new exposure assessment tool that could be used to estimate IIE exposure for epidemiology.

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360 DOSE-RESPONSE RELATIONSHIP BETWEEN A PARTICULAR FORM OF CRYPTOCRYSTALLINE SILICA AND THE INCIDENCE OF SILICOSIS

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Objectives It has been known for centuries that crystalline silica induces silicosis. However, there are different entities of crystalline silica. Siliceous earth is a worldwide unique blend of amorphous and cryptocrystalline silica and lamellar kaolinite. This retrospective cohort study is the first that investigated the silicosis risk of siliceous earth.

Methods The cohort consists of employees exposed to siliceous earth in one company in Bavaria, Germany. Their job activities were collected from personnel files. Workers were included, if they had worked at least one year from the date of recruitment to the end of the study in 2008. The disease data were collected from occupational disease records of the Raw Materials and Chemical Industry Employers' Liability Insurance Association (BG RCI). Two pneumologists reviewed the radiographic findings independently on the basis of reports of radiological findings according to ILO 2000. Workers with an ILO profusion $\geq$ 1/1 (p, q, r) were considered to have silicosis. Using the existing 709 measurement records of the years 1961–2008 exposure to silica was assessed for each subject with a job-exposure matrix. To determine the risk of silicosis Poisson regression was performed and to determine the dose-response relationship cubic splines were applied.

Results In total 675 persons were enumerated, including 84 women. Among women, there were no silicosis but 55 among men. The evaluation of the exposed men showed a silicosis risk at a cumulative exposure of more than 6 mg/m^{3}xyears (RR = 25; 95% CI 5.3–111.5) and especially in underground mining (RR = 12; 95% CI 4.9–28.6). In addition, a dose-response relationship with increasing cumulative exposure was found.

Conclusions We found a dose-response relationship between silicosis and cumulative exposure to siliceous earth. The silicosis risk of siliceous earth is according to these results not higher than that described in the literature for crystalline or cryptocrystalline silica.

361 SILICA DUST AND MORTALITY FROM NON-MALIGNANT RESPIRATORY DISEASES IN THE GERMAN WISMUT MINERS COHORT, 1946–2008

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Objectives To investigate possible associations between silica dust exposure and death from chronic obstructive pulmonary diseases (COPD) and silicosis in German uranium miners.

Methods The cohort consists of 58,672 miners comprising 2,167,600 person-years and 25,239 deaths in the follow-up period 1946–2008. A detailed job-exposure matrix was used to estimate the cumulative exposure to crystalline silica in mg/m^3-years. The total numbers of underlying causes of death from COPD (ICD-10 code: J40-J44) or silicosis (J62-J65) was determined based on certificates of death and autopsy files. Internal Poisson regression with baseline-stratification by age, calendar year and duration of employment was used to estimate the relative risk (RR) and 95% confidence limits (CI) in different categories of cumulative exposure to silica dust for mortality from COPD and silicosis.

Results Nearly all cohort members were exposed to silica dust at some stage with a wide exposure range (mean = 5.9, max = 56 mg/m^3-years). No increase in risk with increasing cumulative silica dust was found for COPD as underlying cause of death only (n = 719), whereas statistically significantly increased RR's in exposure categories above 10 mg/m^3-years were found when COPD was considered as underlying or contributing cause of death (n = 2,675). The corresponding RR in the highest exposure category of 30 or more compared to less than 0.5 mg/m^3-years was 2.2 (95% CI: 1.6–2.8). The RR for silicosis as underlying cause of death (n = 976) compared to the reference category 0–2 mg/m^3-years increased systematically with increasing exposure from RR = 2.8 (95% CI: 1.03–4.6) to 118.1 (95% CI: 50.3–188.0) in the exposure categories 2–5 and 30 or more mg/m^3-years, respectively.

Conclusions Mortality of silicosis is confirmed to be associated with cumulative silica dust exposure even at low levels. Results indicate that death from COPD is related to silica dust, when considering underlying and contributing causes of death.

362 UPDATED RESULTS ON THE RISK OF DEATH FROM LUNG CANCER BY SILICA DUST IN GERMAN WISMUT URANIUM MINERS, 1946–2008

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Objectives To investigate the exposure-response relationship between silica dust and lung cancer mortality within German uranium miners in the extended follow-up period from 1946 to 2008. The cohort consists of 58,672 miners including 2.2 Mio person-years and 3,477 lung cancer deaths.

Methods Individual information on occupational exposure to crystalline silica in mg/m^3-years and the potential confounders radon and arsenic is available for all cohort members based on a detailed job-exposure matrix. Internal Poisson regression with baseline-stratification by age and calendar year was used to estimate the excess relative risk (ERR) per mg/m^3-year. Several spline functions were applied to investigate the exposure-response relationship. Detailed adjustment for cumulative radon and arsenic exposure was conducted. Effect modification by age, time and exposure-rate was tested. Additionally detailed risk analyses with specific focus on the low dose range have been performed.

Results All miners were exposed to crystalline silica at any time. The mean cumulative silica exposure was 5,9 mg/m^3-years with a maximum of 56 mg/m^3-years. A piece-wise linear spline function with a knot at 10 mg/m^3-years provided the best model fit. After full adjustment for radon (continuous variable with