Objectives This study was conducted to compare the cancer incidence in inorganic lead exposed workers with the Korean general population, and to explore the relationship between cancer mortality and blood lead levels.

Method Using the Korean annual medical surveillance for exposure to lead, a cohort comprising 74,659 inorganic lead exposed workers working between January 1st, 2000 and December 31st, 2004 was compiled. This cohort was merged with the Korea National Central Cancer Registry (KNCCR) and death registry of the Korea National Statistical Office (KNSO) in order to evaluate the cancer morbidity for these workers between 2000 and 2008.

Results There were 793 cases cancer and, the incidence of stomach cancer (SIR 1.17, 95% CI=1.01–1.36) was found to be elevated in lead chromate workers. Excesses were observed for kidney (2.15, 1.19–3.88) and bladder cancers (2.29, 1.149–4.58) in lead exposed workers ≥20 years of job duration., kidney cancer (2.25, 1.21–4.18) in workers with ≥10 ug/dl of blood lead level and lung cancer in female workers with ≥10 ug/dl. Workers with ≥40 ug/dl of blood lead levels had a significantly higher risk of overall cancer mortality (RR: 2.75; 95% CI: 1.06–1.98) compared with workers who had less than 10 ug/dl.

Conclusions Our study showed incidence excess of lung cancer in female workers, stomach cancer in lead chromate exposed workers and a possible dose-response relationship between d kidney cancers and lead exposure. Also overall cancer mortality excess was observed in high lead exposed workers.

### Oral presentation

#### 0364 CANCER INCIDENCE AND MORTALITY IN AN AUSTRALIAN COHORT OF LEAD WORKERS WITH HISTORICALLY COLLECTED BLOOD LEAD DATA

Walter Sim, 1Ewan MacFarlane, 1Stella Gwinn, 1Anthony Del Monaco, 1David McLean, 3Dino Pisaniello, 7Gaza Benke, 1Centre for Occupational and Environmental Health, Monash University, Melbourne, Victoria, Australia; 2Centre for Public Health Research, Massey University, Wellington, New Zealand; 3School of Population Health and Clinical Practice, University of Adelaide, Adelaide, South Australia, Australia

Objectives To measure cancer incidence and mortality in a retrospective cohort of Australian lead-exposed workers.

Method The cohort comprised male lead workers who had been participants in state government occupational blood lead surveillance programs conducted since the 1970s. Historically collected blood lead level data were accessed from surveillance records. Linkage was undertaken to the National Death Index and the Australian Cancer Database to identify causes of death and incident cancers.

Results 4114 male subjects were followed for an average of 16.2 years, giving 68,172 person years. All incident cancers and all deaths were ascertained. SMRs were lower than expected (SIR 83, 95% CI: 73–95). The incidence of liver cancer was elevated (SIR 217, 95% CI 103–454), as was the incidence of oesophageal cancer (SIR 240, 95% CI: 129–447). Among those cohort members with at least one blood lead result in excess of 30 μg/dl, oesophageal cancer incidence was elevated (SIR 755; 95% CI 314–1813). Other cancer types were not found to occur in excess. All cause mortality was greater than expected (SMR 111; 95% CI 101–123) based on 406 deaths. Non-malignant digestive system deaths (SMR 167; 95% CI 110–250) and deaths from external causes (SMR 135; 95% CI 105–174) were also elevated.

Conclusions The increase in gastrointestinal tract cancers is consistent with some previous studies of lead workers. Confounding from lifestyle factors, such as alcohol, could not be examined. It is planned to include this cohort in an international pooling study of lead exposed workers.

#### 0365 CHALLENGES TO OCCUPATIONAL CANCER EPIDEMIOLOGY IN QATAR

1Ann Olsson, 1Rachel Denholm, 1Joachim Schüz, 1Kurt Straif, 1Fiona Bonas, 2Faleh Mohamed Hussain Ali. 1International Agency for Research on Cancer, Lyon, France; 2Karolinska Institutet, Stockholm, Sweden; 3Supreme Council of Health, Doha, Qatar

Objectives Assess exposures to occupational carcinogens in Qatar

Method IARC conducted a review of environmental carcinogens (IARC Group 1 and 2A) in Qatar 2013. Information was ascertained from ministries and a survey among Qatar Petroleum associated companies

Results Major parts of the population are migrant workers; male migrant workers are primarily recruited for the construction and the oil-and-gas industry, while female migrant workers mostly do domestic work. The predominant material for construction is lime stone with increasing use of gabbro containing low silica levels compared to quartz. Only small quantities of asbestos have been used. The technologies used for natural gas extraction in Qatar are mostly closed processes.

