

**Table 2.5. Cohort studies of benzene and the chronic myeloid leukemia**

Reference, location	Cohort description	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of cases/deaths	Relative risk (95% CI)	Adjustment for potential confounders	Comments
McCraw <i>et al.</i> (1985) USA	All white male employees at an oil refinery for at least one day between 1973-1982, and retirees alive as of 1973; total 3976	No exposure assessment was performed	CML 205.1	None	1	(SMR) 1.2 (0.0-7.0)		Comparison population Surveillance, Epidemiology and End Results, white men.
Rushton (1993) United Kingdom	Cohort of men who worked for at least a year at 8 oil refineries (35569) and 750 distribution centres (23306) in the UK and followed for 39 years	No exposure assessment was performed	CML 205.1	Distribution workers Refinery workers	8 11	(SMR) 0.8 (0.4-1.6) 0.9 (0.4-1.6)	Age	

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Wong <i>et al.</i> (1993), USA	18135 distribution employees with potential exposure to gasoline for at least 1 year between 1946-1985, followed through June 1989.	8hr TWA total hydrocarbon exposure in ppm estimated for job categories based on industrial hygiene data and expert judgment. Cumulative exposure defined as the sum of products of TWA exposure and duration of exposure of each job in an employee's work history.	CML 205.1	Land-based employees exposed to gasoline Marine based employees exposed to gasoline	1 4	(SMR) 0.3 (0.0-1.4) 1.3 (0.4-3.4)		Detailed exposure measurements not applied to analyses of leukaemia subtypes
Satin <i>et al.</i> , 1996, USA	Cohort of 17,844 petroleum refinery workers, employed 1937-1983, followed through 1987	No exposure assessment was performed	CML 205.1		6	(SMR) 0.8 (0.3-1.8)		

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Rushton & Romaniuk, 1997, United Kingdom	Cohort of petroleum industry distribution workers	Retrospective estimates of workplace exposure for each job reported in the work histories of all the study members were obtained by creating base estimates. Base estimates were estimated based on the exposure measurements and adjusted with the use of modifying factors. Modifying factors represented factors that could have affected the exposure levels (e.g. changes in exposure circumstances over time or between two different work-sites)	CML 205.1	Benzene cumulative exposure ppm-years				Nested case-control analysis; 4 controls selected per case matched by age. Cumulative exposure analysed as a continuous variable showed no association with CML (OR1.0, 95% CI 0.9-1.1)
				<0.60	3	1.0		
				0.60-1.64	3	1.4 (0.2-7.9)		
				1.65-4.78	3	2.5 (0.4-14.7)		
				≥4.79	2	1.1 (0.27.4)		

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Divine <i>et al.</i> (1999b) USA	All (28480) employees who worked at selected refinery, petrochemical, and research establishments at least one day between 1947-1977; employed at these for a cumulative total >5 years; still employed on the end date of the study	Complete work history of all jobs held at the participating factories (Divine <i>et al.</i> , 1999a)	CML 205.1	Employed: before 1950 1950 and after	10 2	(SMR) 1.2 (0.6-2.1) 0.7 (0.0-2.5)		No estimates of exposure to benzene

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Wong <i>et al.</i> , 2001a, USA	Cohort of 7543 petroleum refinery workers (91% men) employed for at least 1 year, 1945-1996, followed to 1996	No exposure assessment was performed	CML 205.1	Men workers hired before 1950	4	(SMR) 1.4 (0.4-3.5)		No estimates of exposure to benzene
				Hired 1950 or later	1	1.2 (0.0-6.6)		
Guenel <i>et al.</i> 2002, France	Cohort of 170000 men employed at an electric utility company for at least one year, 1978-1989	Time weighted average exposure to benzene was estimated based on expert judgement (expressed in units of exposure). Estimates were included in a JEM. Cumulative exposure was calculated by summing yearly exposure estimates in a JEM.	CML 205.1	Benzene unit exposure-years		(OR)		Nested case-control analysis. Odds ratios were not adjusted for potential confounders
				0	7	1.0		
				<5.5	5	1.9 (0.5-7.1)		
				≥5.5	1	1.2 (0.1-11.4)		
	p for trend			0.85				

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Glass <i>et al.</i> , 2003, Australia	Australian petroleum workers cohort	Benzene exposure based on task-based algorithm involving the subject's occupational history; previously measured exposures for particular tasks in the Australian petroleum industry; and task-, site-, and period-specific data.	CML 205.1 (6 cases)	Cumulative lifetime Benzene exposure (ppm-years) ≤ 4 >4-8 >8	NA	1.0 - 0.91 (0.1-9.8)		Nested case-control analysis 5 controls per case randomly selected and matched by age and availability at time of diagnosis of the case
Huebner <i>et al.</i> , 2004, USA	All employees of two refinery/petrochemical plants (Baton Rouge 6941 men, Baytown 6241 men) active in 1970 or hired between 1970-1982 with at least 1 month of employment at the facility and followed through 1997	No exposure determination performed	CML 205.1	Hired before 1950 Baton Rouge Baytown Hired in 1950 or later Baton Rouge Baytown	4 2 1 2	(SMR) 2.1 (0.6-5.3) [1.1] [1.2] 0.8 (0.3-9.2)		

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Sorahan <i>et al.</i> , 2005, United Kingdom	Cohort of 5130 men and 384 women followed for mortality, 1968-2002	Occupational exposure to benzene 1966/67 or earlier; as reported by 233 employers	CML 205.1	All workers	2	(SMR) 0.8 (0.0-2.8)		
Gun <i>et al.</i> 2006, Australia	Australian petroleum workers cohort, 16547 men and 1356 women, followed 1981-1999	None	CML 205.1		5	(SIR) 1.1 (0.4-2.6)		Overlap with Glass <i>et al</i> (2003)
Kirkeleit <i>et al.</i> (2008) Norway	Cohort of 27919 offshore petroleum workers registered to the Norwegian registry of employers and employees and 366114 matched referents from the general working population	Location of work and job category	CML 205.1	Exposed upstream offshore workers	1	1.4 (0.2-10.7)	Sex, age, year of first exposure and education	Cases identified by linkage to the Norwegian cancer registry.