

Appendix B

RADIOLOGICAL IMPACT ANALYSIS METHODS

This appendix describes the methods used to evaluate the radiological impacts of FMF construction, normal operations, incidents and accidents, occupational exposure, and transportation, in terms of radiological doses and associated health effects.

B.1 AIRBORNE RADIOACTIVE EFFLUENTS

The radiological doses due to airborne effluents to persons off the site have been calculated for the general population as far as 80 kilometers away, and for a hypothetical maximally exposed individual at the site boundary. The dose methodology is based on U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 1.109 as implemented in the NRC-developed GASPARG computer code (NRC, 1977a, 1980). The normalized atmospheric concentrations, λ/Q , and normalized ground concentrations, D/Q , were calculated using the XOQDOQ computer program, which follows the methods presented in NRC Regulatory Guide 1.111 (Sagendorf, 1974; NRC, 1977b). The atmospheric dispersion estimates for the Savannah River Plant (SRP) site were based on 1976 to 1977 meteorological data collected near the Plant. The atmospheric dispersion estimates for the Oak Ridge Reservation (ORR) alternate site were based on data collected at the Clinch River Breeder Reactor site from March 1976 to February 1977. Eighty-kilometer population distributions used in the analyses for both sites were generated. The projected population for the year 2000, which represents the approximate midlife of FMF operations, was used.

The 50-year integrated dose commitment following a 1-year exposure was calculated for the general population and the maximally exposed individual for the following pathways:

1. Inhalation
2. Cloud immersion
3. Vegetation ingestion
4. Meat ingestion
5. Milk ingestion
6. Water ingestion

B.2 LIQUID RADIOACTIVE EFFLUENTS

The radiological doses due to liquid releases were calculated using the LADTAP II code, which incorporates the recommendations of NRC Regulatory Guide 1.109 (NRC, 1977a; Simpson and McGill, 1980). Inputs to the code include the discharge source term, dilution factors, and downstream water use. The dose pathways considered include:

1. Drinking water
2. Ingestion of fish and invertebrates
3. Shoreline recreation and boating

For the SRP site, water use was considered from the Savannah River below the Plant to the Atlantic Ocean; for the Oak Ridge site, water use was considered downstream for 80 kilometers. This resulted in a more conservative estimate for the SRP site.

B.3 TRANSPORTATION

Radiation exposures to the population and the maximally exposed individual along the shipping routes were estimated by the methods described in DOE (1978). The radiation level at 1.8 meters from a truckload of nonirradiated uranium products will be about 0.1 millirem per hour (ERDA, 1976). This radiation level is assumed to be typical of shipments to and from the facility. Inputs to the calculations also included highway distances between each site and locations of the uranium hexafluoride feed production and fuel material receiving facilities, as well as average population densities along each route.

REFERENCES FOR APPENDIX B

- DOE (U.S. Department of Energy). 1978. Analytical Methodology and Facility Description--Spent Fuel Policy. DOE-ET-0054, Washington, D.C.
- ERDA (U.S. Energy Research and Development Administration). 1976. Final Environmental Statement--U.S. Nuclear Power Export Activities. ERDA-1542, Vol. 1, Washington, D.C.
- NRC (U.S. Nuclear Regulatory Commission). 1977a. Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50. NRC Regulatory Guide 1.109, Washington, D.C.
- NRC (U.S. Nuclear Regulatory Commission). 1977b. Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Routine Release from Light Water Cooled Reactors. NRC Regulatory Guide 1.111, Washington, D.C.
- NRC (U.S. Nuclear Regulatory Commission). 1980. User's guide to GASPAR. NUREG-0597, Washington, D.C.
- Sagendorf, J. F. 1974. XOQDOQ Program for Evaluating Atmospheric Dispersion from Nuclear Power Stations. NDA-A-TM-ERL-ARL-42, National Oceanic and Atmospheric Administration, Washington, D.C.
- Simpson, P. B., and B. L. McGill. 1980. User's Manual for LADTAP II, A Computer Program for Calculating Radiation Exposure to Man from Routine Releases of Nuclear Reactor Liquid Effluents. NUREG 1CR-126, Oak Ridge National Laboratory, Oak Ridge, Tennessee.