

## Appendix 12A. Tables

Table 12-1. Design Radiation Zones

| Zone                                                       | Dose Rate Limit <sup>1</sup><br>(mem/hr) | Occupancy    | Examples                   |
|------------------------------------------------------------|------------------------------------------|--------------|----------------------------|
| I                                                          | .05                                      | Continuous   | 1. Offsite areas           |
| II                                                         | 0.5                                      | Continuous   | 1. Control Room            |
|                                                            |                                          |              | 2. Yard                    |
|                                                            |                                          |              | 3. Service Building        |
|                                                            |                                          |              | 4. Turbine Building        |
| III                                                        | 1.0                                      | Extended     | 1. Cable Room              |
|                                                            |                                          |              | 2. Battery Room            |
|                                                            |                                          |              | 3. Electrical Penetrations |
| IV                                                         | 2.5                                      | Periodic     | 1. Aux. Building Corridors |
|                                                            |                                          |              | 2. Spent Fuel Pool Surface |
| V                                                          | 15.                                      | Intermittent | 1. Incore Instrument Room  |
|                                                            |                                          |              | 2. Pipe Tunnel Cover       |
| VI                                                         | >15.                                     | Infrequent   | 1. Demineralizer Rooms     |
|                                                            |                                          |              | 2. Filter rooms            |
| <b>Note:</b><br>1. For anticipated operational occurrences |                                          |              |                            |

Table 12-2. Minimum Shield Thicknesses

| Component                        | Location (Typical)<br>Elevation/Columns |       | Source                 |        |                              | Shield (ft)<br>(Note 10) |
|----------------------------------|-----------------------------------------|-------|------------------------|--------|------------------------------|--------------------------|
|                                  |                                         |       | Dimension<br>(Note 11) |        | Table/Flag                   |                          |
|                                  |                                         |       | R(in.)                 | H(in.) |                              |                          |
| Reactor Coolant System           |                                         |       |                        |        |                              |                          |
| Vessel                           | 716                                     | FF-49 | 86.5                   | 488    | (Note 1)                     | 6.0                      |
| Pump                             | 733                                     | GG-47 | 72                     | 72     | <a href="#">12-6</a> , SA,SB | 3.0                      |
| Steam Generator                  | 750                                     | EE-47 | 56.3                   | 180    | <a href="#">12-6</a> , SA,SB | 3.0 (Note 2)             |
| Pressurizer                      | 767                                     | DD-49 | 40                     | 610    | <a href="#">12-6</a> , SC,SB | 3.0 (Note 2)             |
| Pressurizer Relief Tank          | 733                                     | EE-49 | 60                     | 222    | <a href="#">12-6</a> , SC    | 3.0                      |
| Safety Injection System Pump     | 716                                     | HH-54 | 18                     | 12     | (Note 3)                     | 2.0                      |
| Residual Heat Removal System     |                                         |       |                        |        |                              |                          |
| Pump                             | 695                                     | GG-54 | 17.4                   | 12     | <a href="#">12-6</a> , SK    | 3.0                      |
| Heat Exchanger                   | 750                                     | LL-52 | 18.4                   | 354    | <a href="#">12-6</a> , SK    | 2.5                      |
| Containment Spray System         |                                         |       |                        |        |                              |                          |
| Pump                             | 695                                     | GG-55 | 8                      | 12     | (Note 3)                     | 2.5                      |
| Heat Exchanger                   | 750                                     | LL-52 | 28                     | 485    | (Note 3)                     | 2.5                      |
| Chemical & Volume Control System |                                         |       |                        |        |                              |                          |
| Regenerative Heat Exchanger      | 733                                     | DD-50 | 5.2                    | 146    | <a href="#">12-6</a> , SA,SG | 2.5                      |
| Excess Letdown Heat Exchanger    | 733                                     | CC-50 | 4                      | 160    | <a href="#">12-6</a> , SD    | 3.0 (Note 4)             |
| Reciprocating Charging Pump      | 716                                     | JJ-54 | 20.25                  | 34     | <a href="#">12-6</a> , SG    | 2.0                      |
| Centrifugal Charging Pump        | 716                                     | JJ-55 | 9                      | 55     | <a href="#">12-6</a> , SG    | 2.0                      |

| Component                   | Location (Typical)<br>Elevation/Columns |       | Source                 |        |                           | Shield (ft)<br>(Note 10) |
|-----------------------------|-----------------------------------------|-------|------------------------|--------|---------------------------|--------------------------|
|                             |                                         |       | Dimension<br>(Note 11) |        | Table/Flag                |                          |
|                             |                                         |       | R(in.)                 | H(in.) |                           |                          |
| Boric Acid Transfer Pump    | 733                                     | NN-53 | 3.5                    | 10     | (Note 5)                  | 3.0                      |
| Letdown Heat Exchanger      | 750                                     | KK-53 | 11                     | 215.5  | <a href="#">12-6</a> , SD | 2.5                      |
| Seal Water Heat Exchanger   | 733                                     | GG-54 | 7                      | 165.5  | <a href="#">12-6</a> , SG | 2.0                      |
| Volume Control Tank         | 733                                     | KK-50 | 45                     | 108.6  | <a href="#">12-6</a> , SF | 3.0                      |
| Boric Acid Tank             | 733                                     | PP-52 | 192                    | 104    | (Note 5)                  | 3.0                      |
| Mixed Bed Demineralizer     | 733                                     | LL-53 | 16.25                  | 42     | <a href="#">12-7</a>      | 4.0                      |
| Cation Bed Demineralizer    | 733                                     | MM-53 | 13.24                  | 41.4   | <a href="#">12-7</a>      | 4.0                      |
| Reactor Coolant Filter      | 733                                     | KK-52 | 3.375                  | 19     | <a href="#">12-8</a>      | 2.5                      |
| Seal Water Return Filter    | 733                                     | HH-52 | 3.375                  | 19     | <a href="#">12-8</a>      | 2.0                      |
| Seal Water Injection Filter | 7733                                    | JJ-51 | 1.3                    | 20     | <a href="#">12-8</a>      | 2.0                      |
| Boric Acid Filter           | 733                                     | NN-51 | 3.375                  | 19     | <a href="#">12-8</a>      | 3.0                      |
| Boronometer                 | 733                                     | GG-53 | 6.65                   | 18.7   | <a href="#">12-6</a> , SF | 1.0                      |
| Boron Recycle System        |                                         |       |                        |        |                           |                          |
| Holdup Tank                 | 716                                     | PP-58 | 180                    | 283    | <a href="#">12-6</a> , SE | 3.0                      |
| Evaporator-Gas Stripper     | 695                                     | NN-56 | 21                     | 119    | <a href="#">12-6</a> , SL | 3.0                      |
| Feed Pump                   | 716                                     | QQ-56 | 5.5                    | 15     | <a href="#">12-6</a> , SE | 3.0                      |
| Feed Demineralizer          | 733                                     | QQ-56 | 16                     | 100    | <a href="#">12-7</a>      | 4.0                      |
| Feed Filter                 | 733                                     | PP-56 | 3.375                  | 19     | <a href="#">12-8</a>      | 2.0                      |
| Condensate Demineralizer    | 733                                     | PP-56 | 13.15                  | 65     | <a href="#">12-7</a>      | 2.0                      |

