

AMBIENT AIR POLLUTION AND CHILDREN'S EXPOSURE TO LEAD AND CADMIUM IN A SMELTER REGION IN BULGARIA

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BACKGROUND

A smelter plant in the region of South Bulgaria produces lead, cadmium, other non-ferrous metals and hard-alloy products.

Such productions are known to emit into the atmosphere particulates, sulfur dioxide, and airborne lead, cadmium and other heavy metals.

The presence of such a powerful source of hazardous emissions with a potential human health risk required exposure assessment of the population in the area.

OBJECTIVES

- Assessment of external exposure of the general population in the area by monitoring environmental levels of lead and cadmium.
- Assessment of children's internal exposure by measuring blood lead levels
- Assessment of maternal/infant exposure by measuring lead levels in the placenta, maternal and cord blood.

MATERIALS and METHODS

Air pollution monitoring

Period: 1991-99

Sampling sites. Three fixed monitoring stations for ambient air quality in residential areas in the vicinity of the plant: Site 1 ("Assenovgrad"); Site 2 ("Kuklen"); Site 3 ("Dolno Voden")

Sample analysis. Determination of lead and cadmium by atomic absorption spectrometry (Perkin Elmer 3100 with FID)
Detection limit: 0.002 µg/cm³

Data processing: Lead and cadmium levels calculated for monthly and annual averages, median, minimal, maximal concentrations, and 98 percentile.

Children's lead exposure

Sample 100 children, aged 11-12, residing at sites 1 & 3
50 children, same age, from a control area

Determination Blood lead

(atomic absorption spectrometry, extraction with methylisobutyl ketone and ammonium pyrolidine dithiocarbamate)

Data analysis Comparisons (T test) :

- Plant area versus control area
- Site 1 versus site 3
- Plant area 1991 versus 1995

Maternal / infant lead exposure

Sample 76 maternal-infant pairs (sites 1 & 3)

Determination Lead in maternal & cord blood and placenta (atomic absorption spectrometry, Perkin Elmer 5100 Zeeman)

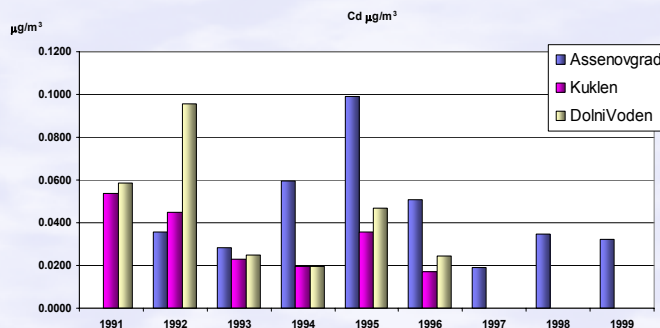
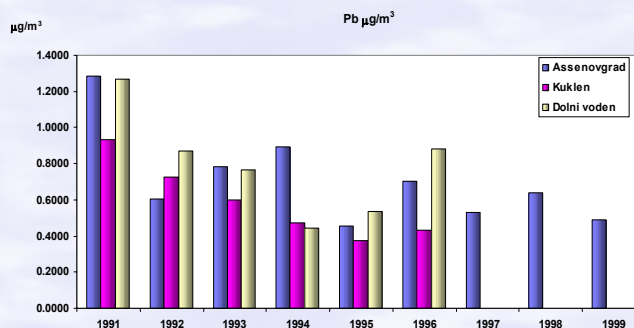
Data analysis Comparisons (T test) :

- Maternal & infant blood lead levels in smokers and non-smokers
- Maternal & infant lead levels in normal and pathological birth outcomes

RESULTS

Children's blood lead (Distribution of individual values)

Blood lead (µg/L)	Plant area Site 1	Plant area Site 3
< 150	56%	28%
150 - 200	17%	28%
201 - 250	17%	14%
> 250	10%	20%



CONCLUSIONS

•General population exposure to lead and cadmium takes place in the vicinity of a non-ferrous metal smelter in Bulgaria; ambient air in residential areas is contaminated with these metals at levels above the national MAC values.

•Environmental contamination results in significantly increased levels of blood lead and cadmium in local children population aged 11-12 in comparison to children of the same age in a non-industrial area.

•Maternal exposures during pregnancy result in high lead levels in placenta and infant blood at birth; abnormal birth outcomes (particularly pre-term births) are associated with significantly higher maternal/fetal lead exposures in comparison to normal births.

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