

Laboratory work № 8

HUMAN HEALTH RISK ASSESSMENT FROM CHEMICALS IN SOIL

1. To recalculate the concentrations of elements in soil into the concentrations in air

$$C_{inh} = C_{dust} \cdot R \cdot f \cdot C_{soil}$$

$$C_{dust} = 7.5 \cdot 10^{-6} \text{ mg/m}^3$$

R=inhalable fraction of dust = 73% = 0,73

F = 1% -polluted part of dust =0,01

$$C_{inh} = C_{dust} \cdot R \cdot f \cdot C_{soil} = C_{dust} \cdot R \cdot f \cdot C_{soil} = 0,00000005475 \cdot C_{soil}$$

$$\frac{C_{inh}}{\text{mg/m}^3} = 0,00000005475 \cdot \frac{C_{soil}}{\text{mg/kg}}$$

2. To calculate coefficient of danger KO_{inh} for each element

$$KO_{inh} = C_{inh} / RfC_{inh}$$

RfC_{inh} = reference inhalation concentration for each element

3. To calculate LADD (Living Average Daily Dose) mg/kg day for adults

$$LADD = \frac{C \times V \times ED \times EF}{BW \times AT \times 365} \times 10^{-6} \quad 1$$

C - C_{soil} , mg/kg

V – daily ingestion (peroral) intake of soil to human body , 100 mg / day;

ED – exposure duration, 30 years ;

EF – exposure frequency – 350 days/year;

BW – body weight (for adults), 70 kg;

AT – average time – 30 year; 365 – number of days in year

$$LADD = C_{soil} \cdot 10^{-6} \cdot 100 \cdot 350 \cdot 30 / 70 \cdot 30 \cdot 365 = 0,0137 \cdot 10^{-4} \cdot C_{soil}$$

3 A

To calculate LADD (Living Average Daily Dose) mg/kg day for children

$$LADD = \frac{C \times V \times ED \times EF}{BW \times AT \times 365} \times 10^{-6} \quad 1$$

C - C_{soil} , mg/kg

V – daily ingestion (peroral) intake of soil to human body , 200 mg / day; for children

ED – exposure duration, 6 years ; for children

EF – exposure frequency – 350 days/year;

BW – body weight (for children), 15 kg;

AT – average time – 5 year for children ; 365 – number of days in year

4.

$$RfD_{\text{per}} = \frac{LADD}{RfD_{\text{per}}}$$

RfD_{per} – reference dose for each element

5. $KO_{\text{sum}} = KO_{\text{inh}} + KO_{\text{per}}$ for each element

6. To choose 4-5 elements, where KO more than 0.1 and summarize them

$$KO_{\text{soil}} = KO_{\text{el.1}} + KO_{\text{el.2}} + KO_{\text{el.3}} + \dots$$

7. To calculate in each point and average for areas :

NUMBER AREAS	Name areas	Points in these areas		
1	East	1-82		
2	West	83-116		
3	Riverside	117-141		
4	Industrial	142-199		

8. To compare KO for different areas (using graphes, diagrams)

9. To calculate the contribution of each element (4-5 main) to sum KO in each area, are the differences?

10. To do statistical data manipulation

11. To calculate $R_{\text{ind.canc}}$

$$R_{\text{ind.canc (adult)}} = LADD (\text{adult}) * SF$$

$$R_{\text{ind.canc (Child)}} = LADD (\text{Child}) * SF$$

SF – slope factor, only 4 elements are **carcinogens**

element	SF (mg/kg day) ⁻¹	
As	15	
Ni	0,91	
Pb	0,042	
Cr (VI)	42	

Try to present the obtained results by tables in Word. But the tables should be clear and not overloaded with numbers.

1/ The mean concentrations of elements in soils, mg/kg

Area	name of area	elements							
		V	Cr					
1		56±12							
2									
3									
4									

2/ The mean concentrations of elements in air, mg/kg, C_{inh} (after modeling)

3/ LADD (adults and childs)

4/.KO.....

