of a disposal facility, the licensee should establish operating procedures regarding acceptance inspection, handling, storage, disposal, radiation monitoring, and emergency measures for the waste as documented procedures pursuant to its QAP. The appropriateness of these procedures is to be confirmed through diverse regulatory inspections.

H.6.5 Engineering and Technical Support

The Technology Development Center of KORAD provides technical support for implementing follow-up on licensing activities and technology developments with an aim to prevent radiological hazards to public health and the environment during the construction, operation, closure and institutional control period after closure, if necessary, by collaborating with external institutions.

H.6.6 Procedure for Characterization and Categorization of Radioactive Waste

To deliver radioactive waste packages to the disposal facility operator, the generator should submit to the operator an “Application Form to Request for Receipt of Radioactive Waste” with information on characterization of the waste to be delivered. The information on characterization of waste needed to apply for receipt is as follows:

- physical, chemical and biological characteristics, and applied characterization methods;
- total radioactivity and radionuclide-specific concentrations;
maximum surface dose rate; and
- safety characteristics of waste package and applied characterization methods.

The NSSC Notice *Acceptance Criteria for Low- and Intermediate-level Radioactive Waste* stipulates to identify radioactivity concentrations in each waste disposal package for the following radionuclides: $^3$H, $^{14}$C, $^{55}$Fe, $^{58}$Co, $^{59}$Ni, $^{60}$Ni, $^{90}$Sr, $^{94}$Nb, $^{99}$Tc, $^{129}$I, $^{137}$Cs, $^{144}$Ce and gross alpha.

**H.6.7 Event Reporting and Record Management**

The NSA prescribes that the nuclear enterpriser should immediately take all the necessary safety measures and report to the NSSC for the following cases:

- if radiological hazards occur;
- if a failure occurs in a nuclear facility; and
- if there is any danger or possibility of danger to the nuclear power facility or radioactive materials due to earthquake, fire or other disasters.

The NSSC Notice *Regulation on Reporting and Public Announcement of Accidents and Incidents for Nuclear Facilities* stipulates in detail the event reporting system. It includes the objects and means of and procedures for reporting, and rating of accidents and incidents. In particular, the reportable events at a radioactive waste disposal facility are as follows:

- leakage of radioactive materials due to fire occurs during transport and packaging;
- surface contamination of areas other than radiation areas of the facility exceeding limiting values due to the leakage of radioactive materials;
- abnormal increase in the local radiation level;
- unplanned and uncontrolled release of radioactive materials into the environment; and
- release of radioactive materials exceeding the ECLs.

The rating of accidents and incidents is based on the International Nuclear Event Scale (INES) of the IAEA.

Information on storage, treatment, or disposal of radioactive waste should be documented and kept in a disposal facility in accordance with Article 145 of the *Enforcement Regulations of the NSA*. The main contents are as follows:
H.6.8 Analysis and Feedback of Operating Experience

The operator of a radioactive waste disposal facility should re-evaluate and complement, if necessary, safety conditions of the disposal facility based on experience and data obtained from operation of the disposal facility and results of safety assessment.

H.6.9 Establishment of a Decommissioning Plan and Regulatory Review

The operators of radioactive waste management facilities, before permanently terminating the business, should establish decommissioning plan for protection against radiation hazards including transfer, safe-keeping, discharge, storage, treatment, disposal, decontamination and make a report to the NSSC. For its part, the NSSC may take necessary measures including collection of radioactive materials, decommissioning of any and all contaminated facilities, and other necessary measures.

H.6.10 Establishment of a Closure Plan and Review of the Regulatory Authority

The NSSC Notices *Technical Requirements for the Operation and Control of Low- and Intermediate-level Radioactive Waste Disposal Facilities* and *General Standards for Deep Geological Repository for High-level Radioactive Waste* stipulate the requirements regarding closure of a radioactive waste disposal facility. The closure of a radioactive waste disposal facility should be carried out according to a pre-approved closure plan and in such a manner that facilitates post-closure institutional control, minimizes the need for continued maintenance and repairs, and facilitates post-closure environmental monitoring and surveillance.

Prior to closure of the disposal facility, various licensing documents including the safety analysis report of the facility should reflect the latest revisions. In addition, the safety regarding the total amount of waste disposed of, records of abnormal events that have occurred during operation and with possible impact on the disposal safety, and the
radiological and non-radiological impact of disposal on the public and the surrounding environment should be re-evaluated to demonstrate the safety of the disposal facility.

In addition, the operator should finally confirm the predicted performance throughout the period stipulated in the SAR upon at the time of completion of closure.

**H.6.11 Safety Regulation on Operation of Major Facility**

The construction work of the 1st phase LILW disposal facility was undertaken on July 31, 2008 when the CP/OL of the facility was granted by the Ministry of Education, Science and Technology (MEST; at present, the NSSC) after deliberation and resolution by the nuclear safety committee (the former advisory committee to the Minister of MEST). The operation of the facility was commenced after the NSSC officially notified the approval of the implementation results of follow-up actions to address findings from the safety review for the CP/OL, and the operator's passing the preoperational inspection.

As part of efforts to resolve the shortage of capacity of on-site radioactive waste storage facilities of NPPs during construction of the disposal facility, KORAD came up with a plan for partial operation of the facility to store the LILW from NPPs before completion construction work for the whole facility including underground disposal silos. Based on the plan, KORAD obtained a change permit from the regulatory body and completed the construction of some surface facilities like radioactive waste receipt/storage building first. Since the completion of construction of the disposal facility, the radioactive waste stored in the receipt/storage building during the partial operation period has been disposed of after confirmation of the acceptability for disposal. As of late March 2017, 6,848 drums (200 liter each) of LILW were stored in the receipt/storage building and 6,920 drums (200 liter each) were disposed of in the disposal units (e.g. silos).

As part of safety regulations for operating facilities, the 1st phase disposal facility have undergone periodic and disposal inspections. The periodic inspection is performed every year for 28 items including the integrity of structures while the disposal inspection is conducted for three items including waste management environment whenever the radioactive waste is disposed of.

Furthermore, KORAD continuously monitors key site-specific parameters which are expected to be changed during the period of pre-operation, operation and post-closure period of the facility.

KORAD transported the LILW generated from Hanul site, Habit site and Kori site by
using a dedicated ship to the receipt/storage building of its disposal facility. The LILW transport ship is safely designed and built in accordance with the international standards of the IAEA and the International Maritime Organization as well as applicable Korean standards of the Ship Safety Act and the Nuclear Safety Act, and approved by the Ministry of Oceans and Fisheries. The safety and adequacy of the operating procedures of the ship have been verified through inspections by KINS and the Korea Register of Shipping.
ARTICLE 17. INSTITUTIONAL MEASURES AFTER CLOSURE
Each Contracting Party shall take the appropriate steps to ensure that after closure of a disposal facility:

- records of the location, design and inventory of that facility required by the regulatory body are preserved;
- active or passive institutional controls such as monitoring or access restrictions are carried out, if required; and
  - i. if, during any period of active institutional control, an unplanned release of radioactive materials into the environment is detected, intervention measures are implemented, if necessary.

H.7.1 Record Keeping

Pursuant to the NSA, radiological data related to a radioactive waste disposal should be permanently preserved. Related records, particularly, the location and design documents of a disposal facility are to be preserved in accordance with the QAP program.

With respect to the requirements regarding preparation and maintenance of records on a radioactive waste disposal facility, items to be recorded, time when the records should be drawn up, and duration of retention are stipulated in detail in the Enforcement Regulations of the NSA and the NSSC Notice Technical Requirements for the Operation and Control of Low- and Intermediate-level Radioactive Waste Disposal Facilities. The major information to be recorded is as follows:

- radioactive waste-related records: manifest information, amount and type of relevant waste and disposal locations;
- radiation safety control-related records: radiation level in the facilities and radiation workers' exposure dose;
- facility inspection records: preoperational inspection, periodic inspection, and disposal inspection records;
- operation and maintenance records: results of inspection, surveillance, and maintenance and repairs of major equipment;
- facility accident records;
environmental monitoring: sampling location and time/date, analytical method and results; and
meteorological records: direction and velocity of the wind, atmospheric stability, precipitation, and atmospheric temperature.

