
4.0 EVALUATION OF DOSE

4.1 DOSE FROM ENVIRONMENTAL MEASUREMENTS

Annual doses to maximum exposed individuals were estimated based on measured concentrations of radionuclides in 2002 MNS REMP samples. The primary purpose of estimating doses based on sample results is to allow comparison to effluent program dose estimates.

Doses based on sample results were calculated using the methodology and data presented in NRC Regulatory Guide 1.109. Measured radionuclide concentrations, averaged over the entire year for a specific radionuclide, indicator location and sample type, were used to calculate REMP-based doses. Where applicable, average background concentration at the corresponding control location was subtracted. Regulatory Guide 1.109 consumption rates for the maximum exposed individual were used in the calculations. When the guide listed "NO DATA" as the dose factor for a given radionuclide and organ, a dose factor of zero was assumed.

Maximum dose estimates (Highest Annual Mean Concentration) based on drinking water, fish, and shoreline sediment sample results are reported in Table 4.1-A. The individual critical population and pathway dose calculations are reported in Table 4.1-B.

REMP-based dose estimates are not reported for airborne radioiodine, airborne particulate, milk, or broadleaf vegetation sample types because no radionuclides other than naturally occurring K-40 and Be-7 were detected in the samples. Dose estimates are not reported for surface water because sampled surface water is not considered to be a potable drinking water source. Exposure estimates based upon REMP TLD results are discussed in Section 3.9.

The maximum environmental organ dose estimate for any single sample type (other than direct radiation from gaseous effluents) collected during 2002 was 5.84E-02 mrem to the maximum exposed child's liver, total body, thyroid, kidney, lung and GI-LLI from drinking water.

4.2 ESTIMATED DOSE FROM RELEASES

Throughout the year, dose estimates were calculated based on actual 2002 liquid and gaseous effluent release data. Effluent-based dose estimates were calculated using the RETDAS computer program which employs methodology and data presented in NRC Regulatory Guide 1.109. The 2002 MNS Annual Radioactive Effluent Release Report (reference 6.6) included calendar year dose estimates for the location with the highest individual organ dose from liquid and gaseous effluent releases. These reported doses are shown in Table 4.1-A along with the corresponding REMP-based dose estimates.

The effluent-based liquid release doses are summations of the dose contributions from the drinking water, fish, and shoreline pathways. The effluent-based gaseous release doses report noble gas exposure separately from iodine, particulate, and tritium exposure. For noble gas exposure there is no critical age group; as the maximum exposed individuals are assumed to receive the same doses, regardless of their age group. For iodine, particulate, and tritium exposure the effluent-based gaseous release doses are summations of the dose contributors from ground/plane, inhalation, milk and vegetation pathways.

4.3 COMPARISON OF DOSES

The environmental and effluent dose estimates given in Table 4.1-A agree reasonably well. The similarity of the doses indicate that the radioactivity levels in the environment do not differ significantly from those expected based on effluent measurements and modeling of the environmental exposure pathways. This indicates that effluent program dose estimates are both valid and reasonably conservative.

There are some differences in how effluent and environmental doses are calculated that affect the comparison. Doses calculated from environmental data are conservative because they are based on a mean that includes only samples with a net positive activity versus a mean that includes all sample results (i.e. zero results are not included in the mean). Also, airborne tritium is not measured in environmental samples but is used to calculate effluent doses.

In calculations based on liquid release pathways, drinking water and fish consumption were the predominant dose pathways based on environmental and effluent data. The maximum total organ dose based on 2002 environmental sample results was 1.09E-01 mrem to the child liver. The maximum total organ dose of 7.82E-02 mrem for liquid effluent-based estimates was to the child liver.

No environmental doses resulted from the gaseous pathway in 2002 because broadleaf vegetation, milk, and airborne radioiodines and particulates indicated no activity. The gaseous effluent dose is due to tritium on broadleaf vegetation.

Noble gas samples are not collected as part of the REMP, preventing an analogous comparison of effluent-based noble gas exposure estimates.

The doses calculated do not exceed the 40CFR190 dose commitment limits for members of the public. Doses to members of the public attributable to the operation of MNS are being maintained well within regulatory limits.

TABLE 4.1-A

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**MCGUIRE NUCLEAR STATION
2002 ENVIRONMENTAL AND EFFLUENT DOSE COMPARISON**

LIQUID RELEASE PATHWAY

| Organ | Environmental or Effluent Data | Critical Age ⁽¹⁾ | Critical Pathway ⁽²⁾ | Location | Maximum Dose ⁽³⁾ (mrem) |
|--------------|---------------------------------------|------------------------------------|--|------------------|---|
| Skin | Environmental | Teen | Shoreline Sediment | 130 (0.5 mi SW) | 2.05E-04 |
| Skin | Effluent | Teen | Shoreline Sediment | 0.5 mi. ENE | 5.22E-04 |
| Bone | Environmental | Child | Fish | 129 (0.5 mi ENE) | 5.26E-02 |
| Bone | Effluent | Child | Fish | 0.5 mi. ENE | 1.09E-02 |
| Liver | Environmental | Child | Drinking Water | 101 (3.3 mi E) | 1.09E-01 |
| Liver | Effluent | Child | Drinking Water | 0.5 mi. ENE | 7.82E-02 |
| T. Body | Environmental | Adult | Drinking Water | 101 (3.3 mi E) | 7.93E-02 |
| T. Body | Effluent | Child | Drinking Water | 0.5 mi. ENE | 6.94E-02 |
| Thyroid | Environmental | Child | Drinking Water | 101 (3.3 mi E) | 5.91E-02 |
| Thyroid | Effluent | Child | Drinking Water | 0.5 mi. ENE | 6.76E-02 |
| Kidney | Environmental | Child | Drinking Water | 101 (3.3 mi E) | 7.55E-02 |
| Kidney | Effluent | Child | Drinking Water | 0.5 mi. ENE | 7.10E-02 |
| Lung | Environmental | Child | Drinking Water | 101 (3.3 mi E) | 6.50E-02 |
| Lung | Effluent | Child | Drinking Water | 0.5 mi. ENE | 6.88E-02 |
| GI-LLI | Environmental | Child | Drinking Water | 101 (3.3 mi E) | 5.95E-02 |
| GI-LLI | Effluent | Child | Drinking Water | 0.5 mi. ENE | 6.97E-02 |

(1) Critical Age is the highest total dose (all pathways) to an age group.

(2) Critical Pathway is the highest individual dose within the identified Critical Age group.

(3) Maximum dose is a summation of the fish, drinking water and shoreline sediment pathways.

GASEOUS RELEASE PATHWAY

IODINE, PARTICULATE, and TRITIUM

| Organ | Environmental or Effluent Data | Critical Age ⁽¹⁾ | Critical Pathway ⁽²⁾ | Location | Maximum Dose ⁽³⁾ (mrem) |
|---------|--------------------------------|-----------------------------|---------------------------------|-----------|------------------------------------|
| Skin | Environmental | - | - | - | 0.00E+00 |
| Skin | Effluent | All | Ground Plane | 0.5 mi. E | 7.70E-07 |
| Bone | Environmental | - | - | - | 0.00E+00 |
| Bone | Effluent | Child | Vegetation | 0.5 mi. E | 8.87E-07 |
| Liver | Environmental | - | - | - | 0.00E+00 |
| Liver | Effluent | Child | Vegetation | 0.5 mi. E | 7.42E-01 |
| T. Body | Environmental | - | - | - | 0.00E+00 |
| T. Body | Effluent | Child | Vegetation | 0.5 mi. E | 7.42E-01 |
| Thyroid | Environmental | - | - | - | 0.00E+00 |
| Thyroid | Effluent | Child | Vegetation | 0.5 mi. E | 7.42E-01 |
| Kidney | Environmental | - | - | - | 0.00E+00 |
| Kidney | Effluent | Child | Vegetation | 0.5 mi. E | 7.42E-01 |
| Lung | Environmental | - | - | - | 0.00E+00 |
| Lung | Effluent | Child | Vegetation | 0.5 mi. E | 7.42E-01 |
| GI-LLI | Environmental | - | - | - | 0.00E+00 |
| GI-LLI | Effluent | Child | Vegetation | 0.5 mi. E | 7.42E-01 |

(1) Critical Age is the highest total dose (all pathways) to an age group.

(2) Critical Pathway is the highest individual dose within the identified Critical Age group.

(3) Maximum dose is a summation of the ground/plane, inhalation, milk and vegetation pathways.

NOBLE GAS

| Air Dose | Environmental or Effluent Data | Critical Age | Critical Pathway | Location | Maximum Dose (mrad) |
|----------------|--------------------------------|--------------|------------------|-----------------|-------------------------|
| Beta Beta | Environmental Effluent | - N/A | - Noble Gas | - 0.5 mi.NNE | Not Sampled 2.58E-02 |
| Gamma Gamma | Environmental Effluent | - N/A | - Noble Gas | - 0.5 mi.NNE | Not Sampled 7.11E-02 |

TABLE 4.1-B

Maximum Individual Dose for 2002 based on Environmental Measurements (mrem) for McGuire Nuclear Station

| Age | Sample Medium | Bone | Liver | T. Body | Thyroid | Kidney | Lung | GI-LLI | Skin |
|---------------|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| Infant | Airborne | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | Drinking Water | 0.00E+00 | 5.73E-02 | 5.73E-02 | 5.73E-02 | 5.73E-02 | 5.73E-02 | 5.73E-02 | 0.00E+00 |
| | Milk | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | <u>TOTAL</u> | 0.00E+00 | 5.73E-02 | 5.73E-02 | 5.73E-02 | 5.73E-02 | 5.73E-02 | 5.73E-02 | 0.00E+00 |
| Child | Airborne | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | Drinking Water | 0.00E+00 | 5.84E-02 | 5.84E-02 | 5.84E-02 | 5.84E-02 | 5.84E-02 | 5.84E-02 | 0.00E+00 |
| | Milk | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | Broadleaf Vegetation | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | Fish | 5.26E-02 | 5.10E-02 | 8.14E-03 | 7.13E-04 | 1.71E-02 | 6.61E-03 | 1.03E-03 | 0.00E+00 |
| | <u>Shoreline Sediment</u> | 3.67E-05 | 3.67E-05 | 3.67E-05 | 3.67E-05 | 3.67E-05 | 3.67E-05 | 3.67E-05 | 4.29E-05 |
| | <u>TOTAL</u> | 5.26E-02 | 1.09E-01 | 6.66E-02 | 5.91E-02 | 7.55E-02 | 6.50E-02 | 5.95E-02 | 4.29E-05 |
| Teen | Airborne | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | Drinking Water | 0.00E+00 | 3.05E-02 | 3.05E-02 | 3.05E-02 | 3.05E-02 | 3.05E-02 | 3.05E-02 | 0.00E+00 |
| | Milk | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | Broadleaf Vegetation | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | Fish | 4.18E-02 | 5.64E-02 | 2.02E-02 | 8.63E-04 | 1.98E-02 | 8.21E-03 | 1.65E-03 | 0.00E+00 |
| | <u>Shoreline Sediment</u> | 1.75E-04 | 1.75E-04 | 1.75E-04 | 1.75E-04 | 1.75E-04 | 1.75E-04 | 1.75E-04 | 2.05E-04 |
| | <u>TOTAL</u> | 4.20E-02 | 8.71E-02 | 5.09E-02 | 3.15E-02 | 5.05E-02 | 3.89E-02 | 3.23E-02 | 2.05E-04 |
| Adult | Airborne | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | Drinking Water | 0.00E+00 | 4.32E-02 | 4.32E-02 | 4.32E-02 | 4.32E-02 | 4.32E-02 | 4.32E-02 | 0.00E+00 |
| | Milk | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | Broadleaf Vegetation | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | Fish | 3.90E-02 | 5.45E-02 | 3.61E-02 | 1.12E-03 | 1.92E-02 | 7.14E-03 | 2.15E-03 | 0.00E+00 |
| | <u>Shoreline Sediment</u> | 3.14E-05 | 3.14E-05 | 3.14E-05 | 3.14E-05 | 3.14E-05 | 3.14E-05 | 3.14E-05 | 3.67E-05 |
| | <u>TOTAL</u> | 3.90E-02 | 9.77E-02 | 7.93E-02 | 4.44E-02 | 6.24E-02 | 5.04E-02 | 4.54E-02 | 3.67E-05 |

Note: Dose tables are provided for sample media displaying positive nuclide occurrence.

