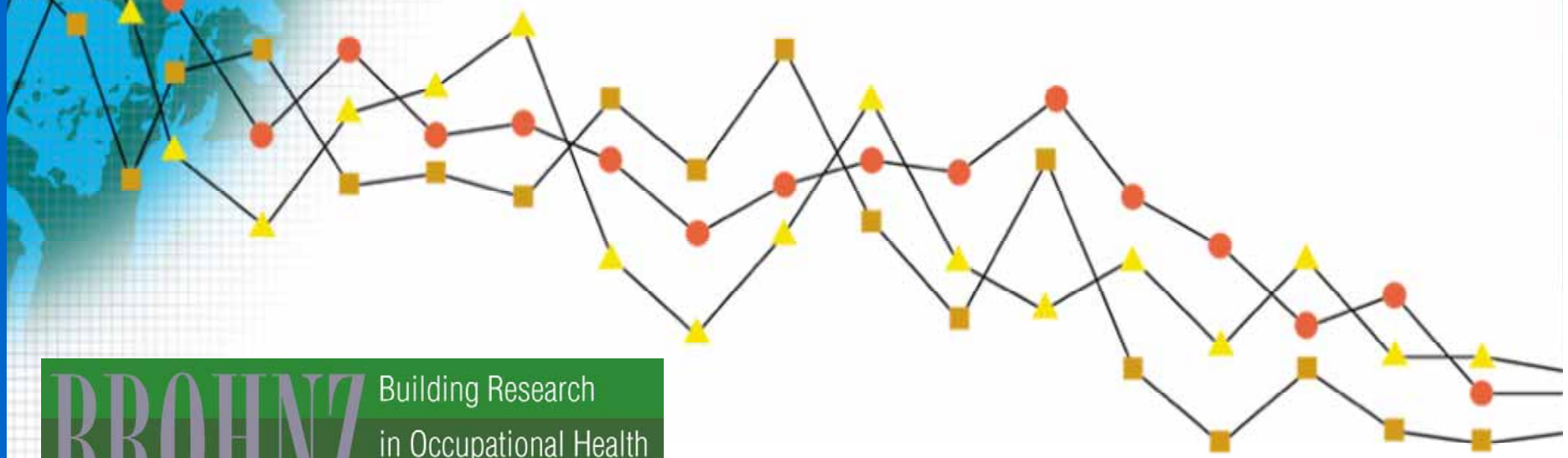
Serum dioxin levels in former New Zealand sawmill workers 20 years after exposure to pentachlorophenol (PCP) ceased



BROHNZ Building Research in Occupational Health in New Zealand

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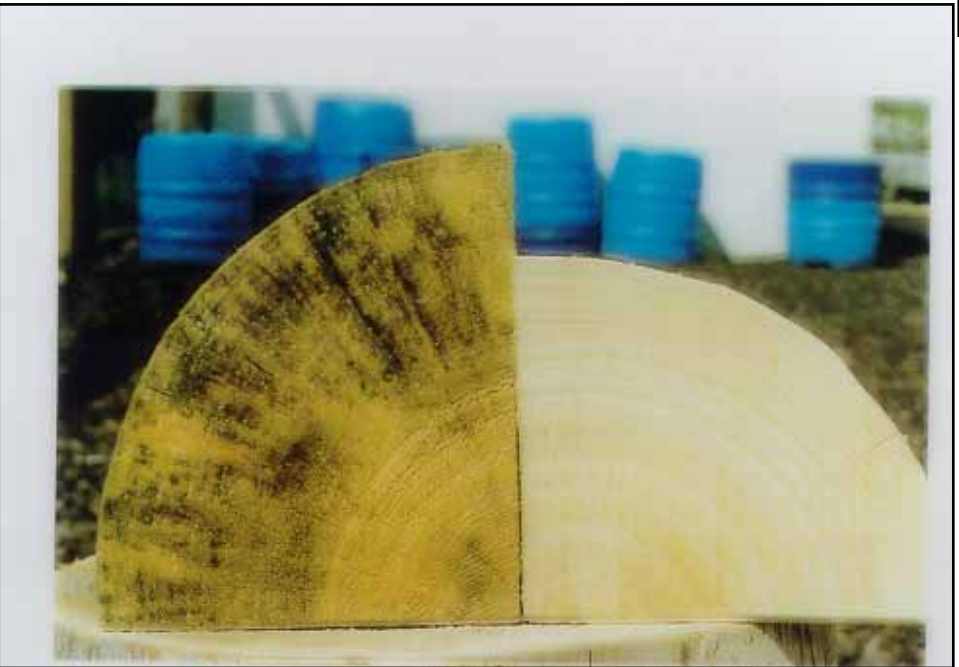
PCP use in New Zealand

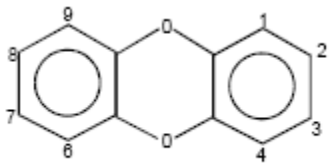
PCP was first registered for use as a fungicide to prevent the growth of sap-stain fungi in 1936.