| Component                         | Location (Typical)<br>Elevation/Columns |       | Source                 |        |                              | Shield (ft)<br>(Note 10) |
|-----------------------------------|-----------------------------------------|-------|------------------------|--------|------------------------------|--------------------------|
|                                   |                                         |       | Dimension<br>(Note 11) |        | Table/Flag                   |                          |
|                                   |                                         |       | R(in.)                 | H(in.) |                              |                          |
| Condensate Filter                 | 733                                     | NN-56 | 1.25                   | 19     | <a href="#">12-8</a>         | 2.0                      |
| Concentrate Filter                | 733                                     | NN-56 | 1.25                   | 19     | <a href="#">12-8</a>         | 2.5                      |
| Boron Thermal Regeneration System |                                         |       |                        |        |                              |                          |
| Moderating Heat Exchanger         | 750                                     | KK-54 | 10                     | 215    | (Note 6)                     | 2.5                      |
| Letdown Chiller Heat Exchang.     | 750                                     | LL-54 | 10                     | 203.5  | <a href="#">12-6</a> , SF    | 2.5                      |
| Letdown Reheat Heat Exchang.      | 750                                     | LL-54 | 4.3                    | 86.9   | <a href="#">12-6</a> , SD,SF | 2.5                      |
| Therm. Reg. Ion Exchanger         | 733                                     | LL-54 | 21.25                  | 28     | <a href="#">12-7</a>         | 4.0                      |
| Liquid Waste Recycle System       |                                         |       |                        |        |                              |                          |
| Evaporator Feed Tank              | 716                                     | LL-59 | 54                     | 120    | <a href="#">12-6</a> , SH    | 2.5                      |
| Waste Drain Tank                  | 716                                     | LL-59 | 66                     | 108    | <a href="#">12-6</a> , SD    | 2.5                      |
| Evaporator Feed Pump              | 716                                     | MM-59 | 5.625                  | 15     | <a href="#">12-6</a> , SH    | 2.0                      |
| Evaporator Feed Filter            | 733                                     | MM-59 | 2                      | 17     | <a href="#">12-8</a>         | 2.0                      |
| Waste Drain Tank Pump             | 716                                     | MM-58 | 4                      | 18     | <a href="#">12-6</a> , SD    | 2.0                      |
| Evaporator                        | 695                                     | LL-51 | 21                     | 119    | <a href="#">12-6</a> , SL    | 3.0                      |
| Evaporator Condensate Dem.        | 733                                     | KK-57 | 16.2                   | 90     | <a href="#">12-7</a>         | 1.5                      |
| Evaporator Condensate Filter      | 733                                     | KK-57 | 1.25                   | 19     | <a href="#">12-8</a>         | 1.0                      |
| Reactor Coolant Drain Tank        | 733                                     | HH-49 | 18                     | 80     | <a href="#">12-6</a> , SD    | 3.0                      |
| RCDT Heat Exchanger               | 733                                     | GG-49 | 7                      | 175    | <a href="#">12-6</a> , SD    | 3.0                      |
| RCDT Pump                         | 733                                     | HH-49 | 5.5                    | 15     | <a href="#">12-6</a> , SD    | 3.0                      |

| Component                              | Location (Typical)<br>Elevation/Columns |       | Source                 |        |                           | Shield (ft)<br>(Note 10) |
|----------------------------------------|-----------------------------------------|-------|------------------------|--------|---------------------------|--------------------------|
|                                        |                                         |       | Dimension<br>(Note 11) |        | Table/Flag                |                          |
|                                        |                                         |       | R(in.)                 | H(in.) |                           |                          |
| Aux Waste Evap Feed Tank               | 760                                     | Yard  | 120<br>(Note 12)       | 252    | <a href="#">12-10</a>     | 2.0                      |
| Aux Waste Evap Feed Tank Pump          | 760                                     | Yard  | 6                      | 4      | <a href="#">12-10</a>     | 1.5                      |
| Liquid Waste Monitor & Disposal System |                                         |       |                        |        |                           |                          |
| Laundry & Hot Shower Tank              | 716                                     | LL-51 | 69                     | 180    | <a href="#">12-6</a> , SI | 1.5                      |
| LHST Pump                              | 716                                     | KK-51 | 4                      | 8      | <a href="#">12-6</a> , SI | 1.5                      |
| LHST Pre-Filter, Post Filter           | 733                                     | LL-55 | 1.25                   | 19     | <a href="#">12-8</a>      | 2.0                      |
| LHST Carbon Filter                     | 733                                     | LL-55 | 1.25                   | 19     | <a href="#">12-8</a>      | 2.0                      |
| Waste Monitor Tank Filter              | 733                                     | KK-55 | 1.25                   | 19     | <a href="#">12-8</a>      | 2.0                      |
| Waste Monitor Tank Demin.              | 733                                     | KK-55 | 16.2                   | 90     | <a href="#">12-7</a>      | 2.5                      |
| Floor Drain Tank                       | 716                                     | KK-52 | 60                     | 240    | <a href="#">12-6</a> , SI | 1.5                      |
| FDT Pump                               | 716                                     | KK-51 | 6                      | 10     | <a href="#">12-6</a> , SI | 1.5                      |
| FDT Filter                             | 733                                     | MM-55 | 1.25                   | 19     | <a href="#">12-8</a>      | 2.0                      |
| Mixing and Settling                    | 716                                     | KK-55 | 60                     | 24.5   | <a href="#">12-6</a> , SI | 1.5                      |
| Sludge Pump                            | 716                                     | LL-55 | 4                      | 15     | <a href="#">12-6</a> , SI | 1.5                      |
| Mixing and Settling Tank Pump          | 716                                     | KK-55 | 4                      | 15     | <a href="#">12-6</a> , SI | 1.5                      |
| Aux Floor Drain Tank                   | 760                                     | Yard  | 120<br>(Note 12)       | 252    | <a href="#">12-10</a>     | 2.0                      |
| Aux FDT Pump                           | 760                                     | Yard  | 6                      | 4      | <a href="#">12-10</a>     | 1.5                      |

| Component                           | Location (Typical)<br>Elevation/Columns |                | Source                 |        |                           | Shield (ft)<br>(Note 10) |
|-------------------------------------|-----------------------------------------|----------------|------------------------|--------|---------------------------|--------------------------|
|                                     |                                         |                | Dimension<br>(Note 11) |        | Table/Flag                |                          |
|                                     |                                         |                | R(in.)                 | H(in.) |                           |                          |
| Solid Waste Disposal System         |                                         |                |                        |        |                           |                          |
| Chemical Drain Tank                 | 695                                     | LL-57          | 21                     | 108    | <a href="#">12-6</a> , SH | 3.0                      |
| Chemical Drain Tank Pump            | 695                                     | LL-57          | 5.5                    | 15     | <a href="#">12-6</a> , SH | 3.0                      |
| Spent Resin Storage Tank            | 716                                     | KK-53          | 107.3                  | 132    | <a href="#">12-6</a> , SM | 4.0                      |
| Spent Resin Sluice Pump             | 716                                     | LL-53          | 5.5                    | 14     | <a href="#">12-6</a> , SM | 4.0                      |
| Spent Resin Sluice Filter           | 733                                     | MM-52          | 4.325                  | 20     | <a href="#">12-6</a> , SM | 3.0                      |
| Resin Batching Tank                 | 750                                     | NN-55          | 30.                    | 92.5   | <a href="#">12-6</a> , SN | 3.0                      |
| Evaporator Concentrate Storage Tank | 750                                     | QQ-55          | 42.                    | 120.0  | <a href="#">12-6</a> , SL | 3.0                      |
| Drumming Room                       | 750                                     | PP-54          | (Note 7)               |        |                           | 3.0                      |
| Solid 171GD Liner Storage           | 760                                     | VV-51a,<br>52a | (Note<br>13)           |        | <a href="#">12-6</a> , SN | 1.0                      |
| Waste Gas System                    |                                         |                |                        |        |                           |                          |
| Compressor                          | 716                                     | NN-52          | 6                      | 25     | <a href="#">12-6</a> , SO | 4.0                      |
| Tank                                | 716                                     | PP-53          | 60                     | 91     | <a href="#">12-6</a> , SO | 4.0                      |
| Hydrogen Recombiner                 | 716                                     | NN-53          | 6                      | 25     | <a href="#">12-6</a> , SO | 1.5                      |
| Spent Fuel Pool Cooling System      |                                         |                |                        |        |                           |                          |
| Cooling Pump                        | 750                                     | PP-52          | 11                     | 15     | (Note 5)                  | 2.0                      |
| Cooling Heat Exchanger              | 750                                     | PP-53          | 17                     | 228    | (Note 5)                  | 2.0                      |
| Cooling Strainer (Note 8)           | 750                                     | PP-52          |                        |        | (Note 5)                  | 2.0                      |
| Demineralizer                       | 750                                     | NN-53          | 19.45                  | 60     | <a href="#">12-7</a>      | 2.0                      |

