

TABLE V-4: SUMMARY OF SELECTED EPIDEMIOLOGIC STUDIES OF LUNG CANCER IN WORKERS EXPOSED TO HEXAVALENT CHROMIUM

## Stainless Steel Welding

Reference/Exhibit Number	Study Population	Reference Population	Chromium (VI) Exposure	Lung Cancer Risk
Moulin (1997, Ex. 35-285)	Meta analysis of epidemiological studies of lung cancer risk among welders in five categories including stainless steel welding and mild steel welding	Stainless steel welding cohort studies: Simonato <u>et al.</u> , 1991; Polodnak <u>et al.</u> , 1981 case control studies: Hull <u>et al.</u> , 1989; Gerin <u>et al.</u> , 1984; Kjuus <u>et al.</u> , 1986.	Stainless steel welders exposed to higher Cr(VI) than mild steel welders	-RR of 1.50 (p<0.05) for stainless steel welders based on combined 114 deaths from five studies -RR of 1.50 (p<0.05) for mild steel welders based on combined 137 deaths from four studies
Sjogren <u>et al.</u> (1994, Ex. 7-113)	Meta analysis of epidemiological studies of exposure to stainless steel welding fumes and lung cancer.	Stainless steel welding cohort studies: Moulin <u>et al.</u> , 1993; Sjogren <u>et al.</u> , 1987 case control studies: Lauritsen <u>et al.</u> , 1996; Gerin <u>et al.</u> , 1984; Kjuus <u>et al.</u> , 1986	Cr(VI) exposure was not part of the analysis	RR of 1.94 (p<0.05) for stainless steel welders based on combined 70 deaths from five studies
Simonato <u>et al.</u> (1991, Ex. 7-114) Gerin <u>et al.</u> (1993, Ex. 35-220)	Cohort of 11,092 male welders from 135 companies in nine European countries. Cohort entrance criteria varied by country.	Age and sex specific mortality rates computed using the WHO mortality data bank.	Average cumulative Cr(VI) exposures estimated between 0.05 to 1.5 mg/m <sup>3</sup> - yr based on job process matrix	-O/E of 1.23 (NS) for primarily stainless steel welders based on 20 deaths -Upward trend (p<0.05) with time since first exposure -No trend with cumulative exposure
Moulin <u>et al.</u> (1993, Ex. 7-92)	Cohort of 2,721 French male welders from 13 factories with a minimum of one year of employment from 1975 to 1988.	6,683 unexposed manual workers from 13 factories with a minimum of one year of employment from 1975 to 1988	-Primarily manual metal arc welding -Cr(VI) exposures not recorded	-O/E of 1.03 (NS) for primarily stainless steel welders based on 2 deaths -No trend with exposure duration
Hansen <u>et al.</u> (1996, Ex. 35-247)	Cohort of 10,059 male welders and other steel workers from 79 Danish companies employed for a minimum of one year between 1964 and 1984.	National cancer incidence rates from the Danish Cancer Registry.	Cr(VI) exposure not recorded	-O/E of 2.38 (NS) for stainless steel only welders based on 5 deaths -No trend with exposure duration
Lauritsen <u>et al.</u> (1996, Ex. 35-291)	Nested case-control study of 94 lung cancer deaths from Hansen study.	439 eligible controls who were not cases and did not have respiratory disease or unknown malignancy as cause of death	Cr(VI) exposure not recorded	-OR of 1.3 (NS) for stainless steel only welders -No trend with exposure duration
Sjogren <u>et al.</u> (1987, Ex. 7-95)	Cohort of 234 male stainless steel welders and 208 male railway track welders. Minimum employment was 5 years between 1950 and 1965. Follow-up through 1984	Mortality rates for Swedish males	Median Cr level for stainless steel welding was 57 µg/m <sup>3</sup> and for gas shielded welding [railway welders] was 5 µg/m <sup>3</sup> in Sweden during 1975	-O/E of 2.5 (NS) for stainless steel welders based on 5 deaths -O/E of 0.3 (NS) for railway welders based on 1 death

Kjuus et al (1986, Ex. 7-72)	A hospital-based case-control study of 176 male incident lung cancer cases admitted to two hospitals in Norway during 1979-1983.	186 controls admitted to the same hospitals in Norway during 1979-1983 and matched to cases for age +/- 5 years.	Cr(VI) exposure not recorded	-OR of 3.0 (p <0.05, adjusted for smoking) for stainless steel welding based on 16 deaths -Welding not significant in logistic model with smoking, asbestos
Hull, et al (1989, Ex. 35-243)	Case-control study of 85 lung cancer cases in white male welders identified through the LA County tumor registry (1972-1987).	Controls were 74 welders with non-pulmonary malignancies	No direct Cr(VI) exposure measurements recorded	-OR of 0.9 (NS) for stainless steel welding based on 34 cases -OR of 1.3 (NS) for manual metal arc welding on stainless steel based on 61 cases

Observed/Expected (O/E)  
Relative Risk (RR)  
Not Statistically Significant (NS)  
Odds Ratio (OR)

Sjogren *et al.* reported on the mortality experience in two cohorts of

welders (Ex. 7-95). The cohort characterized as “high exposure”