Also mixed with oil for use as an alternative to creosote.

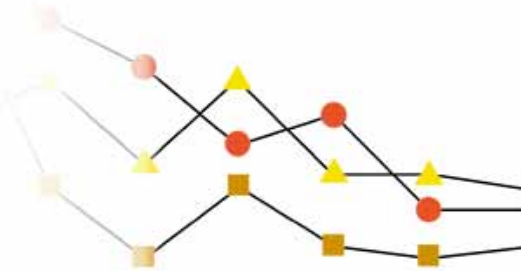


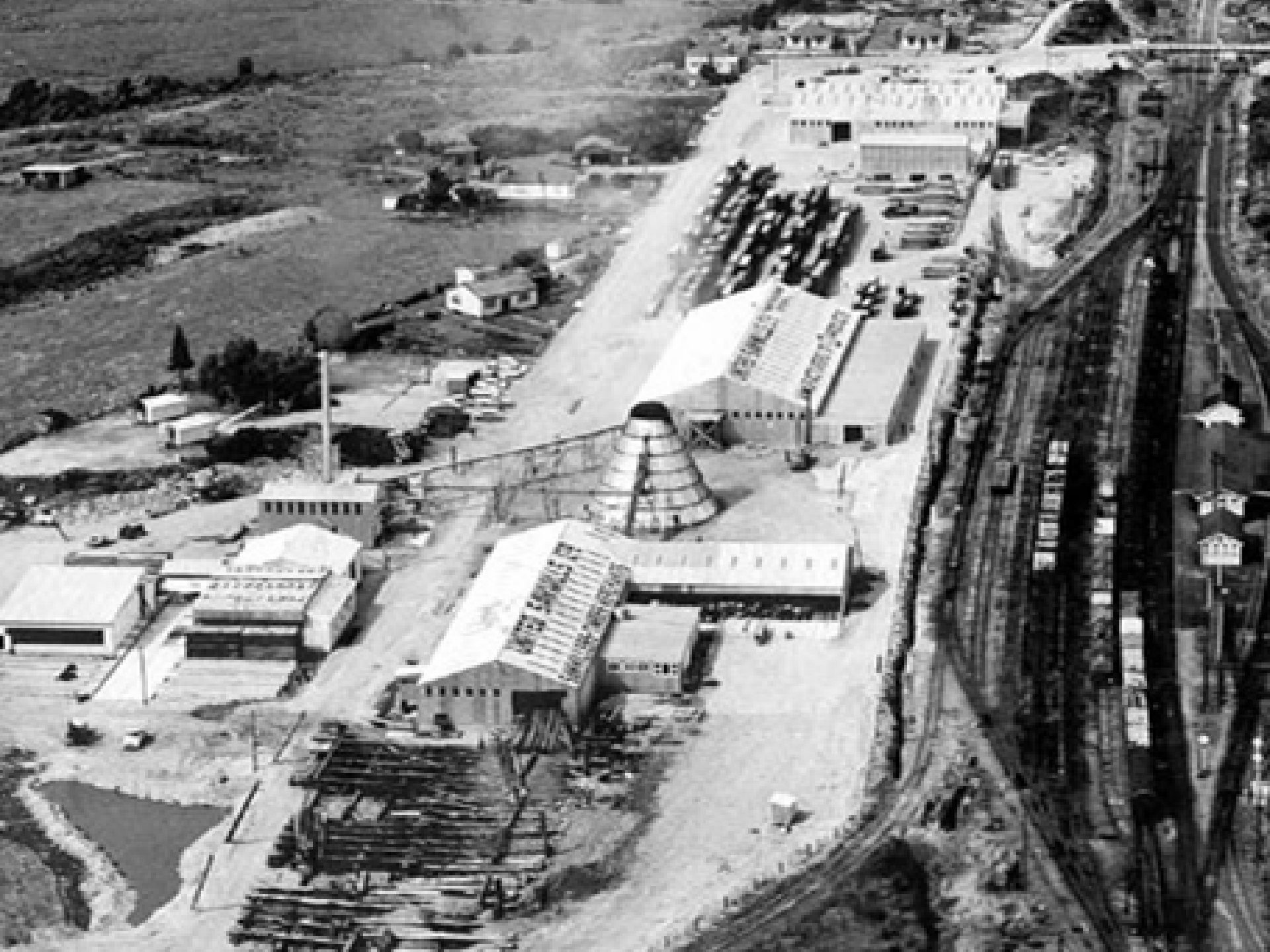
From the 1950s to 1988 most freshly sawn timber PCP treated.