| Component                               | Location (Typical)<br>Elevation/Columns |       | Source                 |        |                           | Shield (ft)<br>(Note 10) |
|-----------------------------------------|-----------------------------------------|-------|------------------------|--------|---------------------------|--------------------------|
|                                         |                                         |       | Dimension<br>(Note 11) |        | Table/Flag                |                          |
|                                         |                                         |       | R(in.)                 | H(in.) |                           |                          |
| Filter                                  | 733                                     | MM-51 | 6                      | 20     | <a href="#">12-8</a>      | 2.0                      |
| Skimmer Pump                            | 750                                     | PP-52 | 7                      | 4      | (Note 5)                  | 2.0                      |
| Skimmer Strainer (Note 8)               | 750                                     | PP-52 |                        |        | (Note 5)                  | 2.0                      |
| Skimmer Filter                          | 733                                     | MM-51 | 3                      | 18     | (Note 5)                  | 2.0                      |
| Sampling System                         |                                         |       |                        |        |                           |                          |
| Heat Exchangers (Note 9)                | 716                                     | EE-53 | 3                      | 90     | <a href="#">12-6</a> , SA | 2.0                      |
| Steam Generator Blowdown Recycle System |                                         |       |                        |        |                           |                          |
| Tank                                    | 716                                     | FF-53 | 36                     | 120    | (Note 5)                  | 1.0                      |
| Pump                                    | 716                                     | FF-53 | 4                      | 5      | (Note 5)                  | 1.0                      |
| Heat Exchanger                          | 733                                     | FF-54 | 7                      | 120    | (Note 5)                  | 2.0                      |
| Demineralizer                           | 733                                     | KK-55 | 13.8                   | 60     | <a href="#">12-7</a>      | 3.0                      |
| Filter                                  | 733                                     | HH-52 | 1.25                   | 19     | <a href="#">12-8</a>      | 2.0                      |

**Note:**

1. Source is reactor core at full power plus coolant activity.
2. Biological shielding (2 ft) provided above operating deck level for active height.
3. Accident source only.
4. Intermittent use only; no shield on annulus side.
5. Minimal radioactivity expected, shielding provided for conservatism.
6. Both shell and tube side are sources, no credit taken for activity removal across thermally regenerative ion exchanger.

| Component | Location (Typical)<br>Elevation/Columns                                                                                                                | Source                 |        |            | Shield (ft)<br>(Note 10) |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|--------|------------|--------------------------|
|           |                                                                                                                                                        | Dimension<br>(Note 11) |        | Table/Flag |                          |
|           |                                                                                                                                                        | R(in.)                 | H(in.) |            |                          |
| 7.        | Designed to handle wastes such as filter cartridges, evaporator bottoms, etc; handling area is 28.5 feet by 37 feet.                                   |                        |        |            |                          |
| 8.        | Strainer located on pump intake.                                                                                                                       |                        |        |            |                          |
| 9.        | Heat exchangers for potentially radioactive samples are to be located behind a shield wall at the end of the Sample Room nearest the Reactor Building. |                        |        |            |                          |
| 10.       | Ordinary concrete or equivalent.                                                                                                                       |                        |        |            |                          |
| 11.       | Dimensions are for a right circular cylinder unless otherwise noted.                                                                                   |                        |        |            |                          |
| 12.       | Dimensions of AUX WEFT and AUX FDT used in shielding calculations.                                                                                     |                        |        |            |                          |
| 13.       | Largest Liner used in storage vault has a radius of 40 in. and a height of 106 in.                                                                     |                        |        |            |                          |

**Table 12-3. Primary Shield Description**

| <b>Region</b>             | <b>Material</b>     | <b>Thickness (in.)</b> |
|---------------------------|---------------------|------------------------|
| Core baffle               | Stainless Steel     | 1.125                  |
| Coolant                   | Water               | 6.52                   |
| Core Barrel               | Stainless Steel     | 2.25                   |
| Coolant/                  | Water/              | 4.75/                  |
| Neutron pads <sup>1</sup> | Stainless Steel     | 2.75                   |
| Pressure Vessel           | Carbon Steel        | 8.625                  |
| Gap                       | Air, Insulation     | 7.00                   |
| Biological shield         | Reinforced concrete |                        |
| Detector wells            |                     | 72.0                   |
| Other                     |                     | 102.0                  |

**Note:**

1. Neutron pads are affixed to the barrel and cover azimuthal regions which experience peak fast neutron exposures. There are four such panels covering the regions from 30° to 65°, 117° to 150°, 210° to 245°, and 297° to 330°.

**Table 12-4. Parameters Used for Design Basis Accident Analysis of Control Room Direct Dose**

|                                     |      |                                         |
|-------------------------------------|------|-----------------------------------------|
| Power Level                         |      | 3565 MWt                                |
| Equivalent fraction of core melting |      | 1.0                                     |
| Fission product fractional releases |      |                                         |
| Noble gases                         |      | 1.0                                     |
| Halogens                            |      | 0.5                                     |
| Remaining inventory                 |      | 0.01                                    |
| Minimum full power operating time   |      | 650 days                                |
| Clean-up rate following accident    |      | 0.0                                     |
| Containment net free volume         |      | 1.22 x 10 <sup>6</sup> ft <sup>3</sup>  |
| Post-accident water depth           |      | 15.2 ft                                 |
| Shielding                           |      | (see Section <a href="#">12.1.2.5</a> ) |
| Occupancy time                      |      | 30 days                                 |
| 0-1 day                             | 100% |                                         |
| 1-4 days                            | 60%  |                                         |
| 4-30 days                           | 40%  |                                         |

**Table 12-5. Design Basis Accident Containment Source Strength (gammas/cc-sec) vs (hours after release)**

|                                  | <b>0</b>           | <b>1</b>           | <b>2</b> | <b>24</b> | <b>720</b> |
|----------------------------------|--------------------|--------------------|----------|-----------|------------|
| <b>Gas</b>                       |                    |                    |          |           |            |
| 0.4 MeV                          | 1.7E8 <sup>1</sup> | 1.7E8 <sup>1</sup> | 1.6E8    | 5.0E7     | 9.4E4      |
| 0.8                              | 1.6E8              | 8.3E7              | 6.1E7    | 4.3E6     | 4.3E4      |
| 1.3                              | 3.1E6              | 2.4E6              | 2.0E6    | 8.4E3     | -          |
| 1.7                              | 2.4E8              | 1.2E7              | 9.0E6    | 3.9E4     | -          |
| 2.2                              | 1.1E8              | 3.3E7              | 2.1E7    | 8.3E4     | -          |
| 2.5                              | 6.9E7              | 4.9E7              | 3.3E7    | 9.9E4     | -          |
| 3.5                              | 5.0E7              | -                  | -        | -         | -          |
| <b>Liquid</b>                    |                    |                    |          |           |            |
| 0.4MeV                           | 3.9E8              | 3.4E8              | 3.4E8    | 3.1E8     | 1.8E8      |
| 0.8                              | 3.0E9              | 2.5E9              | 1.9E9    | 3.6E8     | 4.5E7      |
| 1.3                              | 6.1E8              | 4.1E8              | 3.2E8    | 1.9E7     | 4.5E5      |
| 1.7                              | 2.0E8              | 9.9E7              | 7.5E7    | 1.8E7     | 4.0E6      |
| 2.2                              | 5.5E8              | 4.7E8              | 4.2E8    | 4.2E7     | 1.8E5      |
| 2.5                              | 5.3E7              | 2.8E7              | 2.1E7    | 2.3E8     | 2.4E5      |
| 3.5                              | 4.1E7              | 9.0E6              | 2.6E6    | 3.1E4     | 8.3E3      |
| <b>Note:</b>                     |                    |                    |          |           |            |
| 1. 1.7E8 means $1.7 \times 10^8$ |                    |                    |          |           |            |

Table 12-6. Design Basis Source Strengths for Fluids.