With regard to a radioactive waste disposal facility, the following records should be maintained on an annual basis: 1) site characterization documents; 2) facility design and construction-related data; 3) waste acceptance requirements and procedures; 4) SAR; 5) RER; 6) data on the characteristics of the waste disposed of; 7) location of disposal facility and waste; 8) other characteristic data for the disposal facility; 9) environmental monitoring records; 10) records of unintentional events during operation and after closure; 11) closure-related documents; 12) QA documents, and 13) post-closure institutional control plan and its results.

To preserve the records above, the licensee of a disposal facility should establish an organization, responsibility, and location for maintenance of records and should maintain and store records in a manner that provides a complete and objective description of activities in all stages of disposal. In addition, to ensure the use and maintenance of appropriate information at a post-closure stage, records should be updated up-to-date, maintained in usable form, and made easily accessible.

**H.7.2 Institutional Control**

In accordance with the NSSC Notice *Technical Requirements for the Operation and Control of Low- and Intermediate-level Radioactive Waste Disposal Facilities*, the operator of a disposal facility should establish and submit an institutional control plan to the NSSC by one year before the commencement of institutional control. In case they wish to revise the control plan, the operator should submit to the NSSC a statement of the reasons for revision and the revised control plan by June of the corresponding year before that when the revision is to take place. The post-closure institutional control plan should include the followings:

- control period;
- control organization and responsibility;
- characteristics of the waste disposed of, disposal facilities, and relevant site;
- control methods (control items, control method per item); and
- QA regarding institutional control.

The post-closure institutional control period should be established considering of the characteristics of the waste, engineering design, site characteristics, predicted social
activities related to a disposal facility, records, and historical experience regarding maintenance. After the control period, further control activities should be unnecessary and the risk or dose calculated according to appropriate methods should satisfy the performance objectives for a disposal facility.

Institutional control methods should be able to prove that radiation protection requirements are met by reasonably verifying the closure performance of a disposal facility. Institutional control consists of radiological environmental survey, non-radiological environmental survey, maintenance, site monitoring, access restriction, safety assessment, and record-keeping. However, detailed control methods may be adjusted according to the results of systematic safety evaluation of a disposal facility or the characteristics of a disposal facility and site. Site monitoring should meet the post-closure site monitoring program presented in the site characterization report or SAR for a disposal facility.

H.7.3 Intervention in Case of Unplanned Release

During the post-closure institutional control period of a LILW disposal facility, unplanned release of radioactive materials through activities such as survey of radiation environment, maintenance and repair, and site monitoring should be prevent or monitored. A specific description of the methods with regard to them should be included in the institutional control plan after closure for the disposal facility which should be submitted to the NSSC one year before the commencement of institutional control in accordance with the NSSC Notice Technical Standards for the Operation, etc. Low- and Intermediate-level Radioactive Waste Disposal Facilities.
I. Transboundary Movement
I. Transboundary Movement [Article 27]

ARTICLE 27. TRANSBORDER MOVEMENT

1. Each Contracting Party involved in trans-boundary movement shall take the appropriate steps to ensure that such movement is undertaken in a manner consistent with the provisions of this Convention and relevant binding international instruments.

In so doing:

i. a Contracting Party which is a State of origin shall take the appropriate steps to ensure that trans-boundary movement is authorized and takes place only with the prior notification and consent of the State of destination;

ii. trans-boundary movement through States of transit shall be subject to those international obligations which are relevant to the particular modes of transport utilized;

iii. Contracting Party which is a State of destination shall consent to a trans-boundary movement only if it has the administrative and technical capacity, as well as the regulatory structure, needed to manage the spent fuel or the radioactive waste in a manner consistent with this Convention;

iv. a Contracting Party which is a State of origin shall authorize a trans-boundary movement only if it can satisfy itself in accordance with the consent of the State of destination that the requirements of subparagraph (iii) are met prior to trans-boundary movement;

v. a Contracting Party which is a State of origin shall take the appropriate steps to permit re-entry into its territory, if a trans-boundary movement is not or cannot be completed in conformity with this ARTICLE, unless an alternative safe arrangement can be made.

2. A Contracting Party shall not licence the shipment of its spent fuel or radioactive waste to a destination south of latitude 60 degrees south for storage or disposal.

3. Nothing in this Convention prejudices or affects:

i. the exercise, by ships and aircraft of all States, of maritime, river and air navigation rights and freedoms, as provided for in international law;

ii. rights of a Contracting Party to which radioactive waste is exported for processing to return, or provide for the return of, the radioactive waste and other products after treatment to the State of origin;

iii. the right of a Contracting Party to export its spent fuel for reprocessing;

iv. rights of a Contracting Party to which spent fuel is exported for reprocessing to return, or provide for the return of, radioactive waste and other products resulting from reprocessing operations to the State of origin.
Regulations on transport of radioactive materials are described in the NSA, its Enforcement Decree, its Enforcement Regulation and Regulations on Technical Standards for Radiation Safety Management, etc., and the Notice of the NSSC Regulation on the Packaging and Transport of Radioactive Materials.

The domestic regulations on transport of radioactive materials are based on the Regulations for the safe transport of radioactive materials of the IAEA. The incorporation of the 1996 IAEA Regulations for the Safe Transport of Radioactive Materials (ST-1) into the NSA was made from 1999 to 2001 and the regulations based on this are applied to the safety management of transport of radioactive materials. Currently, the NSSC Notices related to transport of radioactive materials are being revised in order to apply the latest version of the IAEA Regulations (SSR-6, published in 2012) to the domestic regulations for safe transport of radioactive materials.

Articles related to transport of radioactive materials are reflected in the NSA, its Enforcement Decree, its Enforcement Regulation and Regulations on Technical Standards for Radiation Safety Management, etc. Especially, Article 71 (Report on Transport) through 77 (Inspection), of the NSA, Articles 108 (Report on Transport) through 114 (Exemption from Inspection of Report on Transport) of its Enforcement Decree, Articles 98 (Report on Transport) through 110 (Application for Exemption from Inspection) of its Enforcement Regulation, and Articles 89 (Scope of Application) through 128 (Standards for Transport by Post) of the Regulations on Technical Standards for Radiation Safety Management, etc. stipulate the notification of transport of radioactive materials, criteria of both transport and packaging for radioactive materials, radiation exposure management of transport workers, action for the accident during transport, inspection for transport, and design approval and inspecting of transport cask. The detailed technical regulations on the safe transport of radioactive materials are described in the NSSC Notices Regulation on the Packaging and Transport of Radioactive Materials and Regulations for Manufactures and Periodical Inspection of Transport Containers for Radioactive Materials, respectively.

In addition, Korea joined the Antarctic Treaty in 1986 and the Protocol on Environmental Protection to the Antarctic Treaty in 1996, it has been observing the obligations stipulated in the treaty and protocol (e.g. radioactive waste and radioactive material related articles, etc.) in accordance with the Act on Antarctic Activities and the Protection of Antarctic Environment and its Enforcement Decree.
I.2 Safety Requirements

I.2.1 General Safety Requirements

The general safety requirements for transport of radioactive materials specify radiation exposure management, emergency response, QA, compliance of transport safety standards, education of transporting workers, etc.