McGuire Nuclear Station
Dose from Drinking Water Pathway for 2002 Data
Maximum Exposed Infant

Infant Dose from Drinking Water Pathway (mrem) = Usage (l) x Dose Factor (mrem/pCi ingested) x Concentration (pCi/l)

Usage (intake in one year) = 330 l

| Radionuclide | <u>Ingestion Dose Factor</u> | | | | | | | <u>Highest Annual Net Mean Concentration</u> | | <u>Dose (mrem)</u> | | | | | | |
|--------------------------|------------------------------|----------|----------|----------|----------|----------|----------|--|------------------|--------------------|----------|----------|----------|----------|----------|----------|
| | Bone | Liver | T. Body | Thyroid | Kidney | Lung | GI-LLI | Indicator Location | Water (pCi/l) | Bone | Liver | T. Body | Thyroid | Kidney | Lung | GI-LLI |
| | | | | | | | | | | | | | | | | |
| Mn-54 | NO DATA | 1.99E-05 | 4.51E-06 | NO DATA | 4.41E-06 | NO DATA | 7.31E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Co-58 | NO DATA | 3.60E-06 | 8.98E-06 | NO DATA | NO DATA | NO DATA | 8.97E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Fe-59 | 3.08E-05 | 5.38E-05 | 2.12E-05 | NO DATA | NO DATA | 1.59E-05 | 2.57E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Co-60 | NO DATA | 1.08E-05 | 2.55E-05 | NO DATA | NO DATA | NO DATA | 2.57E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Zn-65 | 1.84E-05 | 6.31E-05 | 2.91E-05 | NO DATA | 3.06E-05 | NO DATA | 5.33E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Nb-95 | 4.20E-08 | 1.73E-08 | 1.00E-08 | NO DATA | 1.24E-08 | NO DATA | 1.46E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Zr-95 | 2.06E-07 | 5.02E-08 | 3.56E-08 | NO DATA | 5.41E-08 | NO DATA | 2.50E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| I-131 | 3.59E-05 | 4.23E-05 | 1.86E-05 | 1.39E-02 | 4.94E-05 | NO DATA | 1.51E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Cs-134 | 3.77E-04 | 7.03E-04 | 7.10E-05 | NO DATA | 1.81E-04 | 7.42E-05 | 1.91E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Cs-137 | 5.22E-04 | 6.11E-04 | 4.33E-05 | NO DATA | 1.64E-04 | 6.64E-05 | 1.91E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BaLa-140 | 1.71E-04 | 1.71E-07 | 8.81E-06 | NO DATA | 4.06E-08 | 1.05E-07 | 4.20E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| H-3 | NO DATA | 3.08E-07 | 3.08E-07 | 3.08E-07 | 3.08E-07 | 3.08E-07 | 3.08E-07 | 101 | 564.00 | 0.00E+00 | 5.73E-02 | 5.73E-02 | 5.73E-02 | 5.73E-02 | 5.73E-02 | 5.73E-02 |
| Dose Commitment (mrem) = | | | | | | | | | | 0.00E+00 | 5.73E-02 | 5.73E-02 | 5.73E-02 | 5.73E-02 | 5.73E-02 | 5.73E-02 |

McGuire Nuclear Station
Dose from Drinking Water Pathway for 2002 Data
Maximum Exposed Child

Child Dose from Drinking Water Pathway (mrem) = Usage (l) x Dose Factor (mrem/pCi ingested) x Concentration (pCi/l)

Usage (Intake in one year)= 510 l

| Radionuclide | <u>Ingestion Dose Factor</u> | | | | | | | <u>Highest Annual Net Mean Concentration</u> | | <u>Dose (mrem)</u> | | | | | | |
|--------------|------------------------------|----------|----------|----------|----------|----------|----------|--|------------------|--------------------|----------|----------|----------|----------|----------|----------|
| | Bone | Liver | T. Body | Thyroid | Kidney | Lung | GI-LLI | Indicator Location | Water (pCi/l) | Bone | Liver | T. Body | Thyroid | Kidney | Lung | GI-LLI |
| Mn-54 | NO DATA | 1.07E-05 | 2.85E-06 | NO DATA | 3.00E-06 | NO DATA | 8.98E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Co-58 | NO DATA | 1.80E-06 | 5.51E-06 | NO DATA | NO DATA | NO DATA | 1.05E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Fe-59 | 1.65E-05 | 2.67E-05 | 1.33E-05 | NO DATA | NO DATA | 7.74E-06 | 2.78E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| C0-60 | NO DATA | 5.29E-06 | 1.56E-05 | NO DATA | NO DATA | NO DATA | 2.93E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Zn-65 | 1.37E-05 | 3.65E-05 | 2.27E-05 | NO DATA | 2.30E-05 | NO DATA | 6.41E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Nb-95 | 2.25E-08 | 8.76E-09 | 6.26E-09 | NO DATA | 8.23E-09 | NO DATA | 1.62E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Zr-95 | 1.16E-07 | 2.55E-08 | 2.27E-08 | NO DATA | 3.65E-08 | NO DATA | 2.66E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| I-131 | 1.72E-05 | 1.73E-05 | 9.83E-06 | 5.72E-03 | 2.84E-05 | NO DATA | 1.54E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Cs-134 | 2.34E-04 | 3.84E-04 | 8.10E-05 | NO DATA | 1.19E-04 | 4.27E-05 | 2.07E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Cs-137 | 3.27E-04 | 3.13E-04 | 4.62E-05 | NO DATA | 1.02E-04 | 3.67E-05 | 1.96E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BaLa-140 | 8.31E-05 | 7.28E-08 | 4.85E-06 | NO DATA | 2.37E-08 | 4.34E-08 | 4.21E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| H-3 | NO DATA | 2.03E-07 | 2.03E-07 | 2.03E-07 | 2.03E-07 | 2.03E-07 | 2.03E-07 | 101 | 564.00 | 0.00E+00 | 5.84E-02 | 5.84E-02 | 5.84E-02 | 5.84E-02 | 5.84E-02 | 5.84E-02 |

Dose Commitment (mrem) =

0.00E+00 5.84E-02 5.84E-02 5.84E-02 5.84E-02 5.84E-02 5.84E-02

McGuire Nuclear Station
Dose from Fish Pathway for 2002 Data
Maximum Exposed Child

Child Dose from Fish Pathway (mrem) = Usage (kg) x Dose Factor (mrem/pCi ingested) x Concentration (pCi/kg)

H-3 Concentration in Fish = Surface Water pCi/l x Bioaccumulation Factor 0.9 pCi/kg per pCi/l = 565 pCi/l x 0.9 = 509 pCi/kg

Usage (Intake in one year) = 6.9 kg

| Radionuclide | <u>Ingestion Dose Factor</u> | | | | | | | <u>Highest Annual Net Mean Concentration</u> | | <u>Dose (mrem)</u> | | | | | | |
|--------------------------|------------------------------|----------|----------|----------|----------|----------|----------|--|----------|--------------------|----------|----------|----------|----------|----------|----------|
| | Bone | Liver | T. Body | Thyroid | Kidney | Lung | GI-LLI | Indicator | Fish | Bone | Liver | T. Body | Thyroid | Kidney | Lung | GI-LLI |
| | | | | | | | | Location | (pCi/kg) | | | | | | | |
| Mn-54 | NO DATA | 1.07E-05 | 2.85E-06 | NO DATA | 3.00E-06 | NO DATA | 8.98E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Co-58 | NO DATA | 1.80E-06 | 5.51E-06 | NO DATA | NO DATA | NO DATA | 1.05E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Fe-59 | 1.65E-05 | 2.67E-05 | 1.33E-05 | NO DATA | NO DATA | 7.74E-06 | 2.78E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Co-60 | NO DATA | 5.29E-06 | 1.56E-05 | NO DATA | NO DATA | NO DATA | 2.93E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Zn-65 | 1.37E-05 | 3.65E-05 | 2.27E-05 | NO DATA | 2.30E-05 | NO DATA | 6.41E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Cs-134 | 2.34E-04 | 3.84E-04 | 8.10E-05 | NO DATA | 1.19E-04 | 4.27E-05 | 2.07E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Cs-137 | 3.27E-04 | 3.13E-04 | 4.62E-05 | NO DATA | 1.02E-04 | 3.67E-05 | 1.96E-06 | 129 | 23.30 | 5.26E-02 | 5.03E-02 | 7.43E-03 | 0.00E+00 | 1.64E-02 | 5.90E-03 | 3.15E-04 |
| H-3 | NO DATA | 2.03E-07 | 2.03E-07 | 2.03E-07 | 2.03E-07 | 2.03E-07 | 2.03E-07 | 128 | 509.00 | 0.00E+00 | 7.13E-04 | 7.13E-04 | 7.13E-04 | 7.13E-04 | 7.13E-04 | 7.13E-04 |
| Dose Commitment (mrem) = | | | | | | | | | | 5.26E-02 | 5.10E-02 | 8.14E-03 | 7.13E-04 | 1.71E-02 | 6.61E-03 | 1.03E-03 |

McGuire Nuclear Station
Dose from Shoreline Sediment Pathway for 2002 Data
Maximum Exposed Child

Shoreline Recreation = 14 hr (in one year)
 Shore Width Factor = 0.3 (lake shore - location 129)
 Shore Width Factor = 0.2 (river shoreline - location 130)
 Sediment Surface Mass = 40 kg/m²

Child Dose from Shoreline Sediment Pathway (mrem) = Shoreline Recreation (hr) x External Dose Factor (mrem/hr per pCi/m²) x Shore Width Factor x Sediment Surface Mass (kg/m²) x Sediment Concentration (pCi/kg)

| Radionuclide | External Dose Factor Standing on Contaminated Ground | | Indicator Location | Sediment (pCi/kg) | Highest Annual Net Mean Concentration | | Dose |
|--------------------------|---|----------|-----------------------|----------------------|--|----------|------|
| | (mrem/hr per pCi/m ²) T. Body | Skin | | | (mrem) T. Body | Skin | |
| Mn-54 | 5.80E-09 | 6.80E-09 | 130 | 22.40 | 1.46E-05 | 1.71E-05 | |
| Co-58 | 7.00E-09 | 8.20E-09 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | |
| Co-60 | 1.70E-08 | 2.00E-08 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | |
| Cs-134 | 1.20E-08 | 1.40E-08 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | |
| Cs-137 | 4.20E-09 | 4.90E-09 | 130 | 47.00 | 2.21E-05 | 2.58E-05 | |
| Dose Commitment (mrem) = | | | | | 3.67E-05 | 4.29E-05 | |

McGuire Nuclear Station
Dose from Drinking Water Pathway for 2002 Data
Maximum Exposed Teen

Teen Dose from Drinking Water Pathway (mrem) = Usage (l) x Dose Factor (mrem/pCi ingested) x Concentration (pCi/l)

Usage (intake in one year)= 510 l

| Radionuclide | <u>Ingestion Dose Factor</u> | | | | | | | <u>Highest Annual Net Mean Concentration</u> | | <u>Dose (mrem)</u> | | | | | | |
|-------------------------|------------------------------|----------|----------|----------|----------|----------|----------|--|------------------|--------------------|----------|----------|----------|----------|----------|----------|
| | Bone | Liver | T. Body | Thyroid | Kidney | Lung | GI-LLI | Indicator Location | Water (pCi/l) | Bone | Liver | T. Body | Thyroid | Kidney | Lung | GI-LLI |
| | | | | | | | | | | | | | | | | |
| Mn-54 | NO DATA | 5.90E-06 | 1.17E-06 | NO DATA | 1.76E-06 | NO DATA | 1.21E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Co-58 | NO DATA | 9.72E-07 | 2.24E-06 | NO DATA | NO DATA | NO DATA | 1.34E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Fe-59 | 5.87E-06 | 1.37E-05 | 5.29E-06 | NO DATA | NO DATA | 4.32E-06 | 3.24E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Co-60 | NO DATA | 2.81E-06 | 6.33E-06 | NO DATA | NO DATA | NO DATA | 3.66E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Zn-65 | 5.76E-06 | 2.00E-05 | 9.33E-06 | NO DATA | 1.28E-05 | NO DATA | 8.47E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Nb-95 | 8.22E-09 | 4.56E-09 | 2.51E-09 | NO DATA | 4.42E-09 | NO DATA | 1.95E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Zr-95 | 4.12E-08 | 1.30E-08 | 8.94E-09 | NO DATA | 1.91E-08 | NO DATA | 3.00E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| I-131 | 5.85E-06 | 8.19E-06 | 4.40E-06 | 2.39E-03 | 1.41E-05 | NO DATA | 1.62E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Cs-134 | 8.37E-05 | 1.97E-04 | 9.14E-05 | NO DATA | 6.26E-05 | 2.39E-05 | 2.45E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Cs-137 | 1.12E-04 | 1.49E-04 | 5.19E-05 | NO DATA | 5.07E-05 | 1.97E-05 | 2.12E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BaLa-140 | 2.84E-05 | 3.48E-08 | 1.83E-06 | NO DATA | 1.18E-08 | 2.34E-08 | 4.38E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| H-3 | NO DATA | 1.06E-07 | 1.06E-07 | 1.06E-07 | 1.06E-07 | 1.06E-07 | 1.06E-07 | 101 | 564.00 | 0.00E+00 | 3.05E-02 | 3.05E-02 | 3.05E-02 | 3.05E-02 | 3.05E-02 | 3.05E-02 |
| Dose Commitment (mrem)= | | | | | | | | | | 0.00E+00 | 3.05E-02 | 3.05E-02 | 3.05E-02 | 3.05E-02 | 3.05E-02 | 3.05E-02 |

McGuire Nuclear Station
Dose from Fish Pathway for 2002 Data
Maximum Exposed Teen

Teen Dose from Fish Pathway (mrem) = Usage (kg) x Dose Factor (mrem/pCi ingested) x Concentration (pCi/kg)

H-3 Concentration in Fish = Surface Water pCi/l x Bioaccumulation Factor 0.9 pCi/kg per pCi/l = 565 pCi/l x 0.9 = 509 pCi/kg

Usage (Intake in one year) = 16 kg

| Radionuclide | <u>Ingestion Dose Factor</u> | | | | | | | <u>Highest Annual Net Mean Concentration</u> | | <u>Dose (mrem)</u> | | | | | | |
|--------------------------|------------------------------|----------|----------|----------|----------|----------|----------|--|----------|--------------------|----------|----------|----------|----------|----------|----------|
| | Bone | Liver | T. Body | Thyroid | Kidney | Lung | GI-LLI | Location | (pCi/kg) | Bone | Liver | T. Body | Thyroid | Kidney | Lung | GI-LLI |
| Mn-54 | NO DATA | 5.90E-06 | 1.17E-06 | NO DATA | 1.76E-06 | NO DATA | 1.21E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Co-58 | NO DATA | 9.72E-07 | 2.24E-06 | NO DATA | NO DATA | NO DATA | 1.34E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Fe-59 | 5.87E-06 | 1.37E-05 | 5.29E-06 | NO DATA | NO DATA | 4.32E-06 | 3.24E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Co-60 | NO DATA | 2.81E-06 | 6.33E-06 | NO DATA | NO DATA | NO DATA | 3.66E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Zn-65 | 5.76E-06 | 2.00E-05 | 9.33E-06 | NO DATA | 1.28E-05 | NO DATA | 8.47E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Cs-134 | 8.37E-05 | 1.97E-04 | 9.14E-05 | NO DATA | 6.26E-05 | 2.39E-05 | 2.45E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Cs-137 | 1.12E-04 | 1.49E-04 | 5.19E-05 | NO DATA | 5.07E-05 | 1.97E-05 | 2.12E-06 | 129 | 23.30 | 4.18E-02 | 5.55E-02 | 1.93E-02 | 0.00E+00 | 1.89E-02 | 7.34E-03 | 7.90E-04 |
| H-3 | NO DATA | 1.06E-07 | 1.06E-07 | 1.06E-07 | 1.06E-07 | 1.06E-07 | 1.06E-07 | 128 | 509.00 | 0.00E+00 | 8.63E-04 | 8.63E-04 | 8.63E-04 | 8.63E-04 | 8.63E-04 | 8.63E-04 |
| Dose Commitment (mrem) = | | | | | | | | | | 4.18E-02 | 5.64E-02 | 2.02E-02 | 8.63E-04 | 1.98E-02 | 8.21E-03 | 1.65E-03 |

