best fitted by the linear D-exponential function. A linear function through the origin was also fitted for the cases in the dose range in which no tumors had been observed; this function was the one with the largest slope for which the probability P was not less than 0.05. This last fitting was done on the premise that to predict the effects of radium at low doses by using a linear function, one should use a linear function that realistically fits the existing low-dose data.

A number of years were to pass before dose-response functions for the radium cases were published in the open literature by the Argonne group. Rowland et al. (1978) reported functions derived for a population limited to female dial workers employed before 1930. This cohort consisted of 759 women who had experienced 38 bone sarcomas and 17 head carcinomas. Initial systemic intake was used for the dose parameter, and incidence was in units of tumor cases per person year. The fitted functions were derived from an equation of the form

$$\text{Incidence} = (C + \alpha D + \beta D^2)\, e^{-\gamma D}. \tag{6}$$

Here C is the natural incidence of the malignancy for the population under study, and α, β, and γ are parameters to be determined by the least-squares fitting process. Six functions were tested: the general form shown above and five simplifications obtained by omitting the D, the D^2, the exponential term $e^{-\gamma D}$, and the exponential term plus the D or D^2 term. Each of the equations obtained was tested for goodness of fit with a chi-squared statistic. The fitted values and the value of the chi-squared statistic were shown for each trial. Acceptable fits were those for which the confidence level, p, was ≥ 0.05.

To test for possible bias introduced by including individuals with malignancies whose body contents were determined only after exhumation, these cases were removed with little effect on the fitted equations. For each cohort the best fit for the sarcoma data was given by the equation of the form

$$\text{Incidence} = (C + \beta D^2)\, e^{-\gamma D}, \tag{7}$$

and an acceptable fit was provided by the complete general expression.

When the carcinoma cases were tested, the best fit was given by the expression

$$\text{Incidence} = C + \alpha D, \tag{8}$$

but the complete expression and three other simplifications of it also provided acceptable fits. The small number of carcinomas (17) allowed less discrimination between the proposed equations than the larger number (38) of sarcomas.