I.2.2 Safety Requirements for Transportation Containers

The safety requirements for transport packages specify the safety requirements of each type corresponding to Excepted package, type IP package, type A package, type B package, and packages containing fissile material that are divided into general performance requirements and safety test requirements in conditions of both normal and accident conditions. General requirements and test requirements for transport packages conform to the requirements which are, in general, same as ones specified in the IAEA Regulations (SSR-6).

I.2.3 Safety Requirements for Transportation

The safety requirements for transport include;

- requirements by package type, e.g. Excepted package, type IP package, type A package, type B package and package containing fissile material,
- activity limit of radioactive material,
- restriction of other dangerous properties of contents,
- transport index (TI) and critical safety index (CSI),
- categorization of package,
- marking, labelling, placarding,
- isolation of package and fissile material,
- control of surface dose rate and surface contamination;
- responsibilities of consignors and carriers,
- and requirements by transport means such as vehicle, airplane, and ship, etc.

In general, these safety requirements for transport are equivalent to the requirements specified the IAEA transport regulations (SSR-6).
I.3 Approval and Administrative Action

I.3.1 Design Approval

The approval prescribed in the NSA includes design approval for special radioactive material, design approval for transport packaging and special arrangements specified in the IAEA Regulations for the Safe Transport of Radioactive Material. The NSSC issues an certificate of design approval for transport package after the safety review. And a transport packaging, for which a design approval is granted, should undergo a manufacturing inspection. In addition, an inspection for use is conducted for each packaging every five years from the manufacturing date to ensure the safety for continuous use.

I.3.2 Report on Transportation

As for type B packages, packages containing fissile materials, and packages requiring special arrangement, the details of transport including radioactive contents, the type of load, a written transport procedures and an accident response procedure should be notified to the NSSC in five working days before the date the transport is scheduled to commence, and the NSSC should review said details, and issue an order to correct factors detrimental to safety, if any, prior to transport. As for declared loads, individual transport inspection or periodic inspections are conducted to check the possibility of obeying transport regulations. Moreover, a person who intends to load type B(M) packages or type B(U) packages contain large activity on ship or an airplane and packages requiring special arrangement approval upon arriving in any port or airport in Korea, or passing through Korean territorial waters or aerial routes, should notify the NSSC accordingly not later than seven days in advance to start operations after the loading of radioactive materials.

I.3.3 Cases of Trans-boundary Movement

In June 1998, all of the 299 spent fuel rods stored in the research reactor were sent back to the USA as soon as the decommissioning of KRR-1 and 2 was initiated (refer to J.2.3 for the sealed source).
J. Disused Sealed Sources
**ARTICLE 28. DISUSED SEALED SOURCES**

1. Each Contracting Party shall, in the framework of its national law, take the appropriate steps to ensure that the possession, remanufacturing or disposal of disused sealed sources takes place in a safe manner.

2. A Contracting Party shall allow for reentry into its territory of disused sealed sources if, in the framework of its national law, it has accepted that they be returned to a manufacturer qualified to receive and possess the disused sealed sources.

**J.1 Management System**

In October 1989, the RI waste management facility for the safe treatment and storage of RI waste was constructed in KAERI. The RI waste was collected beginning August 1990 and the RI waste management facility was operated by KAERI until the end of 1996. The responsibility for RI waste management was transferred from the Ministry of Science and Technology (at present, the NSSS) to MOTIE in 1996 according to the Atomic Energy Act (at present, the NSA) and the Electric Utility Act. Currently, KORAD is in charge of management and operation of the RI waste management facility.

RI waste management business is part of storage and treatment of radioactive waste generated from the use facilities specified in Article 9 (Radioactive Waste Management Services) of the RWMA. MOTIE is responsible for the administrative supervision of management of RI waste and the NSSC implements safety regulation.

RI waste has to be collected and delivered to the RI waste management operator by a RI user directly, or through a transport agent.
J.2 Management of Disused Sealed Sources

J.2.1 Requirements for Facilities and Handling

Disused sealed sources generated from RI users are temporarily managed by the RI users in the storage facility which passed a facility inspection in accordance with the ‘NSA’. Specifying matters on safety such as shielding, waste management, etc. in the radiation safety report is compulsory including their safety management regulations with regard to the storage capacity of the facility. Currently, the RI waste management facility being operated by KORAD is inspected by the regulatory body in accordance with the NSA.

J.2.2 Management

In accordance with Article 53 (License for the Use, etc. of Radioisotopes and Radiation Generating Devices) of the NSA, RI use facilities who wish to import from abroad and use RI should obtain a permit for use of RI from the NSSC and meet the importation provisions of the Korea Foundation of Nuclear Safety (KoFONS). The use of domestic RI requires a permit for use of RI from the NSSC.

RI users are allowed to store temporarily disused sealed sources - $^{192}$Ir for the purpose of radiography testing for five years from the date of acquisition and other RIs for the next two years after termination of their use. The disused sealed sources are temporarily stored in the container of the RI users and then delivered to the RI waste management facility of KORAD, pursuant to the NSSC Notice Regulations on Security Control of Radioactive Isotopes.

As per the NSSC Notice Regulations for Compliance of RI Sellers, it is also allowed to commission RI sellers to collect RI waste. Those who wish to commission the operator of the management facility to collect and dispose of RI waste should pay the management expenses defined in the RWMA.
KORAD takes over disused sources of decayed radioactivity from RI users under Article 4 (Radioactive Waste Delivery Procedure and Method) of the *Enforcement Decree of the RWMA*. In accordance with the Notice of MOTIE *Regulation on Radioactive Waste Receiving Method*, KORAD operates its RI waste management facility where the RI waste that has been received from RI users is safely stored and managed. The national RI waste management framework is shown in Figure J.2-1.

![RI Waste Management System](image)

**Figure J.2-1. RI Waste Management Framework**

### J.2.3 Return

Currently, the sealed sources used in Korea are mostly imported from foreign countries. Based on a sales contract between a domestic licensed RI seller and a foreign manufacturer, some of the disused sealed sources are returned to the foreign manufacturer. On the other hand, in case of the sealed sources manufactured in Korea such as $^{192}$Ir, when they are exported to foreign countries and if a foreign RI user wishes to return the disused sealed sources, they can be returned to the seller in Korea. The return of disused sealed sources requires appropriate procedures that include meeting the import requirements set forth in the NSA. The disused sealed sources from
abroad are then delivered to KORAD which was authorized as a RI waste management facility operator in accordance with the NSA.
K. Safety Improvement Activities
K. Safety Improvement Activities

K.1 Establishment of Spent Fuel Management Policy

In accordance with the resolution by the AEPC (the former AEC) on spent fuel management policy, the government launched PECOS in October 2013 to collect a comprehensive public opinion including that of stakeholders and experts, and then to develop a basic plan on spent fuel management. PECOS submitted a set of recommendations on detailed procedures and plans for safe management of spent fuel to the government in June 2015.

Based on the recommendations, the government developed the Basic Plan on Management of High level Radioactive Waste which defines methods and procedures for management of spent fuel in July 2016. The basic plan is outlined as follows: to construct a site-specific underground research laboratory, an centralized interim storage facility for spent fuel and a repository for HLW at a same site; to endeavor to secure an international joint storage and disposal facility in consideration of domestic and oversea situations; to develop core technologies timely to improve the reliability on safety; to strive to conduct spent fuel management projects transparently and objectively and secure the public acceptance through communications with local residents concerned; and to construct additional on-site storage facilities at NPP sites.