McGuire Nuclear Station
Dose from Shoreline Sediment Pathway for 2002 Data
Maximum Exposed Teen

Shoreline Recreation = 67 hr (in one year)
 Shore Width Factor = 0.3 (lake shore - location 129)
 Shore Width Factor = 0.2 (river shoreline - location 130)
 Sediment Surface Mass = 40 kg/m²

Teen Dose from Shoreline Sediment Pathway (mrem) = Shoreline Recreation (hr) x External
 Dose Factor (mrem/hr per pCi/m²) x Shore Width Factor x Sediment Surface Mass (kg/m²) x
 Sediment Concentration (pCi/kg)

| External Dose Factor Standing on Contaminated Ground | | | Highest Annual Net Mean Concentration | | Dose | |
|---|-----------------------------------|----------|--|----------------------|----------|----------|
| Radionuclide | (mrem/hr per pCi/m ²) | | Indicator Location | Sediment (pCi/kg) | (mrem) | |
| | T. Body | Skin | | | T. Body | Skin |
| Mn-54 | 5.80E-09 | 6.80E-09 | 130 | 22.40 | 6.96E-05 | 8.16E-05 |
| Co-58 | 7.00E-09 | 8.20E-09 | ALL | 0.00 | 0.00E+00 | 0.00E+00 |
| Co-60 | 1.70E-08 | 2.00E-08 | ALL | 0.00 | 0.00E+00 | 0.00E+00 |
| Cs-134 | 1.20E-08 | 1.40E-08 | ALL | 0.00 | 0.00E+00 | 0.00E+00 |
| Cs-137 | 4.20E-09 | 4.90E-09 | 130 | 47.00 | 1.06E-04 | 1.23E-04 |
| Dose Commitment (mrem) = | | | | | 1.75E-04 | 2.05E-04 |

McGuire Nuclear Station
Dose from Drinking Water Pathway for 2002 Data
Maximum Exposed Adult

Adult Dose from Drinking Water Pathway (mrem) = Usage (l) x Dose Factor (mrem/pCi ingested) x Concentration (pCi/l)

Usage (intake in one year) = 730 l

| Radionuclide | <u>Ingestion Dose Factor</u> | | | | | | | <u>Highest Annual Net Mean Concentration</u> | | <u>Dose (mrem)</u> | | | | | | |
|--------------------------|------------------------------|----------|----------|----------|----------|----------|----------|--|---------|--------------------|----------|----------|----------|----------|----------|----------|
| | Bone | Liver | T. Body | Thyroid | Kidney | Lung | GI-LLI | Indicator | Water | Bone | Liver | T. Body | Thyroid | Kidney | Lung | GI-LLI |
| | | | | | | | | Location | (pCi/l) | | | | | | | |
| Mn-54 | NO DATA | 4.57E-06 | 8.72E-07 | NO DATA | 1.36E-06 | NO DATA | 1.40E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Co-58 | NO DATA | 7.45E-07 | 1.67E-06 | NO DATA | NO DATA | NO DATA | 1.51E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Fe-59 | 4.34E-06 | 1.02E-05 | 3.91E-06 | NO DATA | NO DATA | 2.85E-06 | 3.40E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Co-60 | NO DATA | 2.14E-06 | 4.72E-06 | NO DATA | NO DATA | NO DATA | 4.02E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Zn-65 | 4.84E-06 | 1.54E-05 | 6.96E-06 | NO DATA | 1.03E-05 | NO DATA | 9.70E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Nb-95 | 6.22E-09 | 3.46E-09 | 1.86E-09 | NO DATA | 3.42E-09 | NO DATA | 2.10E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Zr-95 | 3.04E-08 | 9.75E-09 | 6.60E-09 | NO DATA | 1.53E-08 | NO DATA | 3.09E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| I-131 | 4.16E-06 | 5.95E-06 | 3.41E-06 | 1.95E-03 | 1.02E-05 | NO DATA | 1.57E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Cs-134 | 6.22E-05 | 1.48E-04 | 1.21E-04 | NO DATA | 4.79E-05 | 1.59E-05 | 2.59E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Cs-137 | 7.97E-05 | 1.09E-04 | 7.14E-05 | NO DATA | 3.70E-05 | 1.23E-05 | 2.11E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BaLa-140 | 2.03E-05 | 2.55E-08 | 1.33E-06 | NO DATA | 8.67E-09 | 1.46E-08 | 4.18E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| H-3 | NO DATA | 1.05E-07 | 1.05E-07 | 1.05E-07 | 1.05E-07 | 1.05E-07 | 1.05E-07 | 101 | 564.00 | 0.00E+00 | 4.32E-02 | 4.32E-02 | 4.32E-02 | 4.32E-02 | 4.32E-02 | 4.32E-02 |
| Dose Commitment (mrem) = | | | | | | | | | | 0.00E+00 | 4.32E-02 | 4.32E-02 | 4.32E-02 | 4.32E-02 | 4.32E-02 | 4.32E-02 |

McGuire Nuclear Station
Dose from Fish Pathway for 2002 Data
Maximum Exposed Adult

Adult Dose from Fish Pathway (mrem) = Usage (kg) x Dose Factor (mrem/pCi ingested) x Concentration (pCi/kg)

H-3 Concentration in Fish = Surface Water pCi/l x Bioaccumulation Factor 0.9 pCi/kg per pCi/l = 565 pCi/l x 0.9 = 509 pCi/kg

Usage (intake in one year) = 21 kg

| Radionuclide | <u>Ingestion Dose Factor</u> | | | | | | | <u>Highest Annual Net Mean Concentration</u> | | <u>Dose (mrem)</u> | | | | | | |
|--------------------------|------------------------------|----------|----------|----------|----------|----------|----------|--|----------|--------------------|----------|----------|----------|----------|----------|----------|
| | Bone | Liver | T. Body | Thyroid | Kidney | Lung | GI-LLI | Location | (pCi/kg) | Bone | Liver | T. Body | Thyroid | Kidney | Lung | GI-LLI |
| Mn-54 | NO DATA | 4.57E-06 | 8.72E-07 | NO DATA | 1.36E-06 | NO DATA | 1.40E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Co-58 | NO DATA | 7.45E-07 | 1.67E-06 | NO DATA | NO DATA | NO DATA | 1.51E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Fe-59 | 4.34E-06 | 1.02E-05 | 3.91E-06 | NO DATA | NO DATA | 2.85E-06 | 3.40E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Co-60 | NO DATA | 2.14E-06 | 4.72E-06 | NO DATA | NO DATA | NO DATA | 4.02E-05 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Zn-65 | 4.84E-06 | 1.54E-05 | 6.96E-06 | NO DATA | 1.03E-05 | NO DATA | 9.70E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Cs-134 | 6.22E-05 | 1.48E-04 | 1.21E-04 | NO DATA | 4.79E-05 | 1.59E-05 | 2.59E-06 | ALL | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Cs-137 | 7.97E-05 | 1.09E-04 | 7.14E-05 | NO DATA | 3.70E-05 | 1.23E-05 | 2.11E-06 | 129 | 23.30 | 3.90E-02 | 5.33E-02 | 3.49E-02 | 0.00E+00 | 1.81E-02 | 6.02E-03 | 1.03E-03 |
| H-3 | NO DATA | 1.05E-07 | 1.05E-07 | 1.05E-07 | 1.05E-07 | 1.05E-07 | 1.05E-07 | 128 | 509.00 | 0.00E+00 | 1.12E-03 | 1.12E-03 | 1.12E-03 | 1.12E-03 | 1.12E-03 | 1.12E-03 |
| Dose Commitment (mrem) = | | | | | | | | | | 3.90E-02 | 5.45E-02 | 3.61E-02 | 1.12E-03 | 1.92E-02 | 7.14E-03 | 2.15E-03 |

McGuire Nuclear Station
Dose from Shoreline Sediment Pathway for 2002 Data
Maximum Exposed Adult

Shoreline Recreation = 12 hr (in one year)
Shore Width Factor = 0.3 (lake shore - location 129)
Shore Width Factor = 0.2 (river shoreline - location 130)
Sediment Surface Mass = 40 kg/m²

Adult Dose from Shoreline Sediment Pathway (mrem) = Shoreline Recreation (hr) x External Dose Factor (mrem/hr per pCi/m²) x Shore Width Factor x Sediment Surface Mass (kg/m²) x Sediment Concentration (pCi/kg)

| <u>External Dose Factor Standing on Contaminated Ground</u> | | | <u>Highest Annual Net Mean Concentration</u> | | <u>Dose</u> | |
|---|-----------------------------------|----------|--|----------------------|-------------|----------|
| Radionuclide | (mrem/hr per pCi/m ²) | | Indicator Location | Sediment (pCi/kg) | (mrem) | |
| | T. Body | Skin | | | T. Body | Skin |
| Mn-54 | 5.80E-09 | 6.80E-09 | 130 | 22.40 | 1.25E-05 | 1.46E-05 |
| Co-58 | 7.00E-09 | 8.20E-09 | ALL | 0.00 | 0.00E+00 | 0.00E+00 |
| Co-60 | 1.70E-08 | 2.00E-08 | ALL | 0.00 | 0.00E+00 | 0.00E+00 |
| Cs-134 | 1.20E-08 | 1.40E-08 | ALL | 0.00 | 0.00E+00 | 0.00E+00 |
| Cs-137 | 4.20E-09 | 4.90E-09 | 130 | 47.00 | 1.90E-05 | 2.21E-05 |
| Dose Commitment (mrem) = | | | | | 3.14E-05 | 3.67E-05 |

5.0 QUALITY ASSURANCE

5.1 SAMPLE COLLECTION

EnRad Laboratories, Fisheries, and Aquatic Ecology performed the environmental sample collections as specified by approved sample collection procedures.

5.2 SAMPLE ANALYSIS

EnRad Laboratories performed the environmental sample analyses as specified by approved analysis procedures. EnRad Laboratories is located in Huntersville, North Carolina, at Duke Power Company's Environmental Center.



Duke Power Company's
Environmental Center

5.3 DOSIMETRY ANALYSIS

The Radiation Dosimetry and Records group performed environmental dosimetry measurements as specified by approved dosimetry analysis procedures.

5.4 LABORATORY EQUIPMENT QUALITY ASSURANCE

5.4.1 DAILY QUALITY CONTROL

EnRad Laboratories has an internal quality assurance program which monitors each type of instrumentation for reliability and accuracy. Daily quality control checks ensure that instruments are in proper working order and these checks are used to monitor instrument performance.

5.4.2 CALIBRATION VERIFICATION

National Institute of Standards and Technology (NIST) standards that represent counting geometries are analyzed as unknowns at various frequencies ranging from weekly to annually to verify that efficiency calibrations are valid. The frequency is dependent upon instrument use and performance. Investigations are performed and documented should calibration verification data fall out of limits.

5.4.3 BATCH PROCESSING

Method quality control samples are analyzed with sample analyses that are processed in batches. These include gross beta in drinking water and all tritium analyses.

5.5 DUKE POWER INTERCOMPARISON PROGRAM

EnRad Laboratories participated in the Duke Power Nuclear Generation Department Intercomparison Program during 2002. Interlaboratory cross-check standards, including, Marinelli beakers, air filters, air cartridges, gross beta on smears, and tritium in water samples were analyzed at various times of the year by the four counting laboratories in Duke Power Company for this program. A summary of these Intercomparison Reports for 2002 is documented in Table 5.0-A.

5.6 DUKE POWER AUDITS

The McGuire Radiation Protection Section was audited by the Quality Assurance Group in January of 2002. There were no findings as a result of this 2002 audit.

EnRad Laboratories was audited by the Quality Assurance Group in June of 2002. Laboratory practices and procedures were reviewed. No significant problems were identified as a result of this 2002 audit.

5.7 U.S. NUCLEAR REGULATORY COMMISSION INSPECTIONS

The McGuire Nuclear Station Radiological Environmental Monitoring Program was not audited by the NRC in 2002. EnRad Laboratories was not audited by the NRC in 2002.

5.8 STATE OF NORTH CAROLINA INTERCOMPARISON PROGRAM

EnRad Laboratories routinely participates with the State of North Carolina Department of Environmental Health and Natural Resources (DEHNR) in an intercomparison program. EnRad Laboratories sends air, water, milk, vegetation, sediment, and fish samples which have been collected to the State of North Carolina Radiation Protection Section for intercomparison analysis.

5.9 TLD INTERCOMPARISON PROGRAM

5.9.1 NUCLEAR TECHNOLOGY SERVICES INTERCOMPARISON PROGRAM

Radiation Dosimetry and Records participates in a quarterly TLD intercomparison program administered by Nuclear Technology Services, Inc.

of Roswell, GA. Nuclear Technology Services irradiates environmental dosimeters quarterly and sends them to the Radiation Dosimetry and Records group for analysis of the unknown estimated delivered exposure. A summary of the Nuclear Technology Services Intercomparison Report is documented in Table 5.0-B.

