

Lung cancer in French uranium miners: radon-associated risk at low exposure rate and modifying effectsB. Vacquier^a, A. Rogel^a, S. Caër^b, K. Leuraud^a, A. Acker^b and D. Laurier^c^a*Institut de Radioprotection et de sûreté nucléaire, BP 17, 92262 Fontenay-aux-Roses Cedex, France;* ^b*AREVA NC, 33 rue la Fayette, 75009 Paris, France;* ^c*Institut de Radioprotection et de sûreté nucléaire, DRPH/ SRBE/ LEPID, 92262 Fontenay-aux-roses cedex, France**blandine.vacquier@irsn.fr*

Introduction The association between the cumulative radon exposure and the increase risk of death from lung cancer has been well documented in underground miners exposed to radon studies. However, a better understanding of the effect of low exposure and factors modifying the lung cancer risk is of continued interest. Compared to other miners cohorts, the French cohort is characterised by a high quality of exposure assessment and low levels of exposure. We present here a new analysis which allowed to study modifying factors among the French cohort followed up to 1999. **Methods** The cohort includes men employed for at least one year between 1946 and 1990. Vital status and cause of death were obtained for each miner. Radon exposure was estimated individually for each year. Before 1956, the exposure was reconstructed retrospectively by a experts group and after 1955, the exposure was recorded individually. Standardized mortality ratios (SMRs) were computed using national mortality rates as references. The relationship between radon exposure and risk of lung cancer was estimated using excess relative risk models (ERR), which allow investigation of time dependent modifying factors such as period of exposure, time since exposure, duration of exposure and exposure rate. **Results** The cohort comprises 5,086 miners with a mean duration of follow-up of 30 years. The number of radon exposed miners is 4,133 with an average cumulative radon exposure of 36.5 Working Level Month (WLM). Mean positive annual exposure before 1956 and after 1955 was 21.3 and 1.7 WLM respectively. A total of 1,471 deaths is observed among miners. The analysis confirms a significant excess risk of lung cancer death (n=159; SMR=1.4) and a significant increase in risk with cumulative radon exposure (ERR=0,58 per 100 WLM). The main modifier is the period of exposure: the ERR/WLM is ten times higher after than before 1956. The decrease in risk with time since exposure and exposure rate disappears when period of exposure is taken into account. **Conclusion** This analysis confirms that the relationship between radon exposure and lung cancer risk differs according to period of exposure. Better precision in exposure estimates after 1956 may explain this difference. Continuation of this work is included in a European collaborative research project, aiming to a synthesis of the effects of radon at low levels of exposures. This work was partly supported by AREVA-NC and by the European Commission (Contract FI6R 51648).