As part of measures to implement the basic plan, the government is working on to legislate a law regarding site selection process, and establishment of a committee on HLW management and the Host Community Support Committee. The government’s effort to implement the policy and safe management of HLW is based on decision-making driven by the social consensus reached following the approach recommended by the international community as well as on public trust on the long-term policy.
Figure K.1-1. Schedule for Long-term Management of SF and HLW
The regulatory body amended or legislated the Acts, subordinate statutes and technical standards regarding HLW including spent nuclear fuel. In January 2016, the NSSC Notice General Standards for Deep Geological Repository for High-level Radioactive Waste was enacted to ensure the safety of HLW disposal at all stages of the life-cycle of a deep geological disposal facility from R&D, site investigation, design, construction, operation, closure and post-closure institutional control. Taking into account the progress and conditions of development of disposal system for HLW, the aforementioned Notice presents general standards which incorporate general requirements necessary for the early stage of disposal system development (R&D, site investigation, basic design, etc.). Major provisions of the Notice are as follows:

- Standards for radiological protection for long-term safety of high level radioactive waste disposal
- Standards for development of deep geological disposal facilities
  - standards for site environment and natural barriers (siting criteria)
  - standards for engineered barriers and system design (criteria for structure, equipment and performance)
  - standards for characteristics of disposal for HLW (waste acceptance criteria)
- Standards for operation, closure and post-closure institutional control of deep geological disposal facilities
- Standard format and content of the licence application documents including safety analysis report

Regarding the centralized spent fuel interim storage facility, the NSSC Notices of Technical Standards for the Structure and Equipment of Spent Fuel Interim Storage Facilities and Guidelines for Preparation of Safety Analysis Report for Spent Fuel Interim Storage Facilities were enacted in 2016. They stipulate detailed technical requirements such as safety in handling of spent fuel, radiation shielding capability, criticality prevention, decay heat removal as well as detailed guidance on the preparation of safety analysis report. The Notices have enabled the establishment of technical standards for spent fuel interim storage facilities and laid a foundation for the implementation of the long-term management policy of spent fuel.

In addition, the NSA was amended in December 2015 to include a discharge plan for liquid and gaseous radioactive materials including total amount of radioactive material.
for each site and each nuclide group, as a licensing document for NPPs. NPP operators are required to set in advance the total amount of liquid and gaseous radioactive materials for each nuclide group per site, and keep them below the control limits during the operation of the facilities. Accordingly, it is expected that public trust regarding regulations on effluent discharge as well as effluent control itself can be further improved.

The NSSC Notice *Incineration Criteria for Low- and Intermediate-level Radioactive Wastes* enacted in 1997, stipulating the release or emission limits on exhaust gas to the atmosphere from the incinerator. However, as the emission limits of atmospheric pollutants other than radionuclides had been revised and strengthened periodically by the *Clean Air Conservation Act* and relevant regulations, the Notice was amended to delete its emission limits for non-radioactive pollutants and to apply the emission limits defined in the *Clean Air Conservation Act* and relevant regulations mutatis mutandis in April 2017.

As the LILW disposal facility passed the preoperational inspection, transportation of the LILW generated from nuclear facilities to the disposal facility has been conducted in earnest. Accordingly, a need was raised to strengthen the safety of mass transportation of LILW. Hence, in August 2016, the *Enforcement Regulations of the NSA* was amended to verify the safety of transportation through transportation notification from consignor followed by regulator's inspection when more than 1,600 liters of LILW package is to be transported.
With regard to decommissioning of nuclear facilities, amendment of the NSA was completed in 2015, and amendment of subordinate statutes and related technical standards (e.g. NSSC Notices) were completed in 2015 and 2016. The Technical Standards enacted are as follows:

- **Standard Format and Content of Decommissioning Plan for Nuclear Facilities**
- **Regulation on Verification and Inspection for Decommissioning Status of Nuclear Facilities**
- **Reuse Criteria for Site and Remaining Structures after Completion of Decommissioning of Nuclear Facilities**

The above technical standards stipulate items to be described in detail in the decommissioning plan; methods for verification and inspection of decommissioning progress to be reported biannually by the operator; and radiological criteria for reuse of the site and structures after completion of decommissioning (unrestricted reuse when less than 0.1 mSv/y, restricted reuse when less than 0.1 mSv/y under ALARA conditions and less than 1 mSv/y when the control fails).

The NSA and subordinate statutes were amended with reference to the IAEA Safety Standards GSR Part 6 (Decommissioning of Facilities) to include the following: mandatory submission of a decommissioning plan for a nuclear facility from the stage of construction permit and operation license; periodic revision of the decommissioning plan; securement of decommissioning fund and development of decommissioning strategy; securement of facilitation of decommissioning, list of documents for application submission; and list of documents to be submitted for reporting the completion of decommissioning.

As per the amended NSA, the operators of existing nuclear facilities (NPP, research and training reactor, nuclear fuel cycle facility) should submit a preliminary decommissioning plan within three years (by January 2018) after the amended NSA went into effect.

The operators who applied for construction permits of Shin-Kori Units 5 and 6 and Gijang research reactor, and the licensee who applied for permit of nuclear fuel fabrication, at the time when the NSA was amended, submitted a preliminary decommissioning plan, respectively in 2016. KINS conducted a review of the preliminary decommissioning plans to verify whether the descriptions of the plans satisfy the
requirements specified in the NSA and related Notices.

As per the amended NSA, the operator of Kori Unit 1 which was permanently shutdown in June 2017 should prepare and submit an application for decommissioning with a final decommissioning plan to the NSSC within five years from the date of permanent shutdown.
K.4 Improvement of safety in operation stage of LILW disposal facility

K.4.1 Safety assurance in consideration of changes in external environment

After an earthquake with a magnitude of 5.8 occurred in Gyeongju area on September 12, 2016, public concerns over the safety of nuclear facilities have grown significantly. Especially because both NPPs and the LILW disposal facility are located in Gyeongju, there has been a rising need for re-evaluation of the operational safety of those facilities against earthquakes.

The disposal units (e.g. silos), which are critical parts of the operating 1st phase LILW disposal facility, are the structures whose functional integrity should be maintained when a design basis earthquake occurs. It has been constructed in accordance with Seismic Category I requirements. The seismic monitoring system of the facility is also a Seismic Category I system which is required to remain functional in the event of a design basis earthquake. The adequacy of installation and performance of those systems have been demonstrated by the pre-operational inspection conducted during the period of construction. Even though they were in stable operating conditions, the regulatory body conducted a focused inspection on seismic monitoring system and non-radioactive drainage system in tunnels and silo areas during the periodic inspection for the disposal facility from September to October 2016. The two items of focused inspection were selected from the aspects of in-depth review of proper performance of seismic monitoring system as well as reassessment of the performance of drainage system which is designed to withstand an increased groundwater inflow following localized heavy rain. In addition to the above-mentioned items, 27 items including the structural integrity of silos were reviewed and inspected. Thus, it was confirmed that the disposal facility’s function to isolate radioactive waste remains intact.

As part of safety improvement of the disposal facility against large scale earthquakes, KORAD, the operator of the disposal facility has developed and implemented a plan to conduct the re-evaluation of seismic performance of the operating 1st phase cavern disposal facility and to improve the seismic performance of the disposal vault of the 2nd phase disposal facility which is currently under regulatory review for the CP/OL.

K.4.2 Periodic update of safety assessments

KORAD is scheduled to conduct the periodic safety reassessment of the 1st phase
disposal facility to ensure again the safety of the facility in operation. In the SAR which is one of the licensing documents for the 1st phase disposal facility, the operator has presented its plan to conduct the re-assessment of safety of the facility every 10 year after the date of commencement of business, etc. Hence, the re-assessment will be performed after having detailed discussions on its scope, contents and etc.

This above re-assessment is compatible with the requirements that the operator should reassess the conditions for the safety of the disposal facility regularly and revised if needed as stipulated in the NSSC Notice Technical Standards for the Operation, Etc. of Low- and Intermediate-Level Radioactive Waste Disposal Facilities, rather than the re-assessment of safety to be performed when an event which may affect the facility’s function to isolate radioactive waste occurs due to natural disaster such as earthquake or flooding as stipulated in the same Notice.