5.9.2 STATE OF NORTH CAROLINA INTERCOMPARISON PROGRAM

Radiation Dosimetry and Records routinely participates in a TLD intercomparison program. The State of North Carolina Radiation Protection Section irradiates environmental dosimeters and sends them to the Radiation Dosimetry and Records group for analysis of the unknown estimated delivered exposure. A summary of the State of North Carolina Environmental Dosimetry Intercomparison Report for 2002 is documented in Table 5.0-B.

5.9.3 INTERNAL CROSSCHECK (DUKE POWER)

Radiation Dosimetry and Records participates in a quarterly TLD intracomparison program administered internally by the Dosimetry Lab. The Dosimetry Lab Staff irradiates environmental dosimeters quarterly and submits them for analysis of the unknown estimated delivered exposure. A summary of the Internal Cross Check (Duke Power) Result is documented in Table 5.0-B.

TABLE 5.0-A

DUKE POWER COMPANY

INTERLABORATORY COMPARISON PROGRAM

2002 CROSS-CHECK RESULTS FOR ENRAD LABORATORIES

Cross-Check samples are normally analyzed a minimum of three times. A status of "3 Pass" indicates that all three analyses yielded results within the designated acceptance range. A status of "1 Pass" indicates that one analysis of the cross-check was performed.

Footnote explanations are included following this data table.

Gamma in Water 3.5 liters

| Reference Date | Sample I.D. | Nuclide | Acceptance Range pCi/l | Reference Value pCi/l | Mean Reported Value pCi/l | Cross Check Status |
|----------------|-------------|---------|---------------------------|--------------------------|------------------------------|-----------------------|
| 3/15/2002 | Q021GWSL | Cr-51 | 0.95 - 1.69 E5 | 1.27 E5 | 1.25 E5 | 3 Pass |
| | | Mn-54 | 0.82 - 1.45 E5 | 1.09 E5 | 1.13 E5 | 3 Pass |
| | | Fe-59 | 4.17 - 7.40 E4 | 5.56 E4 | 5.78 E4 | 3 Pass |
| | | Co-60 | 5.75 - 10.20 E4 | 7.67 E4 | 7.68 E4 | 3 Pass |
| | | Zn-65 | 0.80 - 1.43 E5 | 1.07 E5 | 1.12 E5 | 3 Pass |
| | | Cs-134 | 4.46 - 7.91 E4 | 5.95 E4 | 5.36 E4 | 3 Pass |
| | | Cs-137 | 0.97 - 1.72 E5 | 1.29 E5 | 1.24 E5 | 3 Pass |
| | | Ce-139 | 0.00 - 0.00 E0 | 0.00 E0 | 1.82 E3 | 3 Pass ⁽¹⁾ |
| | | Ce-141 | 1.17 - 2.07 E5 | 1.56 E5 | 1.55 E5 | 3 Pass |
| 5/14/2002 | Q022GWR | Cr-51 | 6.77 - 12.01 E3 | 9.03 E3 | 9.32 E3 | 3 Pass |
| | | Mn-54 | 1.38 - 2.45 E3 | 1.84 E3 | 1.98 E3 | 3 Pass |
| | | Co-58 | 1.82 - 3.24 E3 | 2.43 E3 | 2.48 E3 | 3 Pass |
| | | Fe-59 | 1.75 - 3.10 E3 | 2.33 E3 | 2.44 E3 | 3 Pass |
| | | Co-60 | 1.71 - 3.04 E3 | 2.28 E3 | 2.38 E3 | 3 Pass |
| | | Zn-65 | 2.66 - 4.71 E3 | 3.54 E3 | 3.73 E3 | 3 Pass |
| | | Cs-134 | 1.68 - 2.98 E3 | 2.24 E3 | 2.10 E3 | 3 Pass |
| | | Cs-137 | 1.24 - 2.20 E3 | 1.65 E3 | 1.60 E3 | 3 Pass |
| | | Ce-141 | 2.32 - 4.11 E3 | 3.09 E3 | 3.13 E3 | 3 Pass |
| 8/16/2002 | Q023GWS | Cr-51 | 1.58 - 2.80 E5 | 2.10 E5 | 2.10 E5 | 3 Pass |
| | | Mn-54 | 5.73 - 10.16 E4 | 7.64 E4 | 8.16 E4 | 3 Pass |
| | | Co-58 | 4.47 - 7.93 E4 | 5.96 E4 | 6.20 E4 | 3 Pass |
| | | Fe-59 | 4.76 - 8.44 E4 | 6.34 E4 | 6.85 E4 | 3 Pass |
| | | Co-60 | 5.29 - 9.38 E4 | 7.06 E4 | 7.20 E4 | 3 Pass |
| | | Zn-65 | 7.16 - 12.70 E4 | 9.55 E4 | 1.03 E5 | 3 Pass |
| | | Cs-134 | 4.79 - 8.49 E4 | 6.39 E4 | 5.78 E4 | 3 Pass |
| | | Cs-137 | 4.48 - 7.95 E4 | 5.98 E4 | 5.76 E4 | 3 Pass |
| | | Ce-141 | 1.00 - 1.78 E5 | 1.34 E5 | 1.38 E5 | 3 Pass |

Gamma in Water 3.5 liters continued

| Reference Date | Sample I.D. | Nuclide | Acceptance Range pCi/l | Reference Value pCi/l | Mean Reported Value pCi/l | Cross Check Status |
|----------------|-------------|---------|---------------------------|--------------------------|------------------------------|-----------------------|
| 11/19/2002 | Q024GWR | Cr-51 | 2.08 - 3.70 E4 | 2.78 E4 | 3.09 E4 | 3 Pass |
| | | Mn-54 | 5.96 - 10.56 E3 | 7.94 E3 | 9.12 E3 | 3 Pass |
| | | Co-57 | 0.00 - 0.00 E0 | 0.00 E0 | 6.65 E1 | 3 Pass ⁽¹⁾ |
| | | Co-58 | 6.54 - 11.60 E3 | 8.72 E3 | 9.79 E3 | 3 Pass |
| | | Fe-59 | 3.72 - 6.60 E3 | 4.96 E3 | 5.95 E3 | 3 Pass |
| | | Co-60 | 6.68 - 11.85 E3 | 8.91 E3 | 1.02 E4 | 3 Pass |
| | | Zn-65 | 0.75 - 1.33 E4 | 1.00 E4 | 1.22 E4 | 3 Pass |
| | | Cs-134 | 4.04 - 7.16 E3 | 5.38 E3 | 5.46 E3 | 3 Pass |
| | | Cs-137 | 0.89 - 1.58 E4 | 1.19 E4 | 1.27 E4 | 3 Pass |
| | | Ce-141 | 6.32 - 11.21 E3 | 8.43 E3 | 9.56 E3 | 3 Pass |

Gamma in Water 1.0 liter

| Reference Date | Sample I.D. | Nuclide | Acceptance Range pCi/l | Reference Value pCi/l | Mean Reported Value pCi/l | Cross Check Status |
|----------------|-------------|---------|---------------------------|--------------------------|------------------------------|-----------------------|
| 3/15/2002 | Q021GWSL | Cr-51 | 0.95 - 1.69 E5 | 1.27 E5 | 1.28 E5 | 3 Pass |
| | | Mn-54 | 0.82 - 1.45 E5 | 1.09 E5 | 1.16 E5 | 3 Pass |
| | | Fe-59 | 4.17 - 7.40 E4 | 5.56 E4 | 5.85 E4 | 3 Pass |
| | | Co-60 | 5.75 - 10.20 E4 | 7.67 E4 | 7.70 E4 | 3 Pass |
| | | Zn-65 | 0.80 - 1.43 E5 | 1.07 E5 | 1.13 E5 | 3 Pass |
| | | Cs-134 | 4.46 - 7.91 E4 | 5.95 E4 | 5.51 E4 | 3 Pass |
| | | Cs-137 | 0.97 - 1.72 E5 | 1.29 E5 | 1.27 E5 | 3 Pass |
| | | Ce-139 | 0.00 - 0.00 E0 | 0.00 E0 | 1.84 E3 | 3 Pass ⁽¹⁾ |
| | | Ce-141 | 1.17 - 2.07 E5 | 1.56 E5 | 1.60 E5 | 3 Pass |
| 5/14/2002 | Q022GWR | Cr-51 | 6.77 - 12.01 E3 | 9.03 E3 | 9.07 E3 | 3 Pass |
| | | Mn-54 | 1.38 - 2.45 E3 | 1.84 E3 | 2.00 E3 | 3 Pass |
| | | Co-58 | 1.82 - 3.24 E3 | 2.43 E3 | 2.43 E3 | 3 Pass |
| | | Fe-59 | 1.75 - 3.10 E3 | 2.33 E3 | 2.57 E3 | 3 Pass |
| | | Co-60 | 1.71 - 3.04 E3 | 2.28 E3 | 2.44 E3 | 3 Pass |
| | | Zn-65 | 2.66 - 4.71 E3 | 3.54 E3 | 3.86 E3 | 3 Pass |
| | | Cs-134 | 1.68 - 2.98 E3 | 2.24 E3 | 1.98 E3 | 3 Pass |
| | | Cs-137 | 1.24 - 2.20 E3 | 1.65 E3 | 1.57 E3 | 3 Pass |
| | | Ce-141 | 2.32 - 4.11 E3 | 3.09 E3 | 3.13 E3 | 3 Pass |
| 8/16/2002 | Q023GWS | Cr-51 | 1.58 - 2.80 E5 | 2.10 E5 | 2.11 E5 | 3 Pass |
| | | Mn-54 | 5.73 - 10.16 E4 | 7.64 E4 | 8.09 E4 | 3 Pass |
| | | Co-58 | 4.47 - 7.93 E4 | 5.96 E4 | 6.17 E4 | 3 Pass |
| | | Fe-59 | 4.76 - 8.44 E4 | 6.34 E4 | 6.67 E4 | 3 Pass |
| | | Co-60 | 5.29 - 9.38 E4 | 7.06 E4 | 7.02 E4 | 3 Pass |
| | | Zn-65 | 7.16 - 12.70 E4 | 9.55 E4 | 1.01 E5 | 3 Pass |
| | | Cs-134 | 4.79 - 8.49 E4 | 6.39 E4 | 5.82 E4 | 3 Pass |
| | | Cs-137 | 4.48 - 7.95 E4 | 5.98 E4 | 5.76 E4 | 3 Pass |
| | | Ce-141 | 1.00 - 1.78 E5 | 1.34 E5 | 1.37 E5 | 3 Pass |

Gamma in Water 1.0 liter continued

| Reference Date | Sample I.D. | Nuclide | Acceptance Range pCi/l | Reference Value pCi/l | Mean Reported Value pCi/l | Cross Check Status |
|----------------|-------------|---------|---------------------------|--------------------------|------------------------------|-----------------------|
| 11/19/2002 | Q024GWR | Cr-51 | 2.08 - 3.70 E4 | 2.78 E4 | 3.15 E4 | 3 Pass |
| | | Mn-54 | 5.96 - 10.56 E3 | 7.94 E3 | 9.12 E3 | 3 Pass |
| | | Co-57 | 0.00 - 0.00 E0 | 0.00 E0 | 3.87 E1 | 3 Pass ⁽¹⁾ |
| | | Co-58 | 6.54 - 11.60 E3 | 8.72 E3 | 9.71 E3 | 3 Pass |
| | | Fe-59 | 3.72 - 6.60 E3 | 4.96 E3 | 6.07 E3 | 3 Pass |
| | | Co-60 | 6.68 - 11.85 E3 | 8.91 E3 | 1.01 E4 | 3 Pass |
| | | Zn-65 | 0.75 - 1.33 E4 | 1.00 E4 | 1.22 E4 | 3 Pass |
| | | Cs-134 | 4.04 - 7.16 E3 | 5.38 E3 | 5.24 E3 | 3 Pass |
| | | Cs-137 | 0.89 - 1.58 E4 | 1.19 E4 | 1.29 E4 | 3 Pass |
| | | Ce-141 | 6.32 - 11.21 E3 | 8.43 E3 | 9.53 E3 | 3 Pass |