P.O.P. - contained PCDD/Fs



Dibenzo-p-dioxin

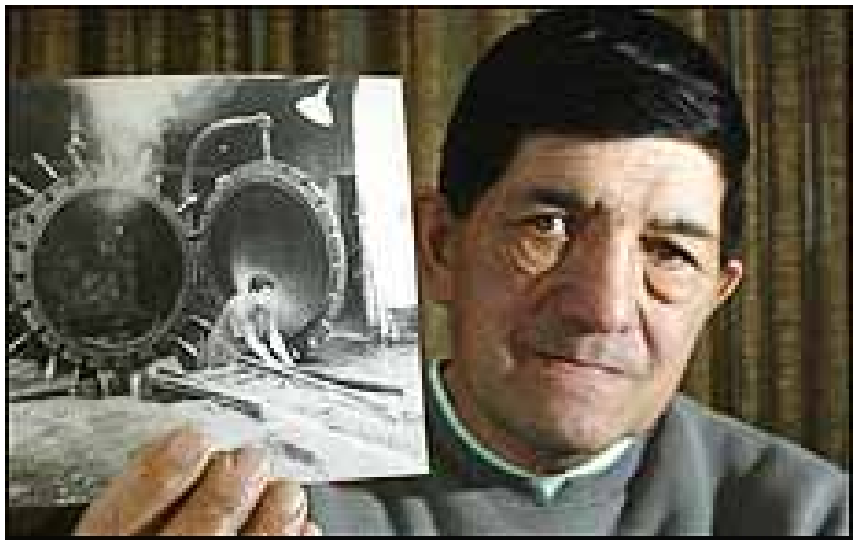




Sorting table or 'Green Chain': Waipa Sawmill

Families demand investigation into dioxin contamination

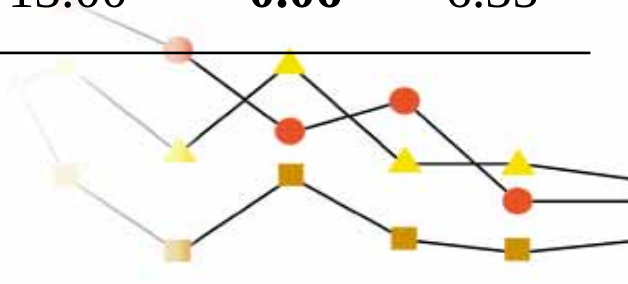
New Zealand Herald
July 15, 2003



PCP in urine concentrations in New Zealand timber workers – 1988/1989 survey.

Job Title	N	Range	GM (mg/l[#])	GSD
Mixing PCP	8	0.14 -13.00	**2.80**	4.75
Tablehands	48	0.005 - 2.20	**0.21**	3.36
Graders/Sorters/Yardhands Diffusion plant/CCA plant Filleters/Kilns	65	0.009 - 0.73	**0.04**	3.06
Green Mill/Dry Mill Mobile Plant	44	<0.002 - 0.20	**0.01**	3.66
Total	165	<0.002 - 13.00	**0.06**	6.35