For this, the regulatory body is working on to develop a regulatory guide for PSR suitable for the characteristics of the 1st phase disposal facility. To this end, the regulatory body is analyzing the regulatory requirements and practical cases of PSR in experienced foreign countries, and developing detailed items for review including radiological and non-radiological impacts.
The government has established an information disclosure system which mandates government organizations to disclose information that they possess and manage at the request of the public or under their duty to disclose information in accordance with the *Official Information Disclosure Act*. It intends to guarantee the people’s right to know and to ensure the public participation in national policy making and the transparency of the policy execution.

Furthermore, with the growing public interest in nuclear and radiation safety, the NSSC amended the NSA in June 2015 to add ‘Duty to Disclose Information’. Based on which, the NSSC has established and run the NSIC to disclose information in a transparent and prompt manner and to conduct active communication with the public. As shown in Figure K.5-1, the NSIC discloses Acts and subordinate statutes, procedures, standards related to nuclear and radiation safety management and the status and outcome of safety management transparently and promptly. In addition, the NSIC provides information regarding real-time environmental radioactivity, performance indicators for NPPs, the status of accidents and failures at NPPs if any, and activities of the NSSC (http://nsic.nssc.go.kr/main.do).

Figure K.5-1. Role and Function of the Nuclear Safety Information Center
As local residents around nuclear facilities make more demands on the secured safety of the nuclear facilities and the provision of safety information, the NSSC has established the Nuclear Safety Consultative Council (NSCC) at each NPP site and in Daejeon which is composed of local residents, experts recommended by the local residents, local governments, the NSSC and KINS. For important safety issues, the NSSC convenes the NSCC meetings to deliver relevant information to local residents and to collect opinions, thereby improving the transparency of information disclosure.

To promote information disclosure, KINS has been operating the WACID to deliver reliable information on radioactive waste safety promptly to the public including stakeholders since May 2004. The WACID system provides on a quarterly basis information regarding the amount of LILW stored, the status of spent fuel, transportation of radioactive waste, and the radioactive discharges. In addition, the WACID system provides advance notice on transportation plan of radioactive waste, and detailed information on radioactive waste, the amount of radioactive effluents, and transportation of spent fuel and radioactive waste to support the public understanding (http://wacid.kins.re.kr).

In addition, KINS has run a Q&A service on its website, and contributed to enhance the transparency of safety regulations by providing answers to various questions on safety management of radioactive waste and spent fuel. The KHNP, KEPCO NF, KORAD, and KAERI also run their own websites to improve the transparency of safety management of radioactive waste and spent fuel. The addresses of their websites are as follows:

- Korea Institute of Nuclear Safety : www.kins.re.kr
- Korea Radioactive Waste Agency : www.korad.or.kr
- Korea Hydro & Nuclear Power Co., Ltd. : www.khnp.co.kr
- KEPCO Nuclear Fuel Co., Ltd. : www.knf.co.kr
- Korea Atomic Energy Research Institute : www.kaeri.re.kr
- INTENTIONAL BLANK -
List of Spent Fuel Management Facilities  
(As of March 31, 2017)

Annex A-1. Spent Fuel Storage Facilities at NPPs

<table>
<thead>
<tr>
<th>Plant</th>
<th>Location</th>
<th>Storage Type</th>
<th>Inventory (MTU)</th>
<th>Total Capacity(*) (MTU)</th>
<th>Reactor Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kori Unit 1</td>
<td>Gijang-gun, Busan</td>
<td>Wet</td>
<td>125.4</td>
<td>164</td>
<td>PWR</td>
</tr>
<tr>
<td>Kori Unit 2</td>
<td></td>
<td></td>
<td>281.5</td>
<td>313</td>
<td>PWR</td>
</tr>
<tr>
<td>Kori Unit 3</td>
<td></td>
<td></td>
<td>797.8</td>
<td>919</td>
<td>PWR</td>
</tr>
<tr>
<td>Kori Unit 4</td>
<td></td>
<td></td>
<td>804.7</td>
<td>920</td>
<td>PWR</td>
</tr>
<tr>
<td>Shin-Kori Unit 1</td>
<td></td>
<td></td>
<td>190.2</td>
<td>532</td>
<td>PWR</td>
</tr>
<tr>
<td>Shin-Kori Unit 2</td>
<td></td>
<td></td>
<td>181.0</td>
<td>532</td>
<td>PWR</td>
</tr>
<tr>
<td>Shin-Kori Unit 3</td>
<td>Ulju-gun, Ulsan</td>
<td>Wet</td>
<td>0.0</td>
<td>326</td>
<td>PWR</td>
</tr>
<tr>
<td>Hanbit Unit 1</td>
<td>Yonggwang-gun</td>
<td>Wet</td>
<td>701.6</td>
<td>920</td>
<td>PWR</td>
</tr>
<tr>
<td>Hanbit Unit 2</td>
<td>Jeollanam-do</td>
<td></td>
<td>470.7</td>
<td>918</td>
<td>PWR</td>
</tr>
<tr>
<td>Hanbit Unit 3</td>
<td></td>
<td></td>
<td>401.6</td>
<td>470</td>
<td>PWR</td>
</tr>
<tr>
<td>Hanbit Unit 4</td>
<td></td>
<td></td>
<td>386.9</td>
<td>470</td>
<td>PWR</td>
</tr>
<tr>
<td>Hanbit Unit 5</td>
<td></td>
<td></td>
<td>263.2</td>
<td>535</td>
<td>PWR</td>
</tr>
<tr>
<td>Hanbit Unit 6</td>
<td></td>
<td></td>
<td>263.9</td>
<td>535</td>
<td>PWR</td>
</tr>
<tr>
<td>Hanul Unit 1</td>
<td>Ulchin-gun, Gyeongsangbuk-do</td>
<td>Wet</td>
<td>410.4</td>
<td>418</td>
<td>PWR</td>
</tr>
<tr>
<td>Hanul Unit 2</td>
<td></td>
<td></td>
<td>384.4</td>
<td>395</td>
<td>PWR</td>
</tr>
<tr>
<td>Hanul Unit 3</td>
<td></td>
<td></td>
<td>469.2</td>
<td>552</td>
<td>PWR</td>
</tr>
<tr>
<td>Hanul Unit 4</td>
<td></td>
<td></td>
<td>467.0</td>
<td>552</td>
<td>PWR</td>
</tr>
<tr>
<td>Hanul Unit 5</td>
<td></td>
<td></td>
<td>238.9</td>
<td>535</td>
<td>PWR</td>
</tr>
<tr>
<td>Hanul Unit 6</td>
<td></td>
<td></td>
<td>214.3</td>
<td>535</td>
<td>PWR</td>
</tr>
<tr>
<td>Plant and Unit</td>
<td>Location</td>
<td>Wet Capacity</td>
<td>Emergency Cores</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>--------------</td>
<td>--------------</td>
<td>-----------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wolsong Unit 1</td>
<td>Gyeongju, Gyeongsangbuk-do</td>
<td>542.3</td>
<td>801</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wolsong Unit 2</td>
<td></td>
<td>599.0</td>
<td>801</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wolsong Unit 3</td>
<td></td>
<td>661.7</td>
<td>801</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wolsong Unit 4</td>
<td></td>
<td>687.6</td>
<td>801</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shin-Wolsong Unit 1</td>
<td></td>
<td>80.3</td>
<td>219</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shin-Wolsong Unit 2</td>
<td></td>
<td>25.4</td>
<td>219</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wolsong Dry Storage</td>
<td></td>
<td>5,590.8</td>
<td>6,237</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* : except for emergency cores
## Annex A-2. Spent Fuel Storage Facilities at Research Facilities