Gamma in Water 0.5 liter

| Reference Date | Sample I.D. | Nuclide | Acceptance Range pCi/l | Reference Value pCi/l | Mean Reported Value pCi/l | Cross Check Status |
|----------------|-------------|---------|---------------------------|--------------------------|------------------------------|-----------------------|
| 3/15/2002 | Q021GWSL | Cr-51 | 0.95 - 1.69 E5 | 1.27 E5 | 1.25 E5 | 3 Pass |
| | | Mn-54 | 0.82 - 1.45 E5 | 1.09 E5 | 1.14 E5 | 3 Pass |
| | | Fe-59 | 4.17 - 7.40 E4 | 5.56 E4 | 5.91 E4 | 3 Pass |
| | | Co-60 | 5.75 - 10.20 E4 | 7.67 E4 | 7.65 E4 | 3 Pass |
| | | Zn-65 | 0.80 - 1.43 E5 | 1.07 E5 | 1.14 E5 | 3 Pass |
| | | Cs-134 | 4.46 - 7.91 E4 | 5.95 E4 | 5.06 E4 | 3 Pass |
| | | Cs-137 | 0.97 - 1.72 E5 | 1.29 E5 | 1.23 E5 | 3 Pass |
| | | Ce-139 | 0.00 - 0.00 E0 | 0.00 E0 | 1.76 E3 | 3 Pass ⁽¹⁾ |
| 5/14/2002 | Q022GWR | Ce-141 | 1.17 - 2.07 E5 | 1.56 E5 | 1.54 E5 | 3 Pass |
| | | Cr-51 | 6.77 - 12.01 E3 | 9.03 E3 | 9.29 E3 | 3 Pass |
| | | Mn-54 | 1.38 - 2.45 E3 | 1.84 E3 | 1.96 E3 | 3 Pass |
| | | Co-58 | 1.82 - 3.24 E3 | 2.43 E3 | 2.47 E3 | 3 Pass |
| | | Fe-59 | 1.75 - 3.10 E3 | 2.33 E3 | 2.51 E3 | 3 Pass |
| | | Co-60 | 1.71 - 3.04 E3 | 2.28 E3 | 2.40 E3 | 3 Pass |
| | | Zn-65 | 2.66 - 4.71 E3 | 3.54 E3 | 3.76 E3 | 3 Pass |
| | | Cs-134 | 1.68 - 2.98 E3 | 2.24 E3 | 2.03 E3 | 3 Pass |
| 8/16/2002 | Q023GWS | Cs-137 | 1.24 - 2.20 E3 | 1.65 E3 | 1.62 E3 | 3 Pass |
| | | Ce-141 | 2.32 - 4.11 E3 | 3.09 E3 | 3.11 E3 | 3 Pass |
| | | Cr-51 | 1.58 - 2.80 E5 | 2.10 E5 | 2.10 E5 | 3 Pass |
| | | Mn-54 | 5.73 - 10.16 E4 | 7.64 E4 | 8.06 E4 | 3 Pass |
| | | Co-58 | 4.47 - 7.93 E4 | 5.96 E4 | 6.02 E4 | 3 Pass |
| | | Fe-59 | 4.76 - 8.44 E4 | 6.34 E4 | 6.77 E4 | 3 Pass |
| | | Co-60 | 5.29 - 9.38 E4 | 7.06 E4 | 7.09 E4 | 3 Pass |
| | | Zn-65 | 7.16 - 12.70 E4 | 9.55 E4 | 1.03 E5 | 3 Pass |
| | | Cs-134 | 4.79 - 8.49 E4 | 6.39 E4 | 5.48 E4 | 3 Pass |
| | | Cs-137 | 4.48 - 7.95 E4 | 5.98 E4 | 5.65 E4 | 3 Pass |
| | | Ce-141 | 1.00 - 1.78 E5 | 1.34 E5 | 1.34 E5 | 3 Pass |

Gamma in Water 0.5 liter continued

| Reference Date | Sample I.D. | Nuclide | Acceptance Range pCi/l | Reference Value pCi/l | Mean Reported Value pCi/l | Cross Check Status |
|----------------|-------------|---------|---------------------------|--------------------------|------------------------------|-----------------------|
| 11/19/2002 | Q024GWR | Cr-51 | 2.08 - 3.70 E4 | 2.78 E4 | 3.10 E4 | 3 Pass |
| | | Mn-54 | 5.96 - 10.56 E3 | 7.94 E3 | 8.98 E3 | 3 Pass |
| | | Co-57 | 0.00 - 0.00 E0 | 0.00 E0 | 6.61 E1 | 3 Pass ⁽¹⁾ |
| | | Co-58 | 6.54 - 11.60 E3 | 8.72 E3 | 9.64 E3 | 3 Pass |
| | | Fe-59 | 3.72 - 6.60 E3 | 4.96 E3 | 5.92 E3 | 3 Pass |
| | | Co-60 | 6.68 - 11.85 E3 | 8.91 E3 | 9.97 E3 | 3 Pass |
| | | Zn-65 | 0.75 - 1.33 E4 | 1.00 E4 | 1.19 E4 | 3 Pass |
| | | Cs-134 | 4.04 - 7.16 E3 | 5.38 E3 | 5.08 E3 | 3 Pass |
| | | Cs-137 | 0.89 - 1.58 E4 | 1.19 E4 | 1.24 E4 | 3 Pass |
| | | Ce-141 | 6.32 - 11.21 E3 | 8.43 E3 | 9.15 E3 | 3 Pass |

Gamma in Filter

| Reference Date | Sample I.D. | Nuclide | Acceptance Range pCi/total | Reference Value pCi/total | Mean Reported Value pCi/total | Cross Check Status |
|----------------|-------------|---------|-------------------------------|------------------------------|----------------------------------|-------------------------|
| 6/13/2002 | E3197-37 | Cr-51 | 1.05 - 2.42 E2 | 1.59 E2 | 1.79 E2 | 3 Pass |
| | | Mn-54 | 4.80 - 8.51 E1 | 6.40 E1 | 6.72 E1 | 3 Pass |
| | | Co-58 | 5.03 - 8.91 E1 | 6.70 E1 | 6.78 E1 | 3 Pass |
| | | Fe-59 | 3.89 - 7.51 E1 | 5.40 E1 | 6.46 E1 | 1/3 High ⁽²⁾ |
| | | Co-60 | 6.30 - 11.17 E1 | 8.40 E1 | 8.70 E1 | 3 Pass |
| | | Zn-65 | 0.91 - 1.61 E2 | 1.21 E2 | 1.30 E2 | 3 Pass |
| | | Cs-134 | 6.08 - 10.77 E1 | 8.10 E1 | 7.99 E1 | 3 Pass |
| | | Cs-137 | 4.58 - 8.11 E1 | 6.10 E1 | 5.73 E1 | 3 Pass |
| | | Ce-141 | 4.58 - 8.11 E1 | 6.10 E1 | 6.84 E1 | 3 Pass |
| 12/5/2002 | E3459-37 | Cr-51 | 1.80 - 3.28 E2 | 2.43 E2 | 2.55 E2 | 3 Pass |
| | | Mn-54 | 0.75 - 1.33 E2 | 1.00 E2 | 1.01 E2 | 3 Pass |
| | | Co-58 | 7.35 - 13.03 E1 | 9.80 E1 | 9.61 E1 | 3 Pass |
| | | Fe-59 | 3.83 - 6.78 E1 | 5.10 E1 | 5.71 E1 | 3 Pass |
| | | Co-60 | 0.87 - 1.54 E2 | 1.16 E2 | 1.19 E2 | 3 Pass |
| | | Zn-65 | 0.95 - 1.68 E2 | 1.26 E2 | 1.28 E2 | 3 Pass |
| | | Cs-134 | 5.25 - 9.31 E1 | 7.00 E1 | 6.50 E1 | 3 Pass |
| | | Cs-137 | 1.16 - 2.06 E2 | 1.55 E2 | 1.45 E2 | 3 Pass |
| | | Ce-141 | 5.85 - 10.37 E1 | 7.80 E1 | 8.05 E1 | 3 Pass |

Iodine in Water

| Reference Date | Sample I.D. | Nuclide | Acceptance Range pCi/l | Reference Value pCi/l | Mean Reported Value pCi/l | Cross Check Status |
|----------------|-------------|---------|---------------------------|--------------------------|------------------------------|-------------------------|
| 5/28/2002 | Q022LIW1 | I-131 | 1.38 - 2.59 E0 | 1.89 E0 | 2.31 E0 | 3 Pass |
| 5/28/2002 | Q022LIW2 | I-131 | 2.03 - 3.60 E1 | 2.71 E1 | 3.87 E1 | 3/3 High ⁽³⁾ |
| 5/28/2002 | Q022LIW3 | I-131 | 3.33 - 5.91 E2 | 4.44 E2 | 4.72 E2 | 3 Pass |

Iodine in Milk

| Reference Date | Sample I.D. | Nuclide | Acceptance Range . pCi/l | Reference Value pCi/l | Mean Reported Value pCi/l | Cross Check Status |
|----------------|-------------|---------|-----------------------------|--------------------------|------------------------------|--------------------|
| 11/5/2002 | Q024LIM1 | I-131 | 2.80 - 4.97 E2 | 3.73 E2 | 3.52 E2 | 3 Pass |
| 11/5/2002 | Q024LIM2 | I-131 | 0.00 - 0.00 E0 | 0.00 E0 | 0.00 E0 | 3 Pass |

Iodine Cartridge

| Reference Date | Sample I.D. | Nuclide | Acceptance Range pCi | Reference Value pCi | Mean Reported Value pCi | Cross Check Status |
|----------------|-------------|---------|-------------------------|------------------------|----------------------------|--------------------|
| 3/8/2002 | A15502-04 | I-131 | 1.47 - 2.61 E5 | 1.96 E5 | 2.31 E5 | 3 Pass |
| 6/13/2002 | E3198-37 | I-131 | 6.98 - 12.37 E1 | 9.30 E1 | 10.7 E1 | 3 Pass |
| 8/9/2002 | A16102-04 | I-131 | 1.89 - 3.35 E5 | 2.52 E5 | 2.95 E5 | 3 Pass |
| 12/5/2002 | E3460-37 | I-131 | 7.28 - 12.90 E1 | 9.70 E1 | 1.12 E2 | 3 Pass |

Beta in Water

| Reference Date | Sample I.D. | Nuclide | Acceptance Range pCi/l | Reference Value pCi/l | Mean Reported Value pCi/l | Cross Check Status |
|----------------|-------------|---------|---------------------------|--------------------------|------------------------------|--------------------|
| 6/13/2002 | E3199-37 | Beta | 2.10 - 3.72 E2 | 2.80 E2 | 2.59 E2 | 3 Pass |
| 6/13/2002 | E3258-37 | Beta | 2.10 - 3.72 E2 | 2.80 E2 | 2.63 E2 | 3 Pass |

Beta Air Particulate

| Reference Date | Sample I.D. | Nuclide | Acceptance Range pCi | Reference Value pCi | Mean Reported Value pCi | Cross Check Status |
|----------------|-------------|------------|-------------------------|------------------------|----------------------------|--------------------|
| 2/15/2002 | A15504-04 | Gross Beta | 5.64 - 10.00 E3 | 7.52 E3 | 7.97 E3 | 3 Pass |

Tritium in Water

| Reference Date | Sample I.D. | Nuclide | Acceptance Range pCi/l | Reference Value pCi/l | Mean Reported Value pCi/l | Cross Check Status |
|----------------|-------------|---------|---------------------------|--------------------------|------------------------------|--------------------|
| 3/15/2002 | Q021TWSL1 | H-3 | 0.93 - 1.66 E4 | 1.25 E4 | 1.26 E4 | 3 Pass |
| 3/15/2002 | Q021TWSL2 | H-3 | 0.00 - 0.00 E0 | 0.00 E0 | 0.00 E0 | 3 Pass |
| 5/14/2002 | Q022TWR1 | H-3 | 4.25 - 8.20 E2 | 5.90 E2 | 5.60 E2 | 3 Pass |
| 5/14/2002 | Q022TWR2 | H-3 | 0.00 - 0.00 E0 | 0.00 E0 | 0.00 E0 | 3 Pass |
| 5/14/2002 | Q022TWR3 | H-3 | 2.06 - 3.66 E3 | 2.75 E3 | 2.84 E3 | 3 Pass |
| 8/15/2002 | Q023TWSL1 | H-3 | 0.00 - 0.00 E0 | 0.00 E0 | 0.00 E0 | 3 Pass |
| 8/15/2002 | Q023TWSL2 | H-3 | 2.94 - 5.21 E4 | 3.92 E4 | 3.37 E4 | 3 Pass |
| 11/22/2002 | Q024TWR1 | H-3 | 0.00 - 0.00 E0 | 0.00 E0 | 0.00 E0 | 3 Pass |
| 11/22/2002 | Q024TWR2 | H-3 | 1.65 - 2.93 E3 | 2.20 E3 | 1.89 E3 | 3 Pass |

Table 5.0-A Footnote Explanations

- (1) Gamma in Water, Sample ID Q021GWSL, Reference Date 3/15/2002: 3.5 L Marinelli, 1.0 L Marinelli, 0.5 L Marinelli,

Ce-139 was observed in cross-checks and was attributed to a contaminant arriving with the source. The nuclide was determined to be present, but there was no reference activity applicable to the results.

Gamma in Water, Sample ID Q024GWR, Reference Date 11/19/2002: 3.5 L Marinelli, 1.0 L Marinelli, 0.5 L Marinelli

Co-57 was observed in cross-checks and was attributed to a contaminant arriving with the source. The nuclide was determined to be present, but there was no reference activity applicable to the results.

- (2) Gamma in Filter, Sample ID E3197-37, Reference Date 6/13/2002

Three results for Fe-59 [1099.2 keV] were reported, with one being above acceptance limit. Calibration verifications for detector 4 (SN: 35-P31076A) were evaluated and yielded acceptable results. General Office PIP G-02-00278 was written to record investigative actions.

- (3) Iodine in Water, Sample ID Q022LIW2, Reference Date 5/28/2002

Three results were reported for this cross-check, all of which were above the cross-check acceptance limit. Investigation yielded the most likely cause for the high results was failure to shake resin dish prior to analysis. General Office PIP G-02-00254 was written to record investigative actions.