concentration in urine, corrected to SG of 1.020



Method and Aims

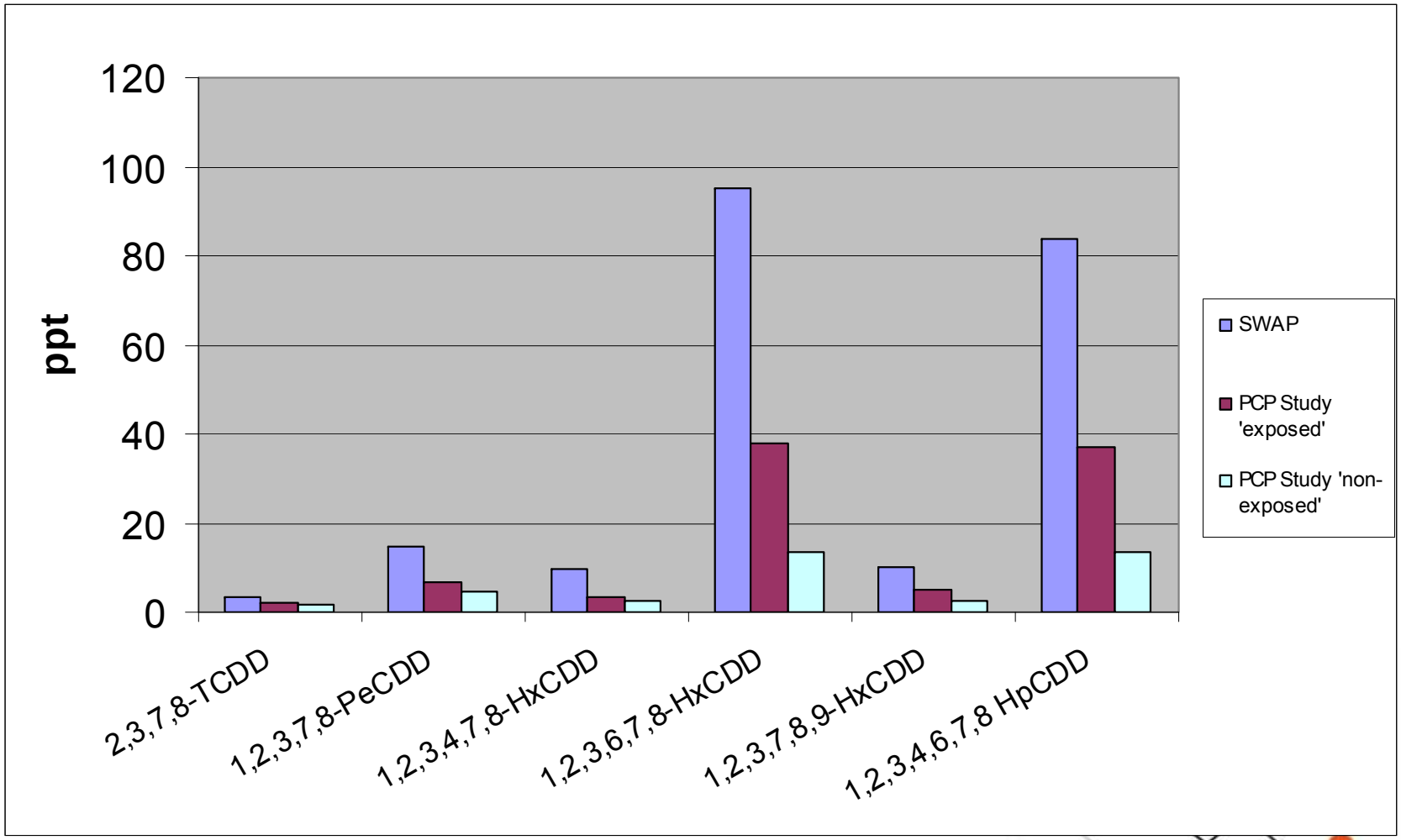
We analysed serum dioxin levels in 94 participants in a morbidity study of former sawmill workers to determine whether:

- Past occupational exposure to PCP was the source of their current body burden of dioxin, and
- To compare the specific congener profiles in PCP and workers' blood

Mean levels (and range of values) in pg/g^{-1}of selected 2,3,7,8-substituted PCDD congeners and WHO-TEQ in 'exposed' and 'non-exposed' former sawmill workers

	2,3,7,8-TCDD	1,2,3,7,8-PeCDD	1,2,3,4,7,8-HxCDD	1,2,3,6,7,8-HxCDD	1,2,3,7,8,9-HxCDD	1,2,3,4,6,7,8 HpCDD	OCDD	WHO-TEQ
'Exposed'	**1.9**	**5.7**	**3.0**	**29.4**	**3.8**	**28.5**	**309.2**	**13.7**
	0.5-4.1	1.91-32.9	0.9-21.0	6.3-343	0.9-35.3	3.7-222	63.9-2740	5.15-90.2
SWAP	**3.6**	**14.8**	**9.8**	**95.3**	**10.0**	**84.0**	**917.6**	**37.8**
	0.6-9.3	2.4-18.3	2.4-18.3	21.5-285	2.7-27.4	9.3-200	184-2200	13.7-77.7
'Non-exposed'	**1.5**	**4.6**	**2.5**	**13.5**	**2.5**	**13.6**	**157.8**	**9.6**

Mean levels in pg/g^{-1}of selected 2,3,7,8-substituted PCDD congeners in SWAP members and in 'exposed' and 'non-exposed' sawmill workers.



