two cases of osteogenic sarcoma among 15 women whose deaths were attributed to radium-mesothorium poisoning. The authors pointed out that this incidence was too high to be coincidental and went on to postulate "that the preexisting deposits of radioactive substances in the bones . . . played an important etiologic role in the subsequent development of the sarcoma." They called attention as well to the existence of four publications implicating external radiation treatments as the cause of sarcomas in humans.

Two years later, Martland (1931) reported that 5 deaths with osteogenic sarcomas had occurred among 18 deaths in workers at the Orange plant. In addition, he described another death with a bone sarcoma in a dial painter who had worked in New York and Connecticut. Martland also reported details on two living individuals with sarcomas and a third he believed would develop a sarcoma. He thus was able to state, "We have . . . in the study of the radium dial painters, proof that radiation can produce malignancy. . . ."

It was possible, from autopsy and exhumation material, to determine with current techniques the radium levels of four of the five sarcoma cases Martland (1931) described. The systemic intake levels ranged from about 243 μCi to over 400 μCi of ^{226}Ra and from 72 μCi to over 2,200 μCi of ^{228}Ra.

Martland (1931) also reviewed the symptoms of radium poisoning. The early cases "were characterized by the presence of jaw necroses and the development of anemias." The jaw necroses were thought to be the consequence of "bacterial infection, usually by way of the teeth, . . ." which resulted in "intractable necrosis of the jaw. . . ." The anemias he believed to be leukopenic, of the regenerative type. Most of these cases occurred within five to ten years after the worker entered the industry.

The later cases showed "crippling bone lesions, developing years after they have left their work as dial painters, and often after several years of good health." These individuals often experienced spontaneous fractures of their bones, and some of them developed bone sarcomas.

Table I in Martland (1931) lists 18 deceased workers from the Orange, New Jersey, plant. Four of these were male chemists, with anemia listed as the cause of death. One individual, who died in 1922, was not seen by Martland. This victim, Case 00-033 in the Argonne files and Case 2 in Martland's (1931) Table I, was exhumed in 1969. Very little radium was found; the body content was only 0.006 μCi of ^{226}Ra, and the calculated systemic intake was only 0.2 μCi of ^{226}Ra and 0.2 μCi of ^{228}Ra. Had this victim been examined at death with the techniques then available, no radium would have been found. This observation suggests that the anemia in this case (and