

The *Forest Industry Health Research Program (FIHRP)* has completed an addendum to the 1996 study entitled "**Exposure to Metals during Hog Fuel Boiler Shutdown Maintenance Activities**" (Bulletin No. 29). The following summarizes the additional information.

HOG FUEL BOILER STUDY ADDENDUM

FOREST INDUSTRY HEALTH RESEARCH PROGRAM

c/o Pulp & Paper Forum
#100-620 Royal Avenue
New Westminster, BC
V3M 1J2
Telephone: (604) 777-1533
Facsimile: (604) 777-1567

During the 1996 Hog Fuel Boiler study, fly ash bulk sampling data were used to estimate the total airborne dust concentration required to expose maintenance workers to metals (i.e. lead and manganese) above their respective Permissible Concentrations (PCs) or proposed PCs. These calculations were done in addition to total metal scans on airborne dust samples. Estimated total airborne dust concentrations of 87 mg/m³ and 8333 mg/m³ are required to exceed the PCs for manganese and lead, respectively. These 1996 data therefore suggest that hog fuel boiler total airborne dust concentration has to be about 8 times above the nuisance dust PC (10 mg/m³) before metals airborne concentrations reach levels hazardous to workers.

Recently, the participating mill made more bulk sampling data available (fly ash and grate ash elemental content, see table 1). Fly ash is typically collected from the flue gas through multi-clones and makes up the majority of the recovered ash, while the grate ash is collected from the bottom of the boiler into hoppers. There are differences in metals content between the two types of ash. Therefore, the location of the worker in the boiler and the type of activity performed during the shutdown maintenance period will indicate to which type of ash the worker is more likely to be exposed. For example, workers shoveling ash from the grates as part of the first phase of the shutdown are more likely to be exposed to grate ash, while workers performing other types of activities (i.e. inspection in the top sections of the boiler) are more likely to be exposed to fly ash.

Based on this difference, the estimated total dust concentration required to expose maintenance workers to metals above their PCs were re-calculated using the grate ash elemental content. Based on the manganese content (see table 1) which is almost twice as high in the grate ash compared to the fly ash, the rough total airborne dust concentration would have to be about 3 to 4 times the nuisance dust PC, i.e. 37 mg/m³, before manganese airborne exposure would become a hazard for workers potentially exposed to grate ash.

Because of the variability of metals content in ash, the estimated metals content in airborne dust should be based on known concentration in bulk material at the time of air sampling. While these calculations are only rough estimates of potential metals exposure, they provide a simple and cost-effective procedure for routine monitoring of worker exposures. However, a better hygiene practice would be to perform metal scans on all air samples collected to determine actual exposures rather than estimate individual metal exposures. This latter procedure is necessary when exposures are at or near the PCs for individual metals.

Table 1: Boiler Ash Trace Elements Analysis

	Fly Ash (µg/g)	Grate ash (µg/g)
Aluminum	15600	20200
Antimony	23	41
Arsenic	4	3
Barium	410	1662
Bismuth	ND (5)	ND (5)
Boron	78	140
Cadmium	2	ND (1)
Calcium	87200	140200
Chromium	23	43
Cobalt	6	1
Copper	39	63
Iron	15300	19600
Lanthanum	3	3
Lead	14	4
Magnesium	14800	22900
Manganese	3179	5248
Molybdenum	ND (1)	2
Nickel	18	33
Phosphorus	3996	6086
Potassium	15900	26300
Silver	0.4	0.5
Sodium	3100	6900
Strontium	410	808
Tellurium	ND (0.05)	ND (0.05)
Tin	ND (20)	ND (20)
Titanium	1000	1000
Tungsten	ND (10)	ND (10)
Uranium	ND (10)	ND (10)
Vanadium	38	44
Yttrium	6	4
Zinc	175	118