Factors Involved in the Elevated Susceptibility of the Perinatal Thyroid Gland to Radioiodine Cancer

*M. R. Sikov, G. E. Dagle, T. Hui, and D. D. Mahlum, Washington State University Tri-Cities, Richland, WA 99352

Abstract for Inland Northwest Cancer Conference

Renewed concern about radioiodine effects in human fetuses and children led us to integrate our modeling of I-131 metabolism and dosimetry in the fetal human thyroid with patterns from quantitative and mechanistic studies in perinatal rodents. Exposure of weanling or adult rats to high I-131 levels resulted in rapid necrosis of the thyroid, followed by fibrosis. Characteristic early changes after perinatal exposure included dose-dependent inhibition of thyroid differentiation and growth. Thyroid tumor incidence was altered in all age groups with patterns that related to differing age-related interactions between initial morphologic responses and resulting physiologic changes during the post exposure period. The incidence of C-cell tumors, the predominant histologic type in controls, was unaffected by lower doses but was decreased at higher doses in all age groups. The primary histologic type in exposed animals, follicular tumors, increased at lower doses, irrespective of age at administration. Incidence progressively increased with dose in the prenatal or neonatal groups, but decreases at higher doses in the older animals.

Tritiated thymidine labeling studies in neonatal rats detected actively proliferating populations of cells between follicles; these represent early functional parenchyma that subsequently gives rise to additional follicles. Cell numbers decreases with time; the peak of labeled follicles and follicular cell proliferation occurred near the end of the first postnatal week, corresponding to the second trimester of human pregnancy. This age-related differences in macrodosimetry and microdosimetry and patterns of thyroid proliferation are superimposed onto the differential injury and repair processes and subsequent interactions with thyroid-pituitary feedback processes. This combination of factors provides and explanation for the elevated perinatal sensitivity to carcinogenesis by I-131.

* Evaluations bases on studies for the Department of Energy and the Nuclear Regulatory Commission performed at Pacific Northwest National Laboratory.

USTUR-0146-99