Body of Abstract: Lung cancer mortality in the Mayak worker cohort is analysed with the two stage clonal expansion (TSCE) model of carcinogenesis. Mayak production association includes a nuclear reactor, radiochemical plant and plutonium production plant. Reactor workers were exposed to external g-ray and neutron exposures, and workers in the radiochemical and plutonium facilities additionally to internal exposures due to plutonium inhalation. The cohort used in this study involves male nuclear workers for whom plutonium measurements and smoking information (smoker/non-smoker) exists and with health follow-up to the end of 1999. A subcohort with 5421 workers and 274 lung cancer deaths is analysed. Within the TSCE model, an action of radiation was assumed both in initiation and promotion. Specific emphasis was given to the distinction of the effects of external and internal exposures. The baseline lung cancer mortality rate was derived from the cohort itself. Using the smoking information significantly increased the quality of the fit. Analysis showed no effect of radiation on transformation. Two models are found to give equally good fit of the data. Both models have a linear dose dependence in TSCE-model parameters for external and internal radiation. Both models have linear dependence either initiation or promotion on birth year effect. It is found that most of the lung cancer cases are due to plutonium inhalation. The estimated excess relative risk per unit dose due to the plutonium α particles is 0.13/Sv, in both models. For the g-ray component, the present analysis gives an excess relative risk for lung cancer mortality of 0.02/Sv, in both models. Resulting risk for plutonium exposures is compatible with the radiation weighting factor 20. In general no strong dose or dose-rate effects were observed within the cohort.