|                    |                                                                     | Gamma Groups |          |          |          |          |          |
|--------------------|---------------------------------------------------------------------|--------------|----------|----------|----------|----------|----------|
| Source Designation |                                                                     | 1            | 2        | 3        | 4        | 5        | 6        |
| SA                 | Reactor coolant, high temperature, fission and corrosion products   |              |          |          |          |          |          |
|                    | SS                                                                  | 1.08 E+6     | 3.23 E+5 | 2.00 E+5 | 7.55 E+4 | 7.20 E+4 | 5.16 E+4 |
|                    | E                                                                   | .114         | .510     | .888     | 1.40     | 1.94     | 2.50     |
| SB                 | Reactor coolant, nitrogen-16 term (per microcurie/cc)               |              |          |          |          |          |          |
|                    | SS                                                                  | ----         | ----     | ----     | 3.33 E+2 | 2.55 E+4 | 1.85 E+3 |
|                    | E                                                                   |              |          |          | 2.74     | 6.13     | 7.12     |
| SC                 | Reactor coolant, pressurizer                                        |              |          |          |          |          |          |
|                    | SS                                                                  | 1.01 E+4     | 1.07 E+5 | 3.08 E+4 | 3.87 E+3 | 1.85 E+3 | 1.25 E+2 |
|                    | E                                                                   | .177         | .524     | .829     | 1.31     | 1.80     | 2.98     |
| SD                 | Reactor coolant, ambient temperature                                |              |          |          |          |          |          |
|                    | SS                                                                  | 1.53 E+6     | 4.58 E+5 | 2.83 E+5 | 1.07 E+5 | 1.02 E+5 | 7.31 E+4 |
|                    | E                                                                   | .114         | .510     | .888     | 1.40     | 1.94     | 2.50     |
| SE                 | Reactor coolant, downstream mixed-bed demineralizer                 |              |          |          |          |          |          |
|                    | SS                                                                  | 1.51 E+6     | 2.00 E+5 | 1.25 E+5 | 5.30 E+4 | 4.91 E+4 | 6.76 E+4 |
|                    | E                                                                   | .113         | .514     | .844     | 1.46     | 2.08     | 2.46     |
| SF                 | Reactor coolant, downstream mixed-bed and cation-bed demineralizer  |              |          |          |          |          |          |
|                    | SS                                                                  | 1.51 E+6     | 1.93 E+5 | 1.19 E+5 | 5.05 E+4 | 4.85 E+4 | 6.73 E+4 |
|                    | E                                                                   | .113         | 5.10     | .845     | 1.46     | 2.08     | 2.46     |
| SG                 | Reactor coolant, demineralizer, gas-stripped (volume control tank)  |              |          |          |          |          |          |
|                    | SS                                                                  | 1.11 E+6     | 1.42 E+5 | 1.01 E+5 | 4.23 E+4 | 2.63 E+4 | 3.73 E+4 |
|                    | E                                                                   | .111         | .534     | .844     | 1.44     | 2.11     | 2.46     |
| SH                 | Reactor coolant, fully degassed                                     |              |          |          |          |          |          |
|                    | SS                                                                  | 4.04 E+4     | 3.70 E+5 | 2.44 E+5 | 8.75 E+4 | 6.49 E+4 | 9.50 E+3 |
|                    | E                                                                   | .180         | .528     | .894     | 1.36     | 1.86     | 2.88     |
| SI                 | Reactor coolant, degassed, diluted with other leakage (factor=1/50) |              |          |          |          |          |          |
|                    | SS                                                                  | 8.08 E+2     | 7.40 E+3 | 4.88 E+3 | 1.75 E+3 | 1.30 E+3 | 1.90 E+1 |
|                    | E                                                                   | .180         | .528     | .894     | 1.36     | 1.86     | 2.88     |
| SJ                 | Reactor coolant, degassed, evaporated (DF=1000)                     |              |          |          |          |          |          |
|                    | SS                                                                  | 4.04 E+1     | 3.70 E+2 | 2.44 E+2 | 8.75 E+1 | 6.49 E+1 | 9.50 E+0 |
|                    | E                                                                   | .180         | .528     | .894     | 1.36     | 1.86     | 2.88     |

| Gamma Groups       |                                                               |          |          |          |          |          |          |
|--------------------|---------------------------------------------------------------|----------|----------|----------|----------|----------|----------|
| Source Designation |                                                               | 1        | 2        | 3        | 4        | 5        | 6        |
| SK                 | Reactor coolant, residual heat removal mode                   |          |          |          |          |          |          |
|                    | SS                                                            | 1.30 E+6 | 2.59 E+5 | 1.11 E+5 | 3.64 E+4 | 2.25 E+4 | 1.79 E+4 |
|                    | E                                                             | .105     | .510     | .873     | 1.36     | 1.92     | 2.42     |
| SL                 | Evaporator concentrates (non-recyclable)                      |          |          |          |          |          |          |
|                    | SS                                                            | 1.23 E+5 | 8.71 E+5 | 2.85 E+5 | 3.29 E+4 | 6.05 E+3 | 3.66 E+1 |
|                    | E                                                             | .181     | .517     | .812     | 1.31     | 1.80     | 2.57     |
| SM                 | Demineralizer resins (combined, no sluice water)              |          |          |          |          |          |          |
|                    | SS                                                            | 3.90 E+7 | 8.55 E+8 | 1.41 E+8 | 1.11 E+7 | 2.80 E+6 | 3.51 E+4 |
|                    | E                                                             | .207     | .571     | .824     | 1.34     | 1.76     | 2.96     |
| SN                 | Demineralizer resins (combined, 6 mo. decay, no sluice water) |          |          |          |          |          |          |
|                    | SS                                                            | 2.14 E+4 | 1.65 E+8 | 2.40 E+7 | 1.43 E+6 | 1.01 E+3 | 4.52 E-1 |
|                    | E                                                             | .122     | .651     | .817     | 1.35     | 2.19     | 2.54     |
| SO                 | Waste gas tank (maximum)                                      |          |          |          |          |          |          |
|                    | SS                                                            | 5.43 E+7 | 5.90 E+5 | 1.91 E+4 | 1.10 E+4 | 1.42 E+4 | 3.02 E+4 |
|                    | E                                                             | .084     | .513     | .850     | 1.55     | 2.18     | 2.42     |

Notes:

1. SS = Source Strength in gammas/cc-sec
2. E = Average energy in MeV
3. E + 6 means  $10^6$

**Table 12-7. Design Basis Source Strengths for Demineralizers**

| <b>Demineralizer<sup>1</sup> (in Place)</b> | <b>0.4 MeV</b>    | <b>0.8 MeV</b>    | <b>1.3 MeV</b>    | <b>1.7 MeV</b>    | <b>2.2 MeV</b>    | <b>3.0 MeV</b>    |
|---------------------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Mixed Bed                                   | $3.8 \times 10^8$ | $5.0 \times 10^8$ | $3.1 \times 10^7$ | $1.0 \times 10^7$ | $2.0 \times 10^6$ | $1.1 \times 10^5$ |
| Cation Bed                                  | $4.8 \times 10^6$ | $4.8 \times 10^8$ | $4.2 \times 10^6$ | $2.4 \times 10^6$ | -                 | -                 |
| Recycle Evaporator Feed                     | $3.5 \times 10^7$ | $4.1 \times 10^7$ | $1.9 \times 10^6$ | $8.2 \times 10^5$ | $1.8 \times 10^5$ | -                 |
| Boron Thermal Regeneration                  | $6.3 \times 10^6$ | $2.6 \times 10^6$ | $5.2 \times 10^5$ | $1.9 \times 10^5$ | $5.5 \times 10^4$ | -                 |
| Spent Fuel Pool                             | $5.3 \times 10^6$ | $9.3 \times 10^5$ | $3.2 \times 10^3$ | $2.8 \times 10^3$ | -                 | -                 |
| Miscellaneous Low Activity:                 | $1.1 \times 10^5$ | $2.8 \times 10^4$ | $4.2 \times 10^3$ | $1.5 \times 10^3$ | $4.5 \times 10^2$ | -                 |
| (Recycle Evaporator Condensate)             |                   |                   |                   |                   |                   |                   |
| (Waste Evaporator Condensate)               |                   |                   |                   |                   |                   |                   |
| (Waste Monitor Tk)                          |                   |                   |                   |                   |                   |                   |
| (S.G. Blowdown Recycle)                     |                   |                   |                   |                   |                   |                   |

Note:

1. See [Table 12-2](#) for location and shielding.

**Table 12-8. Design Basis Source Strengths For Filters**

| Filter <sup>1</sup>                                                       | Estimated Source Strengths (Gamma/cc-sec) |                    |                    |
|---------------------------------------------------------------------------|-------------------------------------------|--------------------|--------------------|
|                                                                           | 0.4 MeV                                   | 0.8 MeV            | 1.3 MeV            |
| Reactor Coolant                                                           |                                           | $7.1 \times 10^7$  | $1.2 \times 10^7$  |
| Seal Water Injection                                                      |                                           | $6.0 \times 10^7$  | $9.2 \times 10^6$  |
| Seal Water Return                                                         |                                           | $1.4 \times 10^7$  | $2.3 \times 10^6$  |
| Recycle Evaporator Feed                                                   |                                           | $1.4 \times 10^7$  | $2.3 \times 10^6$  |
| Recycle Evaporator Condensate                                             | $4.0 \times 10^5$                         | $1.0 \times 10^5$  | $2.5 \times 10^4$  |
| Recycle Evaporator Concentrate                                            |                                           | $1.5 \times 10^6$  | -                  |
| Spent Fuel Pool (Pre and Post Filter, Skimmer Filter)                     |                                           | $1.4 \times 10^7$  | $2.3 \times 10^6$  |
| Waste Evaporator Feed                                                     |                                           | $4.25 \times 10^7$ | $6.85 \times 10^6$ |
| Waste Evaporator Condensate                                               | $4.25 \times 10^5$                        | $3.25 \times 10^5$ | $2.74 \times 10^4$ |
| Waste Monitor Tank                                                        | $4.25 \times 10^5$                        | $3.25 \times 10^5$ | $2.74 \times 10^4$ |
| Laundry and Hot Shower (Primary and Secondary Tank Filter, Carbon Filter) | $4.25 \times 10^5$                        | $3.25 \times 10^5$ | $2.74 \times 10^4$ |
| Boric Acid                                                                |                                           | $1.5 \times 10^6$  | -                  |
| Floor Drain Tank                                                          |                                           | $4.25 \times 10^7$ | $6.85 \times 10^6$ |
| Spent Resin Sluice                                                        |                                           | $1.4 \times 10^7$  | $2.3 \times 10^6$  |

**Note:**

1. See [Table 12-2](#) for location and shielding.

**Table 12-9. Reactor Coolant System Nitrogen-16 Activity**

| <b>Component</b>             | <b>N-16<br/>μCi/gm</b> |
|------------------------------|------------------------|
| Reactor Vessel, Core         | 95                     |
| Reactor Vessel, Upper Region | 125                    |
| Reactor Outlet Pipe          | 113                    |
| Steam Generator              | 92                     |
| Coolant Pump                 | 69                     |
| Reactor Inlet Pipe           | 65                     |

**Table 12-10. Design Source Strengths for Outside Storage Tanks.**

| Gamma Groups                             |         |         |         |         |         |         |
|------------------------------------------|---------|---------|---------|---------|---------|---------|
|                                          | 1       | 2       | 3       | 4       | 5       | 6       |
| Refueling Water Storage Tank:            |         |         |         |         |         |         |
| SS                                       | 1.96E+3 | 1.09E+2 | 1.2E+2  | 9.87E+0 | ---     | ---     |
| E                                        | .008    | .483    | .879    | 1.25    | ---     | ---     |
| Reactor Makeup Water Storage Tank:       |         |         |         |         |         |         |
| SS                                       | 4.34E+1 | 3.74E+1 | 4.68E+1 | 6.67E+0 | ---     | ---     |
| E                                        | .159    | .493    | .889    | 1.26    | ---     | ---     |
| Radwaste Facility Tank #1:               |         |         |         |         |         |         |
| SS                                       | 3.97E+4 | 3.52E+5 | 2.32E+5 | 8.28E+4 | 6.23E+4 | 9.02E+3 |
| E                                        | .180    | .525    | .893    | 1.36    | 1.86    | 2.89    |
| Radwaste Facility Tank #2:               |         |         |         |         |         |         |
| SS                                       | 7.94E+2 | 7.04E+3 | 4.64E+3 | 1.66E+3 | 1.25E+3 | 1.80E+2 |
| E                                        | .180    | .525    | .893    | 1.36    | 1.86    | 2.89    |
| Notes:                                   |         |         |         |         |         |         |
| 1. SS = Source strength in gammas/cc-sec |         |         |         |         |         |         |
| 2. E = Average energy in MeV             |         |         |         |         |         |         |
| 3. E+6 means 10 <sup>6</sup>             |         |         |         |         |         |         |

**Table 12-11. Area Radiation Monitors**

| <b>Detector Number</b> | <b>Detector Location <sup>1</sup></b>              | <b>Type</b> | <b>Range</b>                | <b>Fig. Ref.</b>    |
|------------------------|----------------------------------------------------|-------------|-----------------------------|---------------------|
| 1-EMF-1                | Auxiliary Building Corridor - E1 695 - (FF, GG-56) | G-M         | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-2</a> |
| 1-EMF-2                | Auxiliary Building Corridor - E1 716 - (MM, NN-56) | G-M         | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-3</a> |
| 1-EMF-3                | Auxiliary Building Corridor - E1 716 - (LL, MM-59) | G-M         | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-3</a> |
| 1-EMF-4                | Auxiliary Building Corridor - E1 716 - (GG-56)     | G-M         | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-3</a> |
| 1-EMF-5                | Sample Room Unit 1 - E1 716 (FF-54)                | G-M         | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-3</a> |
| 1-EMF-6                | Auxiliary Building Corridor - E1 733 (MM, NN-53)   | G-M         | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-4</a> |
| 1-EMF-7                | Auxiliary Building Corridor - E1 733 (NN-59)       | G-M         | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-4</a> |
| 1-EMF-8                | Auxiliary Building Corridor - E1 733 (HH-56)       | G-M         | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-4</a> |
| 1-EMF-9                | Reactor Building Incore Instrument Room Unit 1     | G-M         | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-4</a> |
| 1-EMF-10               | Auxiliary Building Corridor - E1 750 (LL-56)       | G-M         | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-5</a> |
| 1-EMF-11               | Waste Drumming Area - E1 750 (PP-54)               | G-M         | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-5</a> |
| 1-EMF-12               | Control Room - E1 755 (CC-56)                      | G-M         | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-6</a> |
| 1-EMF-13               | Laboratory - E1 767 (QQ-56)                        | G-M         | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-6</a> |
| 1-EMF-14               | Auxiliary Building Corridor - E1 760 (RR-54)       | G-M         | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-6</a> |
| 1-EMF-15               | Hot Machine Shop Area - E1 760 (TT-59)             | G-M         | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-7</a> |
| 1-EMF-16               | Refueling Bridge Unit 1 Reactor Building           | G-M         | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-7</a> |
| 1-EMF-17               | Refueling Bridge Unit 1 Spent Fuel Building        | G-M         | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-7</a> |
| 1-EMF-18               | Reactor Coolant Filter 1A                          | I-C         | .1 to 10 <sup>4</sup> R/hr  |                     |
| 1-EMF-19               | Reactor Coolant Filter 1B                          | I-C         | .1 to 10 <sup>4</sup> R/hr  |                     |
| 1-EMF-20               | New Fuel Storage (North)                           | G-M         | .1 to 10 <sup>4</sup> mr/hr |                     |
| 1-EMF-21               | New Fuel Storage (South)                           | G-M         | .1 to 10 <sup>4</sup> mr/hr |                     |
| 1-EMF-22               | Tech Support CTR, ELE 767 (SS-32)                  | G-M         | .1 to 10 <sup>4</sup> mr/hr |                     |