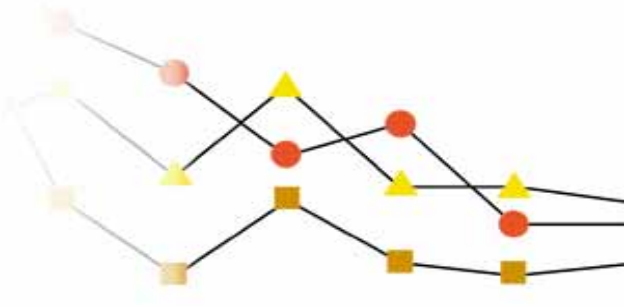
PCP Exposure Score =

Job-title score + Mix + Clean Sludge + Spray

JOB-TITLE SCORE =

1	*2*	*3*	*4*
Non-exposed, i.e.: Despatch Clerk Administration Logging truck drivers	Green mill Dry mill Mobile plant driver	Diffusion plant operator Orderman Grader/Sorter Yard hand Maintenance CCA plant operator Filleter Kiln operator	Tablehand

If [***MIX***] = < daily, then score = ***2***
If [***MIX***} = ≥ daily, then score = ***3***
If [***CLEAN SLUDGE***] = < weekly, then score = ***1.5***
If [***CLEAN SLUDGE***] = ≥ weekly, then score = ***2***
If [***SPRAY***] = with backpack sprayer on stacked timber = ***2***



Mean excess levels of specific dioxin congeners and WHO-TEQ in 'exposed' former sawmill workers according to estimated intensity of PCP exposure

PCDD congener	Exposure intensity		
	<3 (N=27)	3-6 (N=13)	>6 (N=31)
1,2,3,6,7,8-HxCDD	8. 5	20.8	30.1
1,2,3,4,6,7,8-HpCDD	6.5	17.4	22.4
OCDD	80.5	192.6	238.4
WHO-TEQ	1.6	4.9	8.7

Mean excess in WHO-TEQ in 'exposed' former sawmill workers according to work tasks performed

	Exposed		Not exposed	
Task	**n**	**mean**	**n**	**mean**
Mixing PCP	20	**6.99**	53	**1.57**
Cleaning sludge from dip tank	30	**4.99**	43	**1.71**
Handling treated timber on green chain	67	**3.14**	6	**2.19**
Maintenance	18	**1.79**	55	**3.48**

Mean excess levels of specific dioxin congeners and WHO-TEQ in 'exposed' former sawmill workers according to years of PCP exposure in the sawmill industry

PCDD congener	Years of exposure		
	<5 years (N=40)	5-10 years (N=20)	>10 years (N=11)
1,2,3,6,7,8-HxCDD	8. 5	20.8	30.1
1,2,3,4,6,7,8-HpCDD	6.5	17.4	22.4
OCDD	80.5	192.6	238.4
WHO-TEQ	1.6	4.9	8.7

Conclusions

- Randomly selected ‘PCP-exposed’ former sawmill workers had elevated serum dioxin levels compared with ‘non-exposed’ workers of the same age.
- About 10% had dioxin levels 10 to 15 times those without exposure, particularly those who had carried out high risk tasks such as:
  - mixing PCP solutions,
  - cleaning sludge from dip baths
  - pulling timber off the ‘green chain’
  - working for more than 10 years in an exposed job.
- The likely source of the dioxin was the PCP encountered at work more than 20 years ago, as shown by:
  - The congener profiles which were similar to those in raw PCP
  - The exposure-dose relationships seen in internal analyses
  - The close match with the 1980s PCP in urine survey

Acknowledgements

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We also wish to thank those participants in our morbidity survey, and also the members of the group Sawmill Workers Against Poisons (SWAP) for providing access to their own serum dioxin results, and in particular Joe Harawira for assistance in contacting members.

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