<table>
<thead>
<tr>
<th>Facility</th>
<th>Location</th>
<th>Storage Type</th>
<th>Fuel Type</th>
<th>Total Capacity (MTU)</th>
<th>Inventory (MTU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HANARO spent fuel storage pool</td>
<td>Yuseong-gu, Daejeon</td>
<td>Wet</td>
<td>HANARO 36 element fuel assembly</td>
<td>1.3</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>HANARO 18 element fuel assembly</td>
<td>0.6</td>
<td>0.2</td>
</tr>
<tr>
<td>PIEF spent fuel storage pool</td>
<td>Yuseong-gu, Daejeon</td>
<td>Wet</td>
<td>PWR spent fuel assembly &amp; fuel rod</td>
<td>11.3</td>
<td>3.3</td>
</tr>
</tbody>
</table>
### Annex B

#### List of Radioactive Waste Management Facilities (As of March 31, 2017)

Annex. B-1 LILW Storage facilities at NPPs

<table>
<thead>
<tr>
<th>Facility</th>
<th>Location</th>
<th>Purpose</th>
<th>Operation Year</th>
<th>Capacity [200 Liter Drum]</th>
<th>Inventory [200 Liter Drum]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kori storage building No. 1</td>
<td>Gijang-gun, Busan</td>
<td>Temporary storage of radioactive wastes generated from Kori Units 1 to 4</td>
<td>1978</td>
<td>10,000</td>
<td>9,431</td>
</tr>
<tr>
<td>Kori storage building No. 2</td>
<td></td>
<td></td>
<td>1979</td>
<td>6,000</td>
<td>5,599</td>
</tr>
<tr>
<td>Kori storage building No. 3</td>
<td></td>
<td></td>
<td>1987</td>
<td>11,200</td>
<td>9,964</td>
</tr>
<tr>
<td>Kori storage building No. 4</td>
<td></td>
<td></td>
<td>1993</td>
<td>23,000</td>
<td>15,360</td>
</tr>
<tr>
<td>Shin-Kori storage building No. 1</td>
<td></td>
<td>Temporary storage of radioactive wastes generated from Shin-Kori Units 1 &amp; 2</td>
<td>2011</td>
<td>10,000</td>
<td>2,244</td>
</tr>
<tr>
<td>RCA and other facilities</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>1,482(^2)</td>
</tr>
<tr>
<td>Kori Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>44,080</td>
</tr>
<tr>
<td>Wolsong storage building No. 1</td>
<td>Gyeongju, Gyeongsan gbuk-do</td>
<td>Temporary storage of radioactive wastes generated from Wolsong Units 1 to 4</td>
<td>1983</td>
<td>9,000</td>
<td>9,933(^3)</td>
</tr>
<tr>
<td>Shin-Wolsong storage building</td>
<td></td>
<td>Temporary storage of radioactive wastes generated from Shin-Wolsong Units 1 &amp; 2</td>
<td>2015</td>
<td>10,000</td>
<td>236</td>
</tr>
<tr>
<td>RCA and other facilities</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>170</td>
</tr>
<tr>
<td>Wolsong Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10,339</td>
</tr>
</tbody>
</table>

\(^2\) Including 23 drums stored in the controlled area of Shin-Kori Unit 3 at Saeul site

\(^3\) Including spent resin stored in controlled area.
<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
<th>Year</th>
<th>Amount</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hanbit storage building No. 1</td>
<td>Temporary storage of radioactive wastes generated from Hanbit Units 1 &amp; 2</td>
<td>1986</td>
<td>13,300</td>
<td>10,909</td>
</tr>
<tr>
<td>Hanbit storage building No. 2</td>
<td>Temporary storage of radioactive wastes generated from Hanbit Units 1 to 6</td>
<td>2002</td>
<td>10,000</td>
<td>7,465</td>
</tr>
<tr>
<td>RCA and other facilities</td>
<td></td>
<td></td>
<td></td>
<td>2,389</td>
</tr>
<tr>
<td>Hanbit Total</td>
<td></td>
<td></td>
<td></td>
<td>20,763</td>
</tr>
<tr>
<td>Hanul storage building No. 1</td>
<td>Temporary storage of radioactive wastes generated from Hanul Units 1 &amp; 2</td>
<td>1989</td>
<td>7,400</td>
<td>5,732</td>
</tr>
<tr>
<td>Hanul storage building No. 2</td>
<td>Temporary storage of radioactive wastes generated from Hanul Units 1 to 6</td>
<td>1997</td>
<td>10,000</td>
<td>6,145</td>
</tr>
<tr>
<td>RCA and other facilities</td>
<td></td>
<td></td>
<td></td>
<td>4,365</td>
</tr>
<tr>
<td>Hanul Total</td>
<td></td>
<td></td>
<td></td>
<td>16,242</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>91,424</td>
</tr>
</tbody>
</table>
Annex B-2. Radioactive Waste Treatment Facilities at NPPs

<table>
<thead>
<tr>
<th>Reactor Type</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWR</td>
<td>Treatment by gas decay tank or charcoal delay bed for effluent processing</td>
</tr>
<tr>
<td>PHWR</td>
<td>Treatment by charcoal delay bed for effluent processing</td>
</tr>
</tbody>
</table>

* Radioactive effluent from buildings is treated through HEPA and/or charcoal filter


<table>
<thead>
<tr>
<th>Facility</th>
<th>Location</th>
<th>Purpose</th>
<th>Organization</th>
<th>Capacity [200L drum]</th>
<th>Inventory [200L drum]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radioactive waste storage building</td>
<td>Yuseong-gu, Daejeon,</td>
<td>Temporary storage of radioactive wastes generated from research facility</td>
<td>KAERI</td>
<td>33,638</td>
<td>21,146</td>
</tr>
<tr>
<td>KRR-2 temporary storage</td>
<td>Gongneung-dong, Seoul</td>
<td>Temporary storage of decommissioning waste from research reactor 1 &amp; 2</td>
<td>KAERI</td>
<td>-</td>
<td>482</td>
</tr>
</tbody>
</table>
### Annex B-4. Radioactive Waste Treatment Facility at Research Facilities

<table>
<thead>
<tr>
<th>Facility</th>
<th>Location</th>
<th>Purpose</th>
<th>Organization</th>
<th>Operation Year</th>
<th>Facility Feature</th>
<th>Process</th>
<th>Throughput</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radioactive waste treatment facility (RWTF)</td>
<td>Yuseong-gu, Daejeon</td>
<td>Treatment of radioactive waste generated from research facilities</td>
<td>KAERI</td>
<td>1991</td>
<td></td>
<td>Bituminization</td>
<td>0.03 m³/h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Evaporation &amp; Enrichment</td>
<td>1 m³/h</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Compaction</td>
<td>60 ton</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Solar evaporation</td>
<td>0.6 m³/h</td>
<td></td>
</tr>
</tbody>
</table>

### Annex B-5. Combustible Waste Treatment Facility

<table>
<thead>
<tr>
<th>Facility</th>
<th>Location</th>
<th>Purpose</th>
<th>Organization</th>
<th>Operation Year</th>
<th>Treatment Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combustible waste treatment facility</td>
<td>Yuseong-gu, Daejeon</td>
<td>Incineration of Combustible waste generated from the KAERI</td>
<td>KAERI</td>
<td>2011</td>
<td>20 kg/h</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Facility</th>
<th>Location</th>
<th>Purpose</th>
<th>Organization</th>
<th>Operation Year</th>
<th>Capacity [200L drum]</th>
<th>Inventory [200L drum]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd floor of storage building No. 1</td>
<td>Yuseong-gu, Daejeon</td>
<td>Storage of radioactive waste generated in nuclear fuel fabrication facilities</td>
<td>KEPCO NF</td>
<td>1993</td>
<td>3,000</td>
<td>4,350</td>
</tr>
<tr>
<td>1st floor of storage building No. 1</td>
<td></td>
<td></td>
<td></td>
<td>2004</td>
<td>1,900</td>
<td></td>
</tr>
<tr>
<td>Storage building No. 2</td>
<td></td>
<td></td>
<td></td>
<td>1998</td>
<td>4,000</td>
<td>3,901</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8,251</td>
</tr>
</tbody>
</table>