| Detector Number | Detector Location <sup>1</sup>                      | Type | Range                       | Fig. Ref.           |
|-----------------|-----------------------------------------------------|------|-----------------------------|---------------------|
| 1-EMF-23        | RB Purge Filter, ELG-767 (JJ-53)                    | G-M  | .1 to 10 <sup>4</sup> mr/hr |                     |
| 1-EMF-24        | Steam Line 1A, Outboard Doghouse, (GG-43)           | G-M  | .1 to 10 <sup>4</sup> mr/hr |                     |
| 1-EMF-25        | Steam Line 1B, Inboard Doghouse, (GG-53)            | G-M  | .1 to 10 <sup>4</sup> mr/hr |                     |
| 1-EMF-26        | Steam Line 1C, Inboard Doghouse, (GG-52)            | G-M  | .1 to 10 <sup>4</sup> mr/hr |                     |
| 1-EMF-27        | Steam Line 1D, Outboard Doghouse, (GG-44)           | G-M  | .1 to 10 <sup>4</sup> mr/hr |                     |
| 1-EMF-28        | Diesel Generator Room, (BB-45)                      | G-M  | .1 to 10 <sup>4</sup> mr/hr |                     |
| 1-EMF-36HH      | Unit Ventilation (Unit Vent)                        | I-C  | 1 to 10 <sup>8</sup> R/hr   |                     |
| 1-EMF-51A       | Containment                                         | I-C  | 1 to 10 <sup>8</sup> R/hr   |                     |
| 1-EMF-51B       | Containment                                         | I-C  | 1 to 10 <sup>8</sup> R/hr   |                     |
| 2-EMF-1         | Sample Room Unit 2 - E1 716 (EE, FF-58)             | G-M  | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-3</a> |
| 2-EMF-2         | Reactor Building Incore Instrumentation Room Unit 2 | G-M  | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-4</a> |
| 2-EMF-3         | Refueling Bridge Unit 2 Reactor Building            | G-M  | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-7</a> |
| 2-EMF-4         | Refueling Bridge Unit 2 Spent Fuel Building         | G-M  | .1 to 10 <sup>4</sup> mr/hr | <a href="#">1-7</a> |
| 2-EMF-5         | Reactor Coolant Filter 2A ELE 733 (KK, JJ-60, 61)   | I-C  | .1 to 10 <sup>4</sup> R/hr  | <a href="#">1-7</a> |
| 2-EMF-6         | Reactor Coolant Filter 2B ELE 733 (KK, JJ-60, 61)   | I-C  | .1 to 10 <sup>4</sup> R/hr  |                     |
| 2-EMF-7         | New Fuel Storage (North) ELE 767 (TT-62)            | G-M  | .1 to 10 <sup>4</sup> mr/hr |                     |
| 2-EMF-8         | New Fuel Storage (South) ELE 767 (SS-62)            | G-M  | .1 to 10 <sup>4</sup> mr/hr |                     |
| 2-EMF-9         | RB Purge Filter, ELE 767, (JJ-59)                   | G-M  | .1 to 10 <sup>4</sup> mr/hr |                     |
| 2-EMF-10        | Steam Line 2A, Outboard Doghouse, (FF-68)           | G-M  | .1 to 10 <sup>4</sup> mr/hr |                     |
| 2-EMF-11        | Steam Line 2B, Inboard Doghouse, (FF-59)            | G-M  | .1 to 10 <sup>4</sup> mr/hr |                     |
| 2-EMF-12        | Steam Line 2C, Inboard Doghouse, (FF-60)            | G-M  | .1 to 10 <sup>4</sup> mr/hr |                     |
| 2-EMF-13        | Steam Line 2D, Outboard Doghouse, (FF-69)           | G-M  | .1 to 10 <sup>4</sup> mr/hr |                     |
| 2-EMF-14        | Diesel Generator Room, (BB-69)                      | G-M  | .1 to 10 <sup>4</sup> mr/hr |                     |

| Detector Number | Detector Location <sup>1</sup> | Type | Range                     | Fig. Ref. |
|-----------------|--------------------------------|------|---------------------------|-----------|
| 2-EMF-36HH      | Unit Ventilation (Unit Vent)   | I-C  | 1 to 10 <sup>8</sup> R/hr |           |
| 2-EMF-51A       | Containment                    | I-C  | 1 to 10 <sup>8</sup> R/hr |           |
| 2-EMF-51B       | Containment                    | I-C  | 1 to 10 <sup>8</sup> R/hr |           |

Note:

1. The approximate detector location is indicated. For example: 1-EMF-1 is located in the Auxiliary Building corridor at floor elevation 695 between column lines FF and GG at column line 56.

**Table 12-12. Annual Station Dose Estimates (person-rem/yr)**

|                                                             | <b>Dose (Rem)</b> |
|-------------------------------------------------------------|-------------------|
| <b>Normal Operation &amp; Anticipated Occurences</b>        |                   |
| Routine surveillance & plant operations                     | 10                |
| Valve maintenance                                           | 5                 |
| Miscellaneous maintenance                                   | 8                 |
| Primary sampling & analysis                                 | 1.5               |
| Filter & strainer changeouts                                | 1.5               |
| Handling radioactive waste                                  | 2                 |
| Special maintenance (modifications, etc.)                   | 3                 |
| In-service inspections                                      | 3                 |
| <b>Total</b>                                                | <b>34</b>         |
| <b>Refueling Outage</b>                                     |                   |
| Stage area/equipment for Steam Generator work               | 6                 |
| Remove/replace Steam Generator primary manways & diaphragms | 3                 |
| Install/remove Steam Generator nozzle dams                  | 8                 |
| Steam Generator ECT testing                                 | 10                |
| Steam Generator tubing plugging                             | 8                 |
| Steam Generator tube plug removal                           | 5                 |
| Reactor Coolant Pump seal maintenance                       | 3                 |
| Reactor Coolant Pump motor maintenance                      | 4                 |
| Reactor Head removal & replacement                          | 8                 |
| Defuel/Refuel                                               | 1                 |
| Modifications                                               | 8                 |
| Miscellaneous preventative maintenance                      | 7                 |
| Miscellaneous clean-up & decontamination                    | 4                 |
| Valve maintenance                                           | 25                |
| Install/remove temporary shielding                          | 10                |
| In-service Inspections                                      | 10                |
| Snubber Inspections                                         | 2                 |
| General Rx Bldg entry                                       | 1                 |
| Miscellaneous RP support                                    | 3                 |
| Miscellaneous Operations support                            | 3                 |

|                     | Dose (Rem) |
|---------------------|------------|
| Penetration testing | 1          |
| Total               | 130        |
| Total Station Dose  | 164        |

**Table 12-13. Estimated Occupancy Times During Normal Operations and Anticipated Occurrences (man-hrs/wk)**

| <b>Work Area</b>                                  | <b>Administration &amp;<br/>Staff</b> | <b>Operations</b> | <b>Technical<br/>Services</b> | <b>Maintenance</b> | <b>Guards</b> | <b>ESS<sup>1</sup></b> | <b>Janitorial</b> | <b>QA</b>   |
|---------------------------------------------------|---------------------------------------|-------------------|-------------------------------|--------------------|---------------|------------------------|-------------------|-------------|
| 1. Aux. Bldg.<br>Corridors                        | 40                                    | 860               | 1100                          | 960                | -             | 900                    | 800               | 800         |
| 2. Sample Room &<br>Hot Laboratory                | 40                                    | 10                | 800                           | 40                 | -             | 40                     | -                 | -           |
| 3. Letdown &<br>Recycle Systems                   | -                                     | 220               | 215                           | 125                | -             | 165                    | -                 | -           |
| 4. Waste Gas<br>Processing                        | -                                     | 220               | 215                           | 100                | -             | 165                    | -                 | -           |
| 5. Liquid Waste<br>Processing                     | -                                     | 220               | 215                           | 125                | -             | 165                    | -                 | -           |
| 6. Solid Waste<br>Processing                      | -                                     | 210               | 225                           | 60                 | -             | 165                    | -                 | -           |
| 7. Turbine Bldg.                                  | 40                                    | 860               | 350                           | 1300               | 800           | 1800                   | 500               | 200         |
| 8. Control Room                                   | 40                                    | 1280              | 400                           | 1170               | -             | 1000                   | 100               | 200         |
| 9. Service &<br>Administration<br>Bldgs., Outside | 840                                   | 280               | 1160                          | 1360               | 2500          | 1600                   | 600               | 2000        |
| <b>Total</b>                                      | <b>1000</b>                           | <b>4160</b>       | <b>4680</b>                   | <b>5240</b>        | <b>3200</b>   | <b>6000</b>            | <b>2000</b>       | <b>3200</b> |