TABLE 5.0-B

2002 ENVIRONMENTAL DOSIMETER CROSS-CHECK RESULTS

Nuclear Technology Services

| 1st Quarter 2002 | | | | | | 2nd Quarter 2002 | | | | | |
|---------------------------|------------------|-----------------|---------------|--------------------|-----------|---------------------------|------------------|-----------------|---------------|--------------------|-----------|
| TLD Number | Delivered (mrem) | Reported (mrem) | Bias (% diff) | Pass/Fail Criteria | Pass/Fail | TLD Number | Delivered (mrem) | Reported (mrem) | Bias (% diff) | Pass/Fail Criteria | Pass/Fail |
| 100141 | 88 | 88.1 | 0.11 | <+/-15% | Pass | 100340 | 99 | 93.9 | -5.15 | <+/-15% | Pass |
| 100157 | 88 | 92.8 | 5.45 | <+/-15% | Pass | 101179 | 99 | 97.5 | -1.52 | <+/-15% | Pass |
| 100215 | 88 | 91.1 | 3.52 | <+/-15% | Pass | 100349 | 99 | 96.3 | -2.73 | <+/-15% | Pass |
| 100145 | 88 | 91.2 | 3.64 | <+/-15% | Pass | 100397 | 99 | 98.9 | -0.10 | <+/-15% | Pass |
| 100463 | 88 | 90.7 | 3.07 | <+/-15% | Pass | 100022 | 99 | 98.5 | -0.51 | <+/-15% | Pass |
| Average Bias (B) | | | 3.16 | | | Average Bias (B) | | | -2.00 | | |
| Standard Deviation (S) | | | 1.93 | | | Standard Deviation (S) | | | 2.03 | | |
| Measure Performance B +S | | | 5.09 | <15% | Pass | Measure Performance B +S | | | 4.03 | <15% | Pass |
| 3rd Quarter 2002 | | | | | | 4th Quarter 2002 | | | | | |
| TLD Number | Delivered (mrem) | Reported (mrem) | Bias (% diff) | Pass/Fail Criteria | Pass/Fail | TLD Number | Delivered (mrem) | Reported (mrem) | Bias (% diff) | Pass/Fail Criteria | Pass/Fail |
| 100601 | 66 | 64.0 | -3.03 | <+/-15% | Pass | 101275 | 70 | 63.5 | -9.29 | <+/-15% | Pass |
| 100841 | 66 | 65.1 | -1.36 | <+/-15% | Pass | 100478 | 70 | 64.2 | -8.29 | <+/-15% | Pass |
| 100868 | 66 | 65.3 | -1.06 | <+/-15% | Pass | 100503 | 70 | 63.1 | -9.86 | <+/-15% | Pass |
| 100880 | 66 | 68.2 | 3.33 | <+/-15% | Pass | 101011 | 70 | 64.6 | -7.71 | <+/-15% | Pass |
| 100989 | 66 | 65.4 | -0.91 | <+/-15% | Pass | 100538 | 70 | 67.0 | -4.29 | <+/-15% | Pass |
| Average Bias (B) | | | -0.61 | | | Average Bias (B) | | | -7.89 | | |
| Standard Deviation (S) | | | 2.36 | | | Standard Deviation (S) | | | 2.18 | | |
| Measure Performance B +S | | | 2.97 | <15% | Pass | Measure Performance B +S | | | 10.06 | <15% | Pass |

State of North Carolina, Division of Radiation Protection

| Spring 2002 | | | | | | Fall 2002 | | | | | |
|---------------------------|------------------|-----------------|---------------|--------------------|-----------|---------------------------|------------------|-----------------|---------------|--------------------|---------------------|
| TLD Number | Delivered (mrem) | Reported (mrem) | Bias (% diff) | Pass/Fail Criteria | Pass/Fail | TLD Number | Delivered (mrem) | Reported (mrem) | Bias (% diff) | Pass/Fail Criteria | Pass/Fail |
| 100008 | 90 | 80.8 | -10.22 | <+/-15% | Pass | 100777 | 151.6 | 127.3 | -16.03 | <+/-15% | Fail |
| 100030 | 90 | 83.1 | -7.67 | <+/-15% | Pass | 100704 | 151.6 | 127.9 | -15.63 | <+/-15% | Fail |
| 100050 | 90 | 81.3 | -9.67 | <+/-15% | Pass | 100740 | 151.6 | 130.9 | -13.65 | <+/-15% | Pass |
| 100064 | 90 | 84.6 | -6.00 | <+/-15% | Pass | 100680 | 151.6 | 132.4 | -12.66 | <+/-15% | Pass |
| 100117 | 90 | 82.6 | -8.22 | <+/-15% | Pass | 101020 | 151.6 | 123.7 | -18.40 | <+/-15% | Fail |
| 100166 | 90 | 81.1 | -9.89 | <+/-15% | Pass | 100747 | 151.6 | 131.3 | -13.39 | <+/-15% | Pass |
| 100208 | 90 | 79.9 | -11.22 | <+/-15% | Pass | 100759 | 151.6 | 130.6 | -13.85 | <+/-15% | Pass |
| 101122 | 90 | 82.5 | -8.33 | <+/-15% | Pass | 100103 | 151.6 | 128.6 | -15.17 | <+/-15% | Fail |
| Average Bias (B) | | | -8.90 | | | Average Bias (B) | | | -14.85 | | |
| Standard Deviation (S) | | | 1.67 | | | Standard Deviation (S) | | | 1.85 | | |
| Measure Performance B +S | | | 10.57 | <15% | Pass | Measure Performance B +S | | | 16.70 | <15% | Fail ⁽¹⁾ |

Internal Crosscheck (Duke Power)

| 1st Quarter 2002 | | | | | | 2nd Quarter 2002 | | | | | |
|---------------------------|------------------|-----------------|---------------|--------------------|-----------|---------------------------|------------------|-----------------|---------------|--------------------|-----------|
| TLD Number | Delivered (mrem) | Reported (mrem) | Bias (% diff) | Pass/Fail Criteria | Pass/Fail | TLD Number | Delivered (mrem) | Reported (mrem) | Bias (% diff) | Pass/Fail Criteria | Pass/Fail |
| 101102 | 40 | 37.0 | -7.50 | <+/-15% | Pass | 100103 | 33 | 31.5 | -4.55 | <+/-15% | Pass |
| 100109 | 40 | 37.1 | -7.25 | <+/-15% | Pass | 100740 | 33 | 31.6 | -4.24 | <+/-15% | Pass |
| 101122 | 40 | 38.4 | -4.00 | <+/-15% | Pass | 100747 | 33 | 31.9 | -3.33 | <+/-15% | Pass |
| 100268 | 40 | 37.1 | -7.25 | <+/-15% | Pass | 100770 | 33 | 31.3 | -5.15 | <+/-15% | Pass |
| 100807 | 40 | 39.8 | -0.50 | <+/-15% | Pass | 100772 | 33 | 32.4 | -1.82 | <+/-15% | Pass |
| 100810 | 40 | 37.7 | -5.75 | <+/-15% | Pass | 101017 | 33 | 31.7 | -3.94 | <+/-15% | Pass |
| 100169 | 40 | 37.3 | -6.75 | <+/-15% | Pass | 101020 | 33 | 30.8 | -6.67 | <+/-15% | Pass |
| 100366 | 40 | 38.1 | -4.75 | <+/-15% | Pass | 101025 | 33 | 32.3 | -2.12 | <+/-15% | Pass |
| 100815 | 40 | 37.2 | -7.00 | <+/-15% | Pass | 101035 | 33 | 31.3 | -5.15 | <+/-15% | Pass |
| 100823 | 40 | 38.8 | -3.00 | <+/-15% | Pass | 101036 | 33 | 32.3 | -2.12 | <+/-15% | Pass |
| Average Bias (B) | | | -5.38 | | | Average Bias (B) | | | -3.91 | | |
| Standard Deviation (S) | | | 2.31 | | | Standard Deviation (S) | | | 1.57 | | |
| Measure Performance B +S | | | 7.68 | <15% | Pass | Measure Performance B +S | | | 5.48 | <15% | Pass |
| 3rd Quarter 2002 | | | | | | 4th Quarter 2002 | | | | | |
| TLD Number | Delivered (mrem) | Reported (mrem) | Bias (% diff) | Pass/Fail Criteria | Pass/Fail | TLD Number | Delivered (mrem) | Reported (mrem) | Bias (% diff) | Pass/Fail Criteria | Pass/Fail |
| 100792 | 106 | 100.8 | -4.91 | <+/-15% | Pass | 100389 | 66 | 64.5 | -2.27 | <+/-15% | Pass |
| 101274 | 106 | 100.0 | -5.66 | <+/-15% | Pass | 101114 | 66 | 62.3 | -5.61 | <+/-15% | Pass |
| 100314 | 106 | 100.0 | -5.66 | <+/-15% | Pass | 100114 | 66 | 66.6 | 0.91 | <+/-15% | Pass |
| 100460 | 106 | 100.9 | -4.81 | <+/-15% | Pass | 100649 | 66 | 63.0 | -4.55 | <+/-15% | Pass |
| 100101 | 106 | 101.9 | -3.87 | <+/-15% | Pass | 100469 | 66 | 65.2 | -1.21 | <+/-15% | Pass |
| 100783 | 106 | 101.8 | -3.96 | <+/-15% | Pass | 100763 | 66 | 62.0 | -6.06 | <+/-15% | Pass |
| 100760 | 106 | 100.8 | -4.91 | <+/-15% | Pass | 100304 | 66 | 62.8 | -4.85 | <+/-15% | Pass |
| 101349 | 106 | 98.1 | -7.45 | <+/-15% | Pass | 100068 | 66 | 67.2 | 1.82 | <+/-15% | Pass |
| 100794 | 106 | 101.1 | -4.62 | <+/-15% | Pass | 100203 | 66 | 65.0 | -1.52 | <+/-15% | Pass |
| 100012 | 106 | 100.1 | -5.57 | <+/-15% | Pass | 100418 | 66 | 64.7 | -1.97 | <+/-15% | Pass |
| Average Bias (B) | | | -5.14 | | | Average Bias (B) | | | -2.53 | | |
| Standard Deviation (S) | | | 1.03 | | | Standard Deviation (S) | | | 2.69 | | |
| Measure Performance B +S | | | 6.17 | <15% | Pass | Measure Performance B +S | | | 5.22 | <15% | Pass |

Table 5.0-B Footnote Explanations

(1) State of NC Division of Radiation Protection TLD Cross-Check, Fall 2002

There was an unusual amount of time between anneal, irradiation and readout for the Fall 2002 Environmental Crosscheck with the State of NC Division of Radiation Protection. Normal times between irradiation and readout are typically less than 7 days. In the Fall 2002 crosscheck, due to the ice storm and holiday season, the time between irradiation and readout was 18 days. Fading correction was not applied for the report results; fading correction is typically NOT USED.

When fading correction was applied, the cross-checks were within acceptance criteria. Fading correction will be applied to future cross-checks.

Additional information is documented in PIP G-03-00021.

6.0 REFERENCES

- 6.1 McGuire Selected License Commitments
- 6.2 McGuire Technical Specifications
- 6.3 McGuire Updated Final Safety Analysis Report
- 6.4 Duke Power Company McGuire Offsite Dose Calculation Manual
- 6.5 McGuire Annual Radiological Environmental Operating Report 1979 - 2001
- 6.6 McGuire Annual Radioactive Effluent Release Report 2002
- 6.7 Probability and Statistics in Engineering and Management Science, Hines and Montgomery, 1969, pages 287-293.
- 6.8 Practical Statistics for the Physical Sciences, Havilcek and Crain, 1988, pages 83-93.
- 6.9 Nuclear Regulatory Commission Regulatory Guide 1.109, Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purposes of Evaluating Compliance with 10CFR50, Appendix I.
- 6.10 EnRad Laboratories Operating Procedures
- 6.11 RETDAS, Radiological Effluent Tracking and Dose Assessment Software, Vertechs Version 3.5.0, Duke Power Revision # 3.0
- 6.12 NRC Integrated Inspection Report (no audit performed in 2002)
- 6.13 Duke Power Company EnRad Laboratory Charcoal Cartridge Study, performed 2001

APPENDIX A

**ENVIRONMENTAL SAMPLING
&
ANALYSIS PROCEDURES**

APPENDIX A

ENVIRONMENTAL SAMPLING AND ANALYSIS PROCEDURES

Adherence to established procedures for sampling and analysis of all environmental media at McGuire Nuclear Station was required to ensure compliance with Station Selected Licensee Commitments. Analytical procedures were employed to ensure that Selected Licensee Commitments detection capabilities were achieved.

Environmental sampling and analyses were performed by EnRad Laboratories, Dosimetry and Records, and Fisheries and Aquatic Ecology.

This appendix describes the environmental sampling frequencies and analysis procedures by media type.

I. CHANGE OF SAMPLING PROCEDURES

No changes were made to the sampling procedures during 2002.

II. DESCRIPTION OF ANALYSIS PROCEDURES

Gamma spectroscopy analyses are performed using high purity germanium gamma detectors and Canberra analytical software. Designated sample volumes are transferred to appropriate counting geometries and analyzed by gamma spectroscopy. Perishable samples such as fish and broadleaf vegetation are ground to achieve a homogeneous mixture. Soils and sediments are dried, sifted to remove foreign objects (rocks, clams, glass, etc.) then transferred to appropriate counting geometry. Ten percent of samples receiving gamma analysis are analyzed as duplicate analyses.

Low-level iodine analyses are performed by passing a designated sample aliquot through an ion exchange resin to remove and concentrate any iodine in the aqueous sample (milk). The resin is then dried and transferred to appropriate counting geometry and analyzed by gamma spectroscopy.

Tritium analyses are performed quarterly by using low-level environmental liquid scintillation analysis technique on a Packard 2550 liquid scintillation system. Tritium samples are batch processed with a tritium spike to verify instrument performance and sample preparation technique are acceptable.

Gross beta analysis is performed by concentrating a designated aliquot of sample precipitate and analyzing by gas-flow proportional counters. Samples are batch processed with a blank to ensure sample contamination has not occurred.

III. CHANGE OF ANALYSIS PROCEDURES

No analysis procedures were changed during 2002.