- 199 -
Annex B-7. Radioactive Waste Treatment Systems at KEPCO NF

<table>
<thead>
<tr>
<th>Facility</th>
<th>Location</th>
<th>Purpose</th>
<th>Organization</th>
<th>Operation Year</th>
<th>Throughput</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWR liquid waste treatment system in Plant 1</td>
<td>Yuseong-gu, Daejeon</td>
<td>Liquid waste treatment</td>
<td>KEPCO NF</td>
<td>2015</td>
<td>18 m³/d</td>
<td>Reduced Pressure Evaporation &amp; Centrifuge</td>
</tr>
<tr>
<td>PWR liquid waste treatment system in Plant 2</td>
<td></td>
<td></td>
<td></td>
<td>2013</td>
<td></td>
<td>UltraFiltration</td>
</tr>
<tr>
<td>PHWR liquid waste treatment system in Plant 2</td>
<td></td>
<td>Solid waste treatment</td>
<td></td>
<td>1988</td>
<td></td>
<td>Shredding &amp; compaction</td>
</tr>
<tr>
<td>Solid waste treatment system in Plant 1</td>
<td></td>
<td>Solid waste treatment</td>
<td></td>
<td>1998</td>
<td></td>
<td>Cutting &amp; compaction</td>
</tr>
<tr>
<td>Solid waste treatment system in Plant 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Annex B-8. RI Waste Management Facilities

<table>
<thead>
<tr>
<th>Facility</th>
<th>Location</th>
<th>Purpose</th>
<th>Organization</th>
<th>Operation Year</th>
<th>Capacity [200L drum]</th>
<th>Inventory [200L drum]</th>
</tr>
</thead>
<tbody>
<tr>
<td>RI waste management facility</td>
<td>Daejeon</td>
<td>RI waste temporary storage</td>
<td>KORAD</td>
<td>1993</td>
<td>9,750</td>
<td>1,569.8</td>
</tr>
<tr>
<td>Radwaste Receipt/Storage Building of LILW Disposal Center</td>
<td>Gyeongju</td>
<td></td>
<td>KORAD</td>
<td>2014</td>
<td>-</td>
<td>34.51</td>
</tr>
</tbody>
</table>

### Annex B-9. LILW Disposal Facilities

<table>
<thead>
<tr>
<th>Facility</th>
<th>Location</th>
<th>Purpose</th>
<th>Organization</th>
<th>Operation Year</th>
<th>Capacity [200L Drum]</th>
<th>Inventory [200L Drum]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radwaste Receipt/Storage Building of LILW Disposal Center</td>
<td>Gyeongju, Gyeongsangbuk-do</td>
<td>Radioactive waste receipt / storage</td>
<td>KORAD</td>
<td>2010</td>
<td>7,000</td>
<td>6,848</td>
</tr>
<tr>
<td>Silo</td>
<td></td>
<td>Radioactive waste disposal</td>
<td>KORAD</td>
<td>2015</td>
<td>100,000</td>
<td>6,920</td>
</tr>
</tbody>
</table>
## Annex C

### List of Nuclear Facilities under Decommissioning (As of June 30, 2017)

<table>
<thead>
<tr>
<th>Facility</th>
<th>Location</th>
<th>License</th>
<th>Specification</th>
<th>Year</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KRR-1</td>
<td>Gongneung-dong, Seoul</td>
<td>KAERI</td>
<td>TRIGA Mark-Ⅱ (250 kWth)</td>
<td>1962</td>
<td>1995</td>
</tr>
<tr>
<td>KRR-2</td>
<td></td>
<td>KAERI</td>
<td>TRIGA Mark-Ⅲ (2 MWth)</td>
<td>1972</td>
<td>1995</td>
</tr>
<tr>
<td>Kori Unit 1</td>
<td>Gijang-gun, Busan</td>
<td>KHNP</td>
<td>PWR (587MWe)</td>
<td>1978</td>
<td>2017</td>
</tr>
</tbody>
</table>
Radioactive Waste

Regulations for the Packaging and Transport of Radioactive Materials, etc. (No. 2014-50)
The regulation purposes to establish requirements and technical details needed for ensuring packaging and transport safety of radioactive materials as stipulated in the Enforcement Decree of the NSA.

The criteria specify the minimum technical criteria on site conditions of near-surface disposal facilities for the LILW with the provision of the Enforcement Decree of the NSA.

Siting Criteria for Interim Storage Facilities of Spent Fuel (No. 2014-52)
The regulation aims to specify the minimum technical criteria on site conditions of the interim storage facility for spent fuel with the provision of the Enforcement Decree of the NSA.

The criteria stipulate the minimal requirements on structure and equipment that must be considered in relation to the construction and installation of the LILW Disposal Facilities.

Acceptance Criteria for Low-and Intermediate-level Radioactive Waste (No. 2015-04)
The criteria purpose to define delivery methods, plan and procedures and other necessary details needed upon consignment of the delivery of disposal of the LILW to operator as well as specific guideline of waste acceptance which should satisfy at the time of disposal of waste.

The criteria purpose to define the necessary details on QAPs for the LILW disposal facilities and spent fuel interim storage facilities. The criteria apply to the site characterization, design, operation, closure and institutional control of the LILW disposal facilities, and site characterization, design, construction and operation for spent fuel interim storage facilities, respectively.
The criteria purpose to define the necessary details for preventing radiological risks to human health or the environment in relation to the disposal facilities of the LILW and to establish performance objectives to secure the long-term safety in the case of the permanent disposal of radioactive waste. The performance objectives will indicate that after the closure of a disposal facility, risks caused by radioactive waste disposal which should be within the acceptable level both in the present generation and in future generations, and it will also be applied to review and evaluation of radiological safety.

The regulation defines the matters regarding site characterization report for the LILW disposal facilities. This regulation will be applied to near-surface disposal and rock-cavity disposal for the LILW in the regions of land, seashore, or islands. As these regulations include only minimal technological matters pertaining to each disposal form or method, technological details might be added or excluded in part.

Acceptance Criteria for Spent Fuel (No. 2014-59)
The criteria aim to provide the general requirements for delivering spent fuel as generated from the NPPs to operator of the Away From Reactor(AFR) spent fuel interim storage facility. This criteria purpose to define delivery methods, plan and procedures and other necessary details needed upon consignment of the delivery of spent fuel to operator of the AFR spent fuel interim storage facility.

The regulation purposes to define clearance level for deregulation of very low level radioactive waste and procedures, methods, and other necessary details for deregulation application of very low level radioactive waste below the clearance level in the Enforcement Decree of the NSA.

Incineration Criteria for Low- and Intermediate-level Radioactive Wastes (No. 2017-06)
This criteria purpose is to provide technical details for incinerator facilities of the LILW in order to secure the operational safety at the time of incineration treatment of radioactive waste.

The regulation purposes to provide technical details for inspection of manufacture/use of radioactive material transport containers, especially standards in respect of the items,
methods for inspection by type of transport containers.

The criteria stipulate the detailed technical requirements on structure and equipment that must be considered in relation to the design and operation of various treatment facilities of the LILW.

The regulation purposes to manage disposal facilities safely, prevent disasters due to disposal facilities, and protect the environment by defining detailed technical standards regarding the management of disposal facilities for the LILW. This regulation will be applied to the management, closure, and institutional control of disposal facilities of the LILW and their safety assessment on normal and abnormal events which are likely occurred during the operation, closure, and institutional control of disposal facilities.