Conclusions Workers in construction and in the oil and gas sector are mainly migrant workers who remain in the country for short
Oral presentation

Breast cancer incidence among flight attendants

Mary Schubauer-Bergan, Misty Hein, Jeri Anderson, Steven Allee, Alice Sigurdson, Mark Little, Lynne Pinkerton, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, Cincinnati, OH, USA; 2SRA International, Inc., Fairfax, VA, USA; 3National Cancer Institute, National Institutes of Health, Bethesda, MD, USA

Objectives Previous studies suggest that flight attendants have a higher incidence of breast cancer than the general population; however, the reason remains unclear. We evaluated the relation of breast cancer incidence with the general population and to evaluate exposure-response relations.

Results Breast cancer incidence was increased compared to the general population (observed 343, standardised incidence ratio 1.37; 95% confidence interval 1.23, 1.52). Among flight attendants, breast cancer was not significantly associated with ten-year lagged cumulative estimates of absorbed cosmic radiation dose, and metrics of circadian rhythm disruption among a cohort of 6092 female former US flight attendants.

Conclusions Our findings suggest a potential association between metal fume exposure and COPD. Further study with a prospective design is needed to investigate the excessive decline of lung function by welding fume exposure.

The relationship between welding fume exposure and chronic obstructive pulmonary disease in shipyard welders in Korea

Donna Hae Koh, Jung-A Kim, Kyoung-Hui Kim, Seung-Won Yoo. Carcinogenic Hazard Branch, National Cancer Control Institute, National Cancer Center, Goyang-Si, Gyeonggi-Do, Republic of Korea; 2Dong-a University, Busan, Republic of Korea; 3Department of Occupational and Environmental Medicine, Busan Paik Hospital, Inje University, Busan, Republic of Korea; 4Korean Industrial Health Association, Suwon, Republic of Korea; 5Occupational Safety and Health Research Institute, Korea Occupational Safety and Health Agency, Incheon, Republic of Korea

Objectives Welding fume is suspected to accelerate the decline of lung function and development of chronic obstructive pulmonary disease (COPD). The aim of this study was to examine the relationship between welding fume exposure and COPD in Korean shipyard welders.

Method 240 male welders who were working at two shipyards and took the annual health examination including pulmonary function test in 2010 participated in this study. A questionnaire about smoking habits and occupational history was administered. PFT was carried out with strict quality control measures. Exposed fume concentrations were estimated using 884 welding fume measurements taken 2002–2009 in one of the shipyards. Linear multiple regression was employed to evaluate the association between cumulative fume exposure and lung function parameters. Logistic regression was employed to test the excess risk of COPD by cumulative fume exposure. Age, height, the smoking amount, and cumulative fume exposure were incorporated as independent variables in those models.

Results Mean age was 48, and mean work duration was 18 years. The mean cumulative fume exposure was 7.7 mg/m³. The prevalence of COPD was 14.6%. FEV₁ and FVC showed negative correlations with cumulative fume exposure, but statistically non-significant. Odds ratios of COPD were significantly elevated for middle (5.02, 95% CI: 1.27–33.55) and high exposure group (6.20, 95% CI: 1:41–44.98) compared to the low fume exposure group.

Conclusions We found elevated odds ratios of COPD associated with cumulative welding fume exposure. Detailed exposure assessment with long-term exposure data is needed to provide evidence of the association of welding fume exposure and COPD.

Pool case-control studies for enhanced evidence on occupational risk factors in lung cancer research – the SYNERGY project

Ann Olsson, Hans Kromhout, Roel Vermeulen, Susan Peters, Beate Pesch, Thomas Behrens, Benjamin Kendzia, Joachim Schüz, Kurt Straif. 1National Institute for Occupational Safety and Health, Cincinnati, OH, USA; 2The Institute of Environmental Medicine, Karolinska Institutet, Stockholm, Sweden; 3Institute for Risk Assessment Sciences, Utrecht, the Netherlands; 4Institute for Prevention and Occupational Medicine of the German Social Accident Insurance – Institute of the Ruhr-Universität Bochum, Bochum, Germany

Objectives Explore quantitative exposure-response association for exposure to asbestos, crystalline silica, nickel, chromium and polycyclic aromatic hydrocarbons in the general population; further study effects on specific cell types and potential interaction with smoking and co-occurring occupational exposures.

Method Fourteen studies from Europe and Canada were pooled including 17,700 lung cancer cases and 21,800 controls with detailed information on tobacco habits and lifetime occupations. A quantitative job-exposure matrix (SYN-JEM) was developed based on more than 350,000 exposure measurements from the participating countries. Different model specifications were compared to predict historical job-, time-, and region-specific exposure levels. Individual exposure levels were calculated for each subject by linking the SYN-JEM with the individual occupational histories. Unconditional logistic regression models were fitted to estimate odds ratios, 95% confidence intervals, and trends.

Results We observed exposure-response relationships with increasing duration and cumulative exposure for all agents and