IV. SAMPLING AND ANALYSIS PROCEDURES

A.1 AIRBORNE PARTICULATE AND RADIOIODINE

Airborne particulate and radioiodine samples at each of seven locations were composited continuously by means of continuous air samplers. Air particulates were collected on a particulate filter and radioiodines were collected in a charcoal cartridge situated behind the filter in the sampler. The samplers are designed to operate at a constant flow rate (in order to compensate for any filter loading) and are set to sample approximately 2 cubic feet per minute. Filters and cartridges were collected weekly. A weekly gross beta analysis was performed on each filter and a weekly gamma analysis was performed on each charcoal cartridge. Filters were segregated by location and a quarterly gamma analysis was performed on the filter composite. The filter and charcoal cartridge were analyzed independently. The continuous composite samples were collected from the locations listed below.

| | | |
|--------------|---|---|
| Location 120 | = | Site Boundary (0.5 mi. NNE) |
| Location 121 | = | Site Boundary (0.5 mi. NE) |
| Location 125 | = | Site Boundary (0.4 mi. SW) |
| Location 133 | = | Cornelius, NC (6.2 mi. NE) |
| Location 134 | = | East Lincoln Junior High School (8.8 mi. WNW) |
| Location 192 | = | Peninsula development (2.8 mi. NNE) |
| Location 195 | = | Fishing Access Road (0.2 mi. N) |

A.2 DRINKING WATER

Biweekly composite samples were collected. A gross beta and gamma analysis was performed on monthly composites. Tritium analysis was performed on the quarterly composites. The composites were collected biweekly from the locations listed below.

| | | |
|--------------|---|---|
| Location 101 | = | North Mecklenburg Water Supply (3.3 mi E) |
| Location 119 | = | Mt. Holly Municipal Water Supply (7.4 mi. SSW) |
| Location 132 | = | Charlotte Municipal Water Supply (11.2 mi. SSE) |
| Location 136 | = | Mooresville Municipal Water Supply (12.7 mi. NNE) |
| Location 194 | = | East Lincoln Water Supply (6.7 mi. NNW) |

A.3 SURFACE WATER

Biweekly composite samples were collected. A gamma analysis was performed on the monthly composites. Tritium analysis was performed on the quarterly composites sample. The composites were collected biweekly from the locations listed below.

| | | |
|--------------|---|--|
| Location 128 | = | Discharge Canal Bridge (0.4 mi. NE) |
| Location 131 | = | Cowans Ford Dam (0.6 mi. WNW) |
| Location 135 | = | Plant Marshall Intake Canal (11.9 mi. N) |

A.4 MILK

Biweekly grab samples were collected at each dairy. A gamma and low-level Iodine-131 analysis was performed on each sample. The biweekly grab samples were collected from the locations listed below.

| | | |
|--------------|---|---------------------------------------|
| Location 138 | = | Henry Cook Dairy - COWS (3.1 mi. ESE) |
| Location 139 | = | William Cook Dairy - COWS (2.5 mi. E) |
| Location 141 | = | Lynch Dairy - COWS (14.8 mi. WNW) |

A.5 BROADLEAF VEGETATION

Monthly samples were collected as available and a gamma analysis was performed on each sample. The samples were collected from the locations listed below.

| | | |
|--------------|---|---|
| Location 120 | = | Site Boundary (0.5 mi. NNE) |
| Location 125 | = | Site Boundary (0.4 mi. SW) |
| Location 134 | = | East Lincoln Junior High School (8.8 mi. WNW) |
| Location 193 | = | Site Boundary (0.2 mi. N) |

A.6 FOOD PRODUCTS

Samples were collected monthly when available during the harvest season and a gamma analysis was performed on each. The samples were collected at the location listed below.

| | | |
|--------------|---|-------------------|
| Location 188 | = | Garden (2.8 mi N) |
|--------------|---|-------------------|

A.7 FISH

Semiannual samples were collected and a gamma analysis was performed on the edible portions of each sample. Boney fish (i.e. Sunfish) were prepared whole

minus the head and tail portions. The samples were collected from the locations listed below.

| | | |
|--------------|---|---|
| Location 129 | = | Discharge Canal Entrance to Lake Norman (0.5 mi. ENE) |
| Location 137 | = | Pinnacle Access Area (12.0 mi. N) |

A.8 SHORELINE SEDIMENT

Semiannual samples were collected and a gamma analysis was performed on each following the drying and removal of rocks and clams. The samples were collected from the locations listed below.

| | | |
|--------------|---|---|
| Location 129 | = | Discharge Canal Entrance to Lake Norman (0.5 mi. ENE) |
| Location 130 | = | Highway 73 Bridge Downstream (0.5 mi. SW) |
| Location 137 | = | Pinnacle Access Area (12.0 mi. N) |

A.9 DIRECT GAMMA RADIATION (TLD)

Thermoluminescent dosimeters (TLD) were collected quarterly at forty-one locations. A gamma exposure rate was determined for each TLD. The TLDs were placed as indicated below.

- * An inner ring of 14 TLDs at the site boundary, one in each available meteorological sector. The site boundary locations in the N and NNW sectors are over water; however, two special interest TLD's were placed in these sectors inside the site boundary in March, 1991.
- * An outer ring of 16 TLDs, one in each meteorological sector in the 6 to 8 kilometer range.
- * The remaining TLDs were placed in special interest areas such as population centers, residential areas, schools, and control locations.

TLD locations are listed in Table 2.1-B.

A.10 ANNUAL LAND USE CENSUS

An annual Land Use Census was conducted to identify within a distance of 8 kilometers (5.0 miles) from the station, the nearest location from the site boundary in each of the sixteen meteorological sectors, the following:

- * The Nearest Residence
- * The Nearest Meat Animal

- * The Nearest Garden greater than 50 square meters or 500 square feet
- * The Nearest Milk-giving Animal (cow, goat, etc.)

This census was initiated on June 12, 2002 and completed on June 14, 2002.
Results are shown in Table 3.10.

In the environmental program, the air deposition parameters (D/Q) are used to determine air, broadleaf vegetation and milk sampling locations. McGuire's sectors with the three highest values did not change in 2002.

APPENDIX B

**RADIOLOGICAL
ENVIRONMENTAL MONITORING
PROGRAM**

SUMMARY OF RESULTS

2002

Environmental Radiological Monitoring Program Summary

Facility: McGuire Nuclear Station

Docket No. 50-369,370

Location: Mecklenburg County, North Carolina

Report Period: 01-JAN-2002 to 31-DEC-2002

| Medium or Pathway Sampled | Type and Total Number of | Lower Limit of Detection | All Indicator Locations | Location with Highest Annual Mean Name, Distance, Direction | | Control Location | No. of Non-Routine Report Meas. |
|---------------------------|--------------------------|--------------------------|-------------------------|---|-----------------------|-----------------------|---------------------------------|
| Unit of Measurement | Analyses Performed | (LLD) | Mean (Fraction) Range | Location Code | Mean (Fraction) Range | Mean (Fraction) Range | |
| Air Particulate (pCi/m3) | 134 (8.8 mi WNW) | | | | | | |
| | BETA | 364 | 1.00E-02 | 1.54E-2 (312/312) | 121 | 1.57E-2 (52/52) | 0 |
| | | | | 3.68E-3 - 2.38E-2 | (0.5 mi NE) | 4.56E-3 - 2.19E-2 | |
| | CS-134 | 28 | 5.00E-02 | 0.00 (0/24) | | 0.00 (0/4) | 0 |
| | | | | 0.00 - 0.00 | | 0.00 - 0.00 | |
| | CS-137 | 28 | 6.00E-02 | 0.00 (0/24) | | 0.00 (0/4) | 0 |
| | | | | 0.00 - 0.00 | | 0.00 - 0.00 | |
| | I-131 | 28 | 7.00E-02 | 0.00 (0/24) | | 0.00 (0/4) | 0 |
| | | | | 0.00 - 0.00 | | 0.00 - 0.00 | |

Mean and range based upon detectable measurements only

Fraction of detectable measurements at specified locations is indicated in parentheses, (Fraction)

Zero range indicates no detectable activity measurements

Environmental Radiological Monitoring Program Summary

Facility: McGuire Nuclear Station

Docket No. 50-369,370

Location: Mecklenburg County, North Carolina

Report Period: 01-JAN-2002 to 31-DEC-2002

| Medium or Pathway Sampled | Type and Total Number of | Lower Limit of Detection | All Indicator Locations | Location with Highest Annual Mean Name, Distance, Direction | | Control Location | No. of Non-Routine Report Meas. |
|---------------------------|--------------------------|--------------------------|-------------------------|---|-----------------------|-----------------------|---------------------------------|
| Unit of Measurement | Analyses Performed | (LLD) | Mean (Fraction) Range | Location Code | Mean (Fraction) Range | Mean (Fraction) Range | |
| Air Radioiodine (pCi/m3) | | | | | | | 134 (8.8 mi WNW) |
| | CS-134 364 | 5.00E-02 | 0.00 (0/312) | | 0.00 (0/52) | 0.00 (0/52) | 0 |
| | | | 0.00 - 0.00 | | 0.00 - 0.00 | 0.00 - 0.00 | |
| | CS-137 364 | 6.00E-02 | 0.00 (0/312) | | 0.00 (0/52) | 0.00 (0/52) | 0 |
| | | | 0.00 - 0.00 | | 0.00 - 0.00 | 0.00 - 0.00 | |
| | I-131 364 | 7.00E-02 | 0.00 (0/312) | | 0.00 (0/52) | 0.00 (0/52) | 0 |
| | | | 0.00 - 0.00 | | 0.00 - 0.00 | 0.00 - 0.00 | |

Mean and range based upon detectable measurements only

Fraction of detectable measurements at specified locations is indicated in parentheses, (Fraction)

Zero range indicates no detectable activity measurements

Environmental Radiological Monitoring Program Summary

Facility: McGuire Nuclear Station

Docket No. 50-369,370

Location: Mecklenburg County, North Carolina

Report Period: 01-JAN-2002 to 31-DEC-2002

| Medium or Pathway Sampled | Type and Total Number of | Lower Limit of Detection | All Indicator Locations | Location with Highest Annual Mean Name, Distance, Direction | | Control Location | No. of Non-Routine Report Meas. |
|----------------------------|--------------------------|--------------------------|-----------------------------|--|-----------------------------|-----------------------------|---------------------------------|
| Unit of Measurement | Analyses Performed | (LLD) | Mean (Fraction) Range | Location Code | Mean (Fraction) Range | Mean (Fraction) Range | |
| Drinking Water (pCi/liter) | | | | | | | |
| | | | | | | 136 (12.7 mi NNE) | |
| BALA-140 | 65 | 15 | 0.00 (0/52) 0.00 - 0.00 | | 0.00 (0/13) 0.00 - 0.00 | 0.00 (0/13) 0.00 - 0.00 | 0 |
| BETA | 65 | 4 | 2.32 (52/52) 1.15 - 3.23 | 194 (6.7 mi NNW) | 2.47 (13/13) 1.92 - 2.91 | 2.08 (13/13) 1.07 - 2.65 | 0 |
| CO-58 | 65 | 15 | 0.00 (0/52) 0.00 - 0.00 | | 0.00 (0/13) 0.00 - 0.00 | 0.00 (0/13) 0.00 - 0.00 | 0 |
| CO-60 | 65 | 15 | 0.00 (0/52) 0.00 - 0.00 | | 0.00 (0/13) 0.00 - 0.00 | 0.00 (0/13) 0.00 - 0.00 | 0 |
| CS-134 | 65 | 15 | 0.00 (0/52) 0.00 - 0.00 | | 0.00 (0/13) 0.00 - 0.00 | 0.00 (0/13) 0.00 - 0.00 | 0 |
| CS-137 | 65 | 18 | 0.00 (0/52) 0.00 - 0.00 | | 0.00 (0/13) 0.00 - 0.00 | 0.00 (0/13) 0.00 - 0.00 | 0 |
| FE-59 | 65 | 30 | 0.00 (0/52) 0.00 - 0.00 | | 0.00 (0/13) 0.00 - 0.00 | 0.00 (0/13) 0.00 - 0.00 | 0 |
| H-3 | 20 | 2000 | 450 (12/16) 279 - 643 | 101 (3.3 mi E) | 564 (4/4) 509 - 643 | 0.00 (0/4) 0.00 - 0.00 | 0 |
| I-131 | 65 | 15 | 0.00 (0/52) 0.00 - 0.00 | | 0.00 (0/13) 0.00 - 0.00 | 0.00 (0/13) 0.00 - 0.00 | 0 |
| MN-54 | 65 | 15 | 0.00 (0/52) 0.00 - 0.00 | | 0.00 (0/13) 0.00 - 0.00 | 0.00 (0/13) 0.00 - 0.00 | 0 |
| NB-95 | 65 | 15 | 0.00 (0/52) 0.00 - 0.00 | | 0.00 (0/13) 0.00 - 0.00 | 0.00 (0/13) 0.00 - 0.00 | 0 |
| ZN-65 | 65 | 30 | 0.00 (0/52) 0.00 - 0.00 | | 0.00 (0/13) 0.00 - 0.00 | 0.00 (0/13) 0.00 - 0.00 | 0 |
| ZR-95 | 65 | 15 | 0.00 (0/52) 0.00 - 0.00 | | 0.00 (0/13) 0.00 - 0.00 | 0.00 (0/13) 0.00 - 0.00 | 0 |

Mean and range based upon detectable measurements only

Fraction of detectable measurements at specified locations is indicated in parentheses, (Fraction)