This guide purposes to define the matters related to the composition of the safety analysis report for the LILW disposal facilities. This guide will be applied to the safety evaluation and accident analysis for the design, construction, and management of the disposal facilities for the LILW and of their accompanying facilities, and for problems anticipated during the institutional control period.

The Regulation aims to establish requirements needed to inspect the disposal of the LILW at waste disposal facilities. Operators who wish to undergo disposal inspection must submit inspection application form for each batch of waste to the NSSC up to one month before in which disposal is to be implemented.

The regulation purposes to provide technical details for radiation safety management of the LILW transport ships.

**Technical Standards for the Structure and Equipment of Interim Storage Facilities of Spent Fuel (No. 2015-19)**
The regulation purposes to provide technical details for the structure and equipment of interim storage facilities of spent nuclear fuel.
Guidelines for Preparation of Safety Analysis Report for Interim Storage Facilities of Spent Fuel (No. 2016-24)
This guide purposes to define the matters related to the preparation of safety analysis report for interim storage facilities of spent nuclear fuel. This guideline describes comprehensive items in order to accommodate diverse designs and storage methods of spent nuclear fuel at the interim storage facilities.

This general standard stipulates general technical requirements for the safety of deep geological repository for high-level radioactive waste for every phase including basic research, site survey, design, construction, operation, shutdown and post-shutdown management.

■ Radiation

Standards for Radiation Protection, Etc. (No. 2016-16)
The purpose of the standards lies in establishing standards related to radiation protection according to the regulations for radiation protection in the NSA. Especially included is classification of radioactive waste, definition of effluent control limits, and radiological design limits to prevent human and environments from radiation hazards, which applies to the design of the radioactive waste management facilities.

■ Reactor facilities

Standard Format and Content of Radiation Environmental Report for Nuclear Facilities (No. 2016-04)
The regulation purposes to describe the necessary matters regarding items of report, its preparation method and others related to the composition of the radiological environmental report for assessment of the radiological impacts that may occur in the environment due to construction and operation of the nuclear facilities as well as of the draft radiological environmental report for public consultation/hearing of residents nearby. This regulation will be applied to the draft radiological environmental report for the NPPs, the LILW disposal facility and spent fuel interim storage facility, and to the radiological environmental report for research reactor with 100kW thermal, and other waste management facilities and Etc.

The regulation purposes to describe the necessary details regarding the implementation
of a survey of radiation environment and assessment of the radiological impacts on the surrounding environment of nuclear facilities which should be carried out by their installers and/or operators.


The regulation purposes to describe the necessary details regarding reporting items, their procedures and impacts assessment on events and accidents of reactor facilities. Especially this regulation will be applied for items of events and/or accidents which should be reported to the NSSC and release the related information to the general public during operation of nuclear facilities.

**Standard Format and Content of Discharge Plan for Liquid and Gaseous Radioactive Materials for Nuclear Power Plants (No. 2017-04)**

This regulation purposes to describe standard format and content of discharge plan for liquid and gaseous radioactive materials from nuclear power plants.

**Standard Format and Content of Decommissioning Plan for Nuclear Facilities (No. 2015-08)**

This regulation purposes to describe standard format and content of decommissioning plan for nuclear facilities. This regulation will be applied to nuclear power plants and research reactors and nuclear fuel cycle facilities.


This regulation purposes to describe the confirmation and check-up means for decommissioning status of nuclear facilities. This regulation will be applied to nuclear power plants and research reactors and nuclear fuel cycle facilities.

**Reuse Criteria for Site and Remaining Structures after Completion of Decommissioning of Nuclear Facilities (No. 2016-33)**

This regulation purposes to describe the release criteria of site and remaining building after completion of decommissioning of nuclear facilities. This regulation will be applied to nuclear power plants and research reactors and nuclear fuel cycle facilities.
Regulation on the Calculation Standard for Radioactive Waste Management Expenses and Spent Fuel Management Fee (No. 2015-132)
The regulation purposes to describe the necessary details regarding cost of radioactive waste management expense, the spent fuel management fee, and the liability for NPP decommissioning expenses.

Regulation on the Utilization and Management of Radioactive Waste Management Fund (No. 2013-127)
The regulation purposes to describe the necessary details regarding utilization and management of the radioactive waste management fund.

Regulation on Radioactive Waste Receiving Method (No. 2016-230)
The regulation purposes to describe the necessary details regarding receiving method and procedure required by radioactive waste management operators in receiving the LILW and RI waste generated from nuclear facilities.

Notice on Establishment and Support for Public Engagement Commission on Spent Fuel Management (No. 2014-261)
The notice purposes to describe matters necessary to establish and support the Public Engagement Commission on Spent Nuclear Fuel Management so as to carry out public engagement activities with regard to spent fuel management plans in an objective and neutral manner.
Working-Level Editor prepared this National Report.

The organizations which participated in preparing this National Report are as follows;

<table>
<thead>
<tr>
<th>Organization</th>
<th>Address</th>
<th>Phone Number</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Korea Institute of Nuclear Safety</td>
<td>62, Gwahak-ro, Yuseong-gu, Daejeon, 34142, Republic of Korea</td>
<td>+82-(0)42-868-0584</td>
<td><a href="http://www.kins.re.kr/">http://www.kins.re.kr/</a></td>
</tr>
<tr>
<td>Korea Atomic Energy Research Institute</td>
<td>111, 989th St., Daedeokdae-ro, Yuseong-gu, Daejeon, 34057, Republic of Korea</td>
<td>+82-(0)42-868-8022</td>
<td><a href="http://www.kaeri.re.kr/">http://www.kaeri.re.kr/</a></td>
</tr>
<tr>
<td>Korea Hydro &amp; Nuclear Power Co., Ltd</td>
<td>1655, Bulgu-ro, Gyeongju-si, Gyeongsangbuk-do, 38120, Republic of Korea</td>
<td>+82-(0)54-704-3270</td>
<td><a href="http://www.khnp.co.kr/">http://www.khnp.co.kr/</a></td>
</tr>
<tr>
<td>KEPCO Nuclear Fuel</td>
<td>242, 989th St., Daedeokdae-ro, Yuseong-gu, 34057, Republic of Korea</td>
<td>+82-(0)42-868-1612</td>
<td><a href="http://www.knfc.co.kr/">http://www.knfc.co.kr/</a></td>
</tr>
</tbody>
</table>

### National Report Preparation Lists

<table>
<thead>
<tr>
<th>Company</th>
<th>Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSSC</td>
<td>UHM, Jae-Sik, KANG, Ho-Sung, CHOI, Su-Jin, LEE, Sang-Hwa, HUH, Sung-Soo</td>
</tr>
<tr>
<td>KINS</td>
<td>CHON, Je-Keun, AHN, Sang-Myeon, LEE, Youn-Keun, KANG, Gyeong-Uk, SEO, Bo-Kyun, LEE, Jung-Joon, LEE, Kwan-Hee, PARK, Jin-Yong, LEE, Ho-Jin, YOOK, Dae-Sik, KIM, Sung-Il, SEO Eun-Jin, LEE, Bok-Hyoung, KO, Ho-Jung, BANG, Je-Heon, JUNG, Ji-Yoon, LEE, Jeong-Ken</td>
</tr>
<tr>
<td>KORAD</td>
<td>KANG, Ki-Sung, PARK, Jin-Baek, YOO, Ou-Jeong</td>
</tr>
<tr>
<td>KAERI</td>
<td>CHOI, Jong-Won, HONG, Dae-Seok</td>
</tr>
<tr>
<td>KHNP Co. Ltd</td>
<td>SHIN, Hyun-Keun, YEOM, Jun-Gi</td>
</tr>
<tr>
<td>KEPCO NF</td>
<td>JU, Young-Jong, KANG, Hyun-Gyu</td>
</tr>
</tbody>
</table>