

**Table 2.3. Cohort studies of exposure to benzene and the risk for acute lymphoblastic leukaemia (ALL)**

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	ALL 204.0	None	1	(SMR) 3.4 (0.0–18.5)		
Rushton (1993) United Kingdom	Cohort of men who worked for at least a yr at 8 oil refineries (35569) and 750 distribution centres (23 306) in the United Kingdom and followed for 39 yr	No exposure assessment was performed	ALL 204.0	Distribution workers Refinery workers	5 4	(SMR) 1.3 (0.4–3.1) 0.8 (0.2–1.9)		

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Wong <i>et al.</i> (1993), USA	18135 distribution employees with potential exposure to gasoline for at least 1 yr between 1946–1985, followed up to 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.	ALL 204.0	Land-based employees exposed to gasoline	2	(SMR) 1.3 (0.1–4.5)		Detailed exposure measurements not applied to analyses of leukaemia subtypes
				Marine based employees exposed to gasoline	1	0.8 (0.0–4.4)		
Satin <i>et al.</i> (1996) USA	Cohort of 17844 petroleum refinery workers, employed 1937–1983, followed up to 1987	No exposure assessment was performed	ALL 204.1		8	(SMR) 2.6 (1.1–5.1)		All ALL deaths occurred in men hired before 1955.

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Yin <i>et al.</i> (1996), PR China	Benzene exposed workers employed in a variety of industries and a comparison group working in units/factories where benzene was not used.; 74828 exposed and 35805 unexposed	Benzene exposed jobs were determined based upon factory level and job title specific information on benzene use in seven calendar periods	ALL 204.0	Exposed	5	2.8 (0.5–54.5)	Age, sex	NCI-CAPM Industrial cohort
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 yr; 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)	ALL 204.0	Employed: All before 1950	5 5	(SMR) 1.0 (0.3–2.4) 1.3 (0.4–3.1)		No estimates of exposure to benzene

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Guénel <i>et al.</i> (2002) France	Cohort of 170000 men employed at an electric utility company for at least one yr, 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 of all the consecutive jobs in the individual's work history.	ALL 204.0	Benzene unit exposure-yr 0 < 5.5 ≥ 5.5 p for trend	9 1 2	(OR) 1.0 0.6 (0.1–5.3) 3.3 (0.3–43.3) 0.16		Nested case-control analysis. Odds ratios were not adjusted for potential confounders

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Lewis <i>et al.</i> (2003) Canada	Cohort of 17230 men and 8062 women employed for at least a yr for a petroleum company hired between 1964 and 1994 linked to national mortality and cancer incidence databases.	Estimates of similar exposure groups based upon job title and location by industrial hygienists	ALL 204.0	Men Women	2 0	(SIR) [1.4] -		Detailed exposure measurements not applied to analysis of ALL
Gun <i>et al.</i> (2006) Australia	Australian petroleum workers cohort, 16547 men and 1356 women, followed 1981–1999	No exposure assessment was performed	ALL 204.0		3	(SIR) 1.7 (0.4–5.0)	Age	Estimate for men only

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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	ALL 204.0	Upstream offshore workers	1	2.2 (0.3–16.6)	Sex, age, yr of first exposure and education	Cases identified by linkage to the Norwegian cancer registry.

ALL, acute lymphoblastic leukaemia ; hr, hour or hours; ppm, parts per million; yr, year or years