Zero range indicates no detectable activity measurements

Environmental Radiological Monitoring Program Summary

Facility: McGuire Nuclear Station

Docket No. 50-369,370

Location: Mecklenburg County, North Carolina

Report Period: 01-JAN-2002 to 31-DEC-2002

| Medium or Pathway Sampled | Type and Total Number of | Lower Limit of Detection | All Indicator Locations | Location with Highest Annual Mean Name, Distance, Direction | | Control Location | No. of Non-Routine Report Meas. |
|---------------------------|--------------------------|--------------------------|-------------------------|---|-----------------------|-----------------------|---------------------------------|
| Unit of Measurement | Analyses Performed | (LLD) | Mean (Fraction) Range | Location Code | Mean (Fraction) Range | Mean (Fraction) Range | |
| Surface Water (pCi/liter) | | | | | | 135 (11.9 mi N) | |
| | BALA-140 | 39 | 15 | | 0.00 (0/26) | 0.00 (0/13) | 0 |
| | | | | | 0.00 - 0.00 | 0.00 - 0.00 | |
| | CO-58 | 39 | 15 | | 0.00 (0/26) | 0.00 (0/13) | 0 |
| | | | | | 0.00 - 0.00 | 0.00 - 0.00 | |
| | CO-60 | 39 | 15 | | 0.00 (0/26) | 0.00 (0/13) | 0 |
| | | | | | 0.00 - 0.00 | 0.00 - 0.00 | |
| | CS-134 | 39 | 15 | | 0.00 (0/26) | 0.00 (0/13) | 0 |
| | | | | | 0.00 - 0.00 | 0.00 - 0.00 | |
| | CS-137 | 39 | 18 | | 0.00 (0/26) | 0.00 (0/13) | 0 |
| | | | | | 0.00 - 0.00 | 0.00 - 0.00 | |
| | FE-59 | 39 | 30 | | 0.00 (0/26) | 0.00 (0/13) | 0 |
| | | | | | 0.00 - 0.00 | 0.00 - 0.00 | |
| | H-3 | 12 | 2000 | 128 | 492 (8/8) | 565 (4/4) | 0 |
| | | | | (0.4 mi NE) | 408 - 736 | 420 - 736 | |
| | I-131 | 39 | 15 | | 0.00 (0/26) | 0.00 (0/13) | 0 |
| | | | | | 0.00 - 0.00 | 0.00 - 0.00 | |
| | MN-54 | 39 | 15 | | 0.00 (0/26) | 0.00 (0/13) | 0 |
| | | | | | 0.00 - 0.00 | 0.00 - 0.00 | |
| | NB-95 | 39 | 15 | | 0.00 (0/26) | 0.00 (0/13) | 0 |
| | | | | | 0.00 - 0.00 | 0.00 - 0.00 | |
| | ZN-65 | 39 | 30 | | 0.00 (0/26) | 0.00 (0/13) | 0 |
| | | | | | 0.00 - 0.00 | 0.00 - 0.00 | |
| | ZR-95 | 39 | 15 | | 0.00 (0/26) | 0.00 (0/13) | 0 |
| | | | | | 0.00 - 0.00 | 0.00 - 0.00 | |

Mean and range based upon detectable measurements only

Fraction of detectable measurements at specified locations is indicated in parentheses, (Fraction)

Zero range indicates no detectable activity measurements

Environmental Radiological Monitoring Program Summary

Facility: McGuire Nuclear Station

Docket No. 50-369,370

Location: Mecklenburg County, North Carolina

Report Period: 01-JAN-2002 to 31-DEC-2002

| Medium or Pathway Sampled | Type and Total Number of | Lower Limit of Detection | All Indicator Locations | Location with Highest Annual Mean Name, Distance, Direction | | Control Location | No. of Non-Routine Report Meas. |
|---------------------------|--------------------------|--------------------------|-------------------------|---|-----------------------|-----------------------|---------------------------------|
| Unit of Measurement | Analyses Performed | (LLD) | Mean (Fraction) Range | Location Code | Mean (Fraction) Range | Mean (Fraction) Range | |
| Milk (pCi/liter) | | | | | | 141 (14.8 mi WNW) | |
| | BALA-140 | 78 | 15 | 0.00 (0/52) | 0.00 (0/26) | 0.00 (0/26) | 0 |
| | | | | 0.00 - 0.00 | 0.00 - 0.00 | 0.00 - 0.00 | |
| | CS-134 | 78 | 15 | 0.00 (0/52) | 0.00 (0/26) | 0.00 (0/26) | 0 |
| | | | | 0.00 - 0.00 | 0.00 - 0.00 | 0.00 - 0.00 | |
| | CS-137 | 78 | 18 | 0.00 (0/52) | 0.00 (0/26) | 0.00 (0/26) | 0 |
| | | | | 0.00 - 0.00 | 0.00 - 0.00 | 0.00 - 0.00 | |
| | I-131 | 78 | 15 | 0.00 (0/52) | 0.00 (0/26) | 0.00 (0/26) | 0 |
| | | | | 0.00 - 0.00 | 0.00 - 0.00 | 0.00 - 0.00 | |
| | LLI-131 | 78 | 1 | 0.00 (0/52) | 0.00 (0/26) | 0.00 (0/26) | 0 |
| | | | | 0.00 - 0.00 | 0.00 - 0.00 | 0.00 - 0.00 | |

Mean and range based upon detectable measurements only

Fraction of detectable measurements at specified locations is indicated in parentheses, (Fraction)

Zero range indicates no detectable activity measurements

Environmental Radiological Monitoring Program Summary

Facility: McGuire Nuclear Station

Docket No. 50-369,370

Location: Mecklenburg County, North Carolina

Report Period: 01-JAN-2002 to 31-DEC-2002

| Medium or Pathway Sampled | Type and Total Number of | Lower Limit of Detection | All Indicator Locations | Location with Highest Annual Mean Name, Distance, Direction | | Control Location | No. of Non-Routine Report Meas. |
|-----------------------------------|--------------------------|--------------------------|-------------------------|---|-----------------------|-----------------------|---------------------------------|
| Unit of Measurement | Analyses Performed | (LLD) | Mean (Fraction) Range | Location Code | Mean (Fraction) Range | Mean (Fraction) Range | |
| Broadleaf Vegetation (pCi/kg-wet) | 134 (8.8 mi WNW) | | | | | | |
| | CS-134 | 28 | 60 | 0.00 (0/21) | 0.00 (0/7) | 0.00 (0/7) | 0 |
| | | | | 0.00 - 0.00 | 0.00 - 0.00 | 0.00 - 0.00 | |
| | CS-137 | 28 | 80 | 0.00 (0/21) | 0.00 (0/7) | 0.00 (0/7) | 0 |
| | | | | 0.00 - 0.00 | 0.00 - 0.00 | 0.00 - 0.00 | |
| | I-131 | 28 | 60 | 0.00 (0/21) | 0.00 (0/7) | 0.00 (0/7) | 0 |
| | | | | 0.00 - 0.00 | 0.00 - 0.00 | 0.00 - 0.00 | |

Mean and range based upon detectable measurements only

Fraction of detectable measurements at specified locations is indicated in parentheses, (Fraction)

Zero range indicates no detectable activity measurements

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|-------------------------------|--------------------------|--------------------------|-------------------------|---|-----------------------|-----------------------|---------------------------------|
| Unit of Measurement | Analyses Performed | (LLD) | Mean (Fraction) Range | Location Code | Mean (Fraction) Range | Mean (Fraction) Range | |
| Food Products (pCi/kg-wet) | | | | | | No Control Location | |
| | CS-134 | 11 | 60 | | 0.00 (0/11) | 0.00 (0/0) | 0 |
| | | | | | 0.00 - 0.00 | 0.00 - 0.00 | |
| | CS-137 | 11 | 80 | | 0.00 (0/11) | 0.00 (0/0) | 0 |
| | | | | | 0.00 - 0.00 | 0.00 - 0.00 | |
| | I-131 | 11 | 60 | | 0.00 (0/11) | 0.00 (0/0) | 0 |
| | | | | | 0.00 - 0.00 | 0.00 - 0.00 | |

Mean and range based upon detectable measurements only

Fraction of detectable measurements at specified locations is indicated in parentheses, (Fraction)

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|---------------------------|--------------------------|--------------------------|-------------------------|---|-----------------------|-----------------------|---------------------------------|
| Unit of Measurement | Analyses Performed | (LLD) | Mean (Fraction) Range | Location Code | Mean (Fraction) Range | Mean (Fraction) Range | |
| Fish (pCi/kg-wet) | | | | | | 137 (12.0 mi N) | |
| | CO-58 | 12 | 130 | | 0.00 (0/6) | 0.00 (0/6) | 0 |
| | | | | | 0.00 - 0.00 | 0.00 - 0.00 | |
| | CO-60 | 12 | 130 | | 0.00 (0/6) | 0.00 (0/6) | 0 |
| | | | | | 0.00 - 0.00 | 0.00 - 0.00 | |
| | CS-134 | 12 | 130 | | 0.00 (0/6) | 0.00 (0/6) | 0 |
| | | | | | 0.00 - 0.00 | 0.00 - 0.00 | |
| | CS-137 | 12 | 150 | 129 | 23.3 (2/6) | 0.00 (0/6) | 0 |
| | | | | (0.5 mi ENE) | 22.2 - 24.4 | 0.00 - 0.00 | |
| | FE-59 | 12 | 260 | | 0.00 (0/6) | 0.00 (0/6) | 0 |
| | | | | | 0.00 - 0.00 | 0.00 - 0.00 | |
| | MN-54 | 12 | 130 | | 0.00 (0/6) | 0.00 (0/6) | 0 |
| | | | | | 0.00 - 0.00 | 0.00 - 0.00 | |
| | ZN-65 | 12 | 260 | | 0.00 (0/6) | 0.00 (0/6) | 0 |
| | | | | | 0.00 - 0.00 | 0.00 - 0.00 | |

Mean and range based upon detectable measurements only

Fraction of detectable measurements at specified locations is indicated in parentheses, (Fraction)

Zero range indicates no detectable activity measurements

Environmental Radiological Monitoring Program Summary

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Docket No. 50-369,370

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|---------------------------------|--------------------------|--------------------------|-------------------------|---|-----------------------|-----------------------|---------------------------------|
| Unit of Measurement | Analyses Performed | (LLD) | Mean (Fraction) Range | Location Code | Mean (Fraction) Range | Mean (Fraction) Range | |
| Shoreline Sediment (pCi/kg-dry) | | | | | | 137 (12.0 mi N) | |
| | MN-54 | 6 | 0 | 22.4 (1/4) | 130 | 22.4 (1/2) | 0.00 (0/2) |
| | | | | 22.4 - 22.4 | (0.5 mi SW) | 22.4 - 22.4 | 0.00 - 0.00 |
| | CO-58 | 6 | 0 | 0.00 (0/4) | | 0.00 (0/2) | 0.00 (0/2) |
| | | | | 0.00 - 0.00 | | 0.00 - 0.00 | 0 |
| | CO-60 | 6 | 0 | 0.00 (0/4) | | 0.00 (0/2) | 0.00 (0/2) |
| | | | | 0.00 - 0.00 | | 0.00 - 0.00 | 0 |
| | CS-134 | 6 | 150 | 0.00 (0/4) | | 0.00 (0/2) | 0.00 (0/2) |
| | | | | 0.00 - 0.00 | | 0.00 - 0.00 | 0 |
| | CS-137 | 6 | 180 | 90.0 (4/4) | 130 | 159 (2/2) | 112 (1/2) |
| | | | | 19.8 - 248 | (0.5 mi SW) | 71.5 - 248 | 112 - 112 |

Mean and range based upon detectable measurements only

Fraction of detectable measurements at specified locations is indicated in parentheses, (Fraction)

Zero range indicates no detectable activity measurements

If LLD is equal to 0.00, then the LLD is not required by Selected Licensee Commitments

Environmental Radiological Monitoring Program Summary

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Report Period: 01-JAN-2002 to 31-DEC-2002

| Medium or Pathway Sampled | Type and Total Number of | Lower Limit of Detection | All Indicator Locations | Location with Highest Annual Mean Name, Distance, Direction | | Control Location | No. of Non- Routine Report Meas. |
|--|-----------------------------------|--------------------------------|----------------------------|---|--------------------------|--------------------------|---|
| Unit of Measurement | Analyses Performed | (LLD) | Mean (Fraction) Range | Location Code | Mean (Fraction) Range | Mean (Fraction) Range | |
| Direct Radiation TLD (mR/standard quarter) | | | | | | 175 (15.5 mi WNW) | |
| | 164 | 0.00E+00 | 16.9 (160/160) | 173 | 24.3 (4/4) | 23.7 (4/4) | 0 |
| | | | 9.80 - 29.5 | (8.4 mi NNW) | 22.1 - 26.0 | 22.2 - 24.8 | |

Mean and range based upon detectable measurements only

Fraction of detectable measurements at specified locations is indicated in parentheses, (Fraction)

Zero range indicates no detectable activity measurements

APPENDIX C

**SAMPLING DEVIATIONS
&
UNAVAILABLE ANALYSES**

APPENDIX C

MCGUIRE NUCLEAR STATION SAMPLING DEVIATIONS & UNAVAILABLE ANALYSES

| DEVIATION & UNAVAILABLE REASON CODES | | | |
|--------------------------------------|------------------------|----|---|
| BF | Blown Fuse | PO | Power Outage |
| FZ | Sample Frozen | PS | Pump out of service / Undergoing Repair |
| IW | Inclement Weather | SL | Sample Loss/Lost due to Lab Accident |
| LC | Line Clog to Sampler | SM | Motor / Rotor Seized |
| OT | Other | TF | Torn Filter |
| PI | Power Interrupt | VN | Vandalism |
| PM | Preventive Maintenance | | |

C.1 SAMPLING DEVIATIONS

Air Particulate and Air Radioiodines

| Location | Scheduled Collection Dates | Actual Collection Dates | Reason Code | Corrective Action |
|----------|----------------------------|-------------------------|-------------|---|
| 121 | 6/19 – 6/26/2002 | 6/19 – 6/26/2002 | PO | Power outage to sampling equipment occurred during the composite period. Power was cut due to a tree falling on the main service line to the McGuire site. Power was interrupted for approximately three hours. |
| 195 | 6/19 – 6/26/2002 | 6/19 – 6/26/2002 | | |
| 120 | 6/19 – 6/26/2002 | 6/19 – 6/26/2002 | | |

Surface Water

| Location | Scheduled Collection Dates | Actual Collection Dates | Reason Code | Corrective Action |
|----------|----------------------------|-------------------------|-------------|---|
| 128 | 6/12 – 7/10/2002 | 6/12 – 7/10/2002 | PO | Power outage to sampling equipment occurred during the composite period. Power was cut due to a tree falling on the main service line to the McGuire site. Power was interrupted for approximately three hours. |

C.2 UNAVAILABLE ANALYSES

There were no unavailable analyses for the 2002 REMP.

APPENDIX D

ANALYTICAL DEVIATIONS

No analytical deviations were incurred for the
2002 Radiological Environmental Monitoring Program

APPENDIX E

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM RESULTS

This appendix includes all of the sample analysis reports generated from each sample medium for 2002. Appendix E is located separately from this report and is permanently archived at Duke Power Company's Environmental Center radiological environmental master file, located at the McGuire Nuclear Station Site in Huntersville, North Carolina.