**Note:**

1. ESS Maintenance

**Table 12-14. Estimated Occupancy Times During A Refueling Outage (man-hrs)**

|                                              | Administration &<br>Staff | Operations | Technical<br>Services | Maintenance | Janitorial | QA   |
|----------------------------------------------|---------------------------|------------|-----------------------|-------------|------------|------|
| CRDM<br>Disconnect/Reconnect                 | -                         | -          | 50                    | 690         | -          | 50   |
| Head & Internals<br>Movement                 | -                         | -          | 250                   | 1330        | -          | 150  |
| Defuel/Refuel-Transfer<br>Canal              | -                         | 2270       | 300                   | 650         | -          | -    |
| Defuel/Refuel-Spent<br>Fuel Pool             | -                         | 850        | 900                   | 200         | -          | 800  |
| Head Flange Work on<br>Storage Stand         | -                         | -          | 30                    | 300         | -          | 10   |
| CRDM Work on Storage<br>Stand                | -                         | -          | 700                   | 700         | -          | -    |
| Reactor Coolant Pump<br>Seal Work            | -                         | -          | 200                   | 1300        | -          | 100  |
| Reactor Coolant Pump<br>Motor Work           | -                         | -          | 50                    | 2300        | -          | -    |
| Inservice Inspection                         | -                         | -          | 200                   | 3800        | -          | 1300 |
| Eddy Current Inspection                      | -                         | -          | 1500                  | 1450        | -          | 200  |
| Incore Instrumentation                       | -                         | -          | 150                   | 1400        | -          | 50   |
| Reactor Building Valve<br>Work               | -                         | -          | 250                   | 2000        | -          | 20   |
| Aux. Building Valve<br>Work                  | -                         | -          | 150                   | 1200        | -          | 10   |
| Preventive Maintenance<br>& Periodic Testing | -                         | -          | 50                    | 500         | -          | 50   |

|                                   | <b>Administration &amp;<br/>Staff</b> | <b>Operations</b> | <b>Technical<br/>Services</b> | <b>Maintenance</b> | <b>Janitorial</b> | <b>QA</b> |
|-----------------------------------|---------------------------------------|-------------------|-------------------------------|--------------------|-------------------|-----------|
| Misc. Cleanup & Decon             | -                                     | -                 | 450                           | -                  | 1400              | -         |
| Reactor Building<br>General Entry | 80                                    | 1160              | 3450                          | 1380               | 50                | 450       |
| Totals                            | 80                                    | 4280              | 8680                          | 19200              | 1500              | 3190      |

**Table 12-15. Estimated Occupational Dose by Job Function**

| <b>Function</b>                     | <b>Dose<sup>1</sup></b> |
|-------------------------------------|-------------------------|
| Reactor Operations & Surveillance   | 5                       |
| Routine Maintenance                 | 70                      |
| Inservice Inspection                | 3                       |
| Waste Processing                    | 2                       |
| Defuel/Refuel                       | 5                       |
| Misc. (less than 1 person rem/task) | 10                      |
| Special Maintenance                 | 5                       |
|                                     | <hr/> 100               |

Note:

1. Percent of total station dose
2. Basis. 1994 & 1995 actual values averaged and correlated to Table 12-14 values.

**Table 12-16. Estimates of Airborne Radioactive Contamination in the Containment**

| <b>Isotope</b> | <b>Concentration<br/>(<math>\mu\text{C}/\text{ML}</math>)</b> | <b>Fraction of 10CFR 20.1201<br/>Limit</b> |
|----------------|---------------------------------------------------------------|--------------------------------------------|
| AR41           | $8.6 \times 10^{-08}$                                         | $1.2 \times 10^{-3}$                       |
| KR83m          | $4.6 \times 10^{-08}$                                         | $1.8 \times 10^{-7}$                       |
| KR85m          | $3.0 \times 10^{-07}$                                         | $6.0 \times 10^{-4}$                       |
| KR85           | $7.7 \times 10^{-05}$                                         | $3.1 \times 10^{-2}$                       |
| KR87           | $1.2 \times 10^{-07}$                                         | $9.6 \times 10^{-4}$                       |
| KR88           | $8.9 \times 10^{-07}$                                         | $1.8 \times 10^{-2}$                       |
| KR89           | $1.3 \times 10^{-09}$                                         | $5.2 \times 10^{-4}$                       |
| XE131m         | $6.0 \times 10^{-07}$                                         | $6.0 \times 10^{-5}$                       |
| XE133m         | $8.9 \times 10^{-07}$                                         | $3.6 \times 10^{-4}$                       |
| XE133          | $8.3 \times 10^{-05}$                                         | $3.3 \times 10^{-2}$                       |
| XE135m         | $1.2 \times 10^{-08}$                                         | $5.3 \times 10^{-5}$                       |
| XE135          | $1.1 \times 10^{-06}$                                         | $4.4 \times 10^{-3}$                       |
| XE137          | $2.7 \times 10^{-09}$                                         | $1.1 \times 10^{-3}$                       |
| XE138          | $6.7 \times 10^{-08}$                                         | $6.7 \times 10^{-4}$                       |
| I130           | $2.7 \times 10^{-12}$                                         | $3.6 \times 10^{-7}$                       |
| I131           | $3.4 \times 10^{-11}$                                         | $6.8 \times 10^{-5}$                       |
| I132           | $1.4 \times 10^{-09}$                                         | $1.9 \times 10^{-5}$                       |
| I133           | $5.3 \times 10^{-10}$                                         | $2.1 \times 10^{-4}$                       |
| I134           | $5.5 \times 10^{-11}$                                         | $1.1 \times 10^{-7}$                       |
| I135           | $2.7 \times 10^{-11}$                                         | $1.5 \times 10^{-6}$                       |
| Total          | $1.6 \times 10^{-04}$                                         | $9.2 \times 10^{-2}$                       |

**Assumptions:**

1. Reactor coolant activity from [Table 11-3](#)
2. Reactor coolant leak rate is 1%/day for noble gases; 0.001%/day for iodines.
3. Decay during build-up for 100 days.
4. Volume of lower compartment is  $3.68 \times 10^5 \text{ ft.}^3$ .
5. The Reactor Coolant System remains pressurized.
6. Recirculation cleanup time prior to entry into lower compartment is 16 hours.
7. Purge time prior to entry into lower compartment is 2 hours.
8. Lower compartment purge rate is 7500 cfm.
9. The total containment volume of  $1.038 \times 10^6 \text{ ft.}^3$  is available for dilution at the time of entry.
10. Occupancy time 1.5 hours per week.
11. Ar41 production by neutron capture near reactor vessel.
12. 10CFR 20.1201 derived air concentrations have been adjusted for occupancy.

**Table 12-17. Estimates of Airborne Radioactive Contamination in the Auxiliary Building Room**

| <b>Isotope</b> | <b>Concentration<br/>(<math>\mu\text{C}/\text{ML}</math>)</b> | <b>Fraction of<br/>10CFR 20.1201 Limit</b> |
|----------------|---------------------------------------------------------------|--------------------------------------------|
| KR83m          | $1.2 \times 10^{-08}$                                         | $4.8 \times 10^{-7}$                       |
| KR85m          | $5.1 \times 10^{-08}$                                         | $1.0 \times 10^{-3}$                       |
| KR85           | $1.2 \times 10^{-09}$                                         | $4.8 \times 10^{-6}$                       |
| KR87           | $3.6 \times 10^{-08}$                                         | $2.9 \times 10^{-3}$                       |
| KR88           | $1.0 \times 10^{-07}$                                         | $2.0 \times 10^{-2}$                       |
| KR89           | $2.8 \times 10^{-09}$                                         | $1.1 \times 10^{-2}$                       |
| XE131m         | $3.1 \times 10^{-09}$                                         | $3.1 \times 10^{-6}$                       |
| XE133m         | $2.2 \times 10^{-08}$                                         | $8.8 \times 10^{-5}$                       |
| XE133          | $9.3 \times 10^{-07}$                                         | $3.7 \times 10^{-3}$                       |
| XE135m         | $8.4 \times 10^{-09}$                                         | $3.7 \times 10^{-4}$                       |
| XE135          | $1.2 \times 10^{-07}$                                         | $4.8 \times 10^{-3}$                       |
| XE137          | $5.1 \times 10^{-09}$                                         | $2.0 \times 10^{-2}$                       |
| XE 138         | $2.8 \times 10^{-08}$                                         | $2.8 \times 10^{-3}$                       |
| I130           | $9.8 \times 10^{-13}$                                         | $1.3 \times 10^{-6}$                       |
| I131           | $1.2 \times 10^{-10}$                                         | $2.4 \times 10^{-3}$                       |
| I132           | $4.9 \times 10^{-11}$                                         | $6.5 \times 10^{-6}$                       |
| I133           | $1.8 \times 10^{-10}$                                         | $7.2 \times 10^{-4}$                       |
| I134           | $2.4 \times 10^{-11}$                                         | $4.8 \times 10^{-7}$                       |
| I135           | $9.4 \times 10^{-11}$                                         | $5.4 \times 10^{-5}$                       |
| Total          | $1.3 \times 10^{-06}$                                         | $7.1 \times 10^{-2}$                       |

**Assumptions:**

1. Activity shown in [Table 11-3](#) is reduced by demineralizer efficiencies shown in [Table 11-12](#).
2. Leak rate is 160 lb/day/unit.
3. All of the noble gas and 0.75 percent of the iodine escapes from leakage.
4. The ventilation flow rate is 3270 cfm.
5. The volume of the room is 3168 ft.<sup>3</sup>.
6. Occupancy time is 15 hours per week.
7. Concentrations shown are equilibrium values.
8. 10CFR 20.1201 derived air concentrations have been adjusted for occupancy

**Table 12-18. Estimates of Airborne Radioactive Contamination in the Turbine Building**

| <b>Isotope</b> | <b>Concentration<br/>(<math>\mu\text{C}/\text{ML}</math>)</b> | <b>Fraction of<br/>10CFR 20.1201 Limit</b> |
|----------------|---------------------------------------------------------------|--------------------------------------------|
| KR83m          | $8.4 \times 10^{-15}$                                         | $8.4 \times 10^{-13}$                      |
| KR85m          | $3.8 \times 10^{-14}$                                         | $1.9 \times 10^{-9}$                       |
| KR85           | $9.1 \times 10^{-16}$                                         | $9.1 \times 10^{-12}$                      |
| KR87           | $2.3 \times 10^{-14}$                                         | $4.6 \times 10^{-9}$                       |
| KR88           | $7.6 \times 10^{-14}$                                         | $3.8 \times 10^{-8}$                       |
| KR89           | $6.9 \times 10^{-16}$                                         | $6.9 \times 10^{-9}$                       |
| XE131m         | $2.4 \times 10^{-15}$                                         | $6.0 \times 10^{-12}$                      |
| XE133m         | $1.8 \times 10^{-14}$                                         | $1.8 \times 10^{-10}$                      |
| XE133          | $7.2 \times 10^{-13}$                                         | $7.2 \times 10^{-9}$                       |
| XE135m         | $8.2 \times 10^{-15}$                                         | $9.1 \times 10^{-10}$                      |
| XE135          | $9.0 \times 10^{-14}$                                         | $9.0 \times 10^{-9}$                       |
| XE137          | $1.4 \times 10^{-15}$                                         | $1.4 \times 10^{-8}$                       |
| XE138          | $1.5 \times 10^{-14}$                                         | $3.8 \times 10^{-9}$                       |
| I130           | $5.0 \times 10^{-16}$                                         | $1.7 \times 10^{-9}$                       |
| I131           | $1.3 \times 10^{-13}$                                         | $6.5 \times 10^{-6}$                       |
| I132           | $3.8 \times 10^{-14}$                                         | $1.3 \times 10^{-8}$                       |
| I133           | $1.8 \times 10^{-13}$                                         | $1.8 \times 10^{-6}$                       |
| I134           | $6.9 \times 10^{-15}$                                         | $3.5 \times 10^{-10}$                      |
| I135           | $7.9 \times 10^{-14}$                                         | $1.1 \times 10^{-7}$                       |
| Total          | $1.4 \times 10^{-12}$                                         | $8.5 \times 10^{-6}$                       |

**Assumptions:**

1. Main steam iodine concentrations are shown in [Table 11-6](#).
2. All of the iodine and noble gas from a 1700 lb/hr (per unit) steam leak is released.
3. 0.75 percent of the iodine present in a 5 gpm/unit liquid leak rate to the Turbine Building Sump is released.
4. Turbine Building volume is 8,880,000 ft.<sup>3</sup>.
5. Turbine Building ventilation flow rate is 690,000 cfm.
6. Concentrations shown are equilibrium values.
7. Occupancy is continuous.

Table 12-19. RCA and RCA Control Points

| Figure & Elevation                       | RCA Boundaries (Zones)                                | RCA Control Points                 |                |                         |
|------------------------------------------|-------------------------------------------------------|------------------------------------|----------------|-------------------------|
|                                          |                                                       | Location                           | (Column Lines) | Type                    |
| <a href="#">12-1</a> EL. 695'+0          | IV, V & VI                                            |                                    |                |                         |
| <a href="#">12-2</a> EL. 716'+0          | IV, V & VI                                            |                                    |                |                         |
| <a href="#">12-3</a> EL. 733'+0 & 739'+0 | IV, V, & VI                                           | Aux bldg. door to U-2 D/G Rm.      | CC-67          | Incidental Access Point |
|                                          |                                                       | Aux bldg. door to U-2 Turbine Bldg | AA-67          | Incidental Access Point |
|                                          |                                                       | U-2 Aux Bldg double sub hatch      | AA-59          | Incidental Access Point |
|                                          |                                                       | Aux bldg. door to U-1 D/G Rm.      | CC-45          | Incidental Access Point |
|                                          |                                                       | Aux bldg. door to U-1 Turbine Bldg | AA-45          | Incidental Access Point |
|                                          |                                                       | U-1 Aux Bldg double sub hatch      | AA-53          | Incidental Access Point |
| <a href="#">12-4</a> EL. 750'+0          | IV, V, & VI                                           | U-1 Aux bldg, sub hatch            | AA-54          | Incidental Access Point |
|                                          |                                                       | U-1 Aux Bldg. double sub hatch     | AA-52          | Incidental Access Point |
|                                          |                                                       | U-2 Aux bldg. sub hatch            | AA-58          | Incidental Access Point |
|                                          |                                                       | U-2 Aux Bldg. double sub hatch     | AA-60          | Incidental Access Point |
| <a href="#">12-5</a> EL. 760'+6 & 767+0  | IV, V, and areas of III to the left of EE column line | First Aid Rm                       | SS-52          | Incidental Access Point |
|                                          |                                                       | U-1 SFP door 1000                  | SS-52          | Incidental Access Point |
|                                          |                                                       | U-1 SFP door 1000A                 | SS-48          | Incidental Access Point |
|                                          |                                                       | U-1 SFP roll-up door               | RR-47          | Incidental Access Point |
|                                          |                                                       | 1202 roll-up door                  | YYA-62         | Incidental Access Point |
|                                          |                                                       | Waste Shipping roll-up door        | YYA-68         | Incidental Access Point |

| Figure &<br>Elevation                    | RCA<br>Boundaries<br>(Zones) | RCA Control Points                         |                   |                                       |
|------------------------------------------|------------------------------|--------------------------------------------|-------------------|---------------------------------------|
|                                          |                              | Location                                   | (Column<br>Lines) | Type                                  |
|                                          |                              | Hot Tool Crib roll-up door                 | UU-68             | Incidental Access Point               |
|                                          |                              | Hot Tool Crib door 1039                    | TT-68             | Incidental Access Point               |
|                                          |                              | U-2 SFP door 1026A                         | SS-64             | Incidental Access Point               |
|                                          |                              | U-2 SFP roll-up door                       | RR-65             | Incidental Access Point               |
|                                          |                              | Equip Staging Bldg. roll-up door           | PPB-14            | Incidental Access Point               |
|                                          |                              | Equip Staging Bldg. door 1063              | PPB-14            | Incidental Access Point               |
|                                          |                              | Solid Pad roll-up door                     | YY-50             | Incidental Access Point               |
|                                          |                              | Solid Pad door south                       | XX-50             | Incidental Access Point               |
|                                          |                              | Solid Pad door west                        | VV-52             | Incidental Access Point               |
|                                          |                              | U-1 Electrical Pen Rm 925E (MG Set Rm)     | CC-53             | Emergency entrance OPS TCA            |
|                                          |                              | U-2 Electrical Pen Rm 925F (MG Set Rm)     | CC-59             | Emergency entrance OPS TCA            |
| <a href="#">12-6</a> EL. 774'+0 & 784'+0 | III, IV, & VI                | RCA Entrance/Exit                          | QQ-56             | Primary RCA personnel entrance/exit   |
|                                          |                              | RP Office door 1115                        | XX-56             | Incidental Access Point               |
|                                          |                              | Corridor over Aux Bldg. roof, south stairs | FF-56             | Secondary RCA personnel entrance/exit |

**Table 12-20. Deleted Per 2011 Update**