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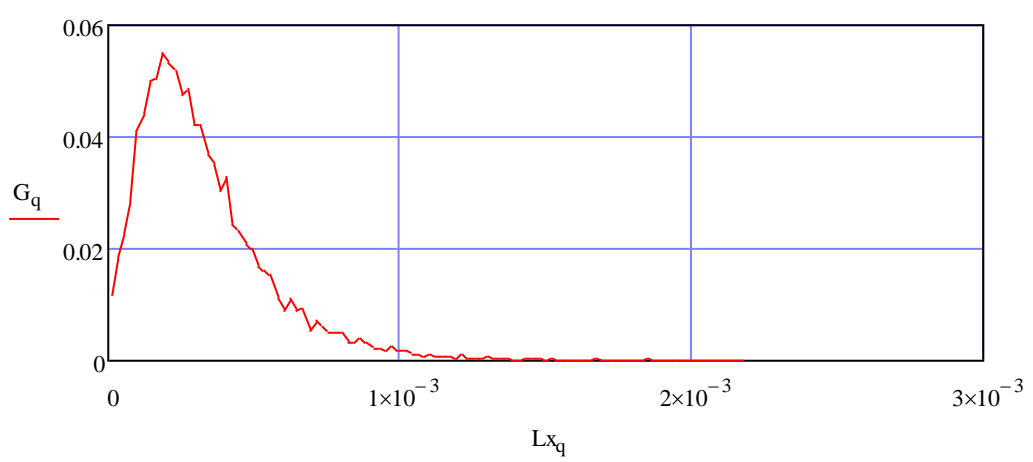
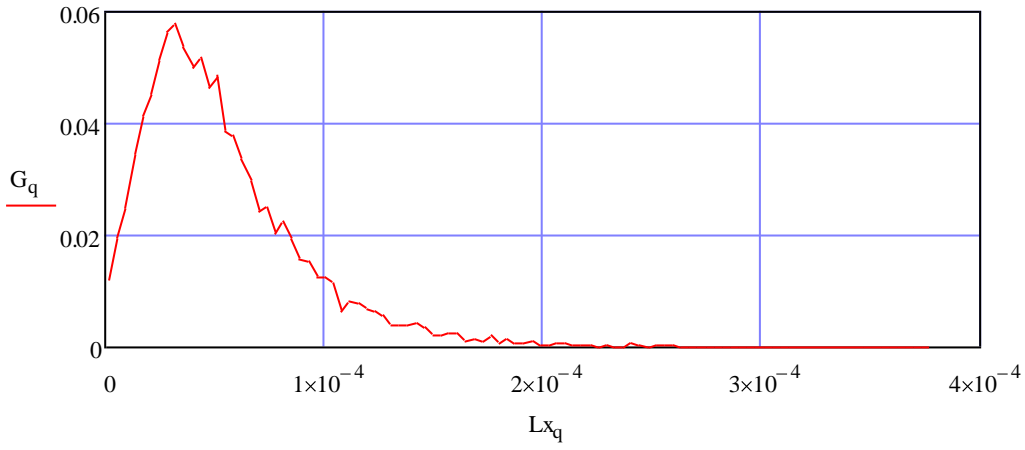
12. Calculation of propability density

$$LADD = \frac{C \times V \times ED \times EF}{BW \times AT \times 365} * 10^{-6}$$

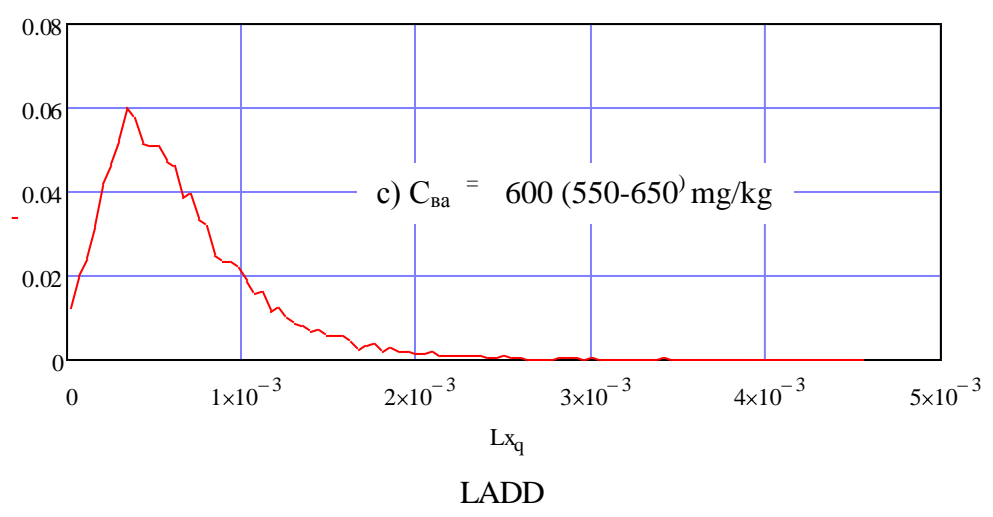
Table. Parameter distribution for metal exposure and risk/ Input data

Parameter	Symbol	Units	Type	Distribution	Reference
daily ingestion (peroral) intake of soil to human body	V	mg / day	normal	100 (0-170)	
exposure duration	ED	year	lognormal	30 (19-43)	
exposure frequency	EF	day/year	triangular	350 (180-365)	
body weight	BW	kg	lognormal	70 (55-80)	
average time	AT	year	point	30	
Concentration of elements in soil	C _{soil}	mg / kg	Normal	C _{el} ±SD	

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6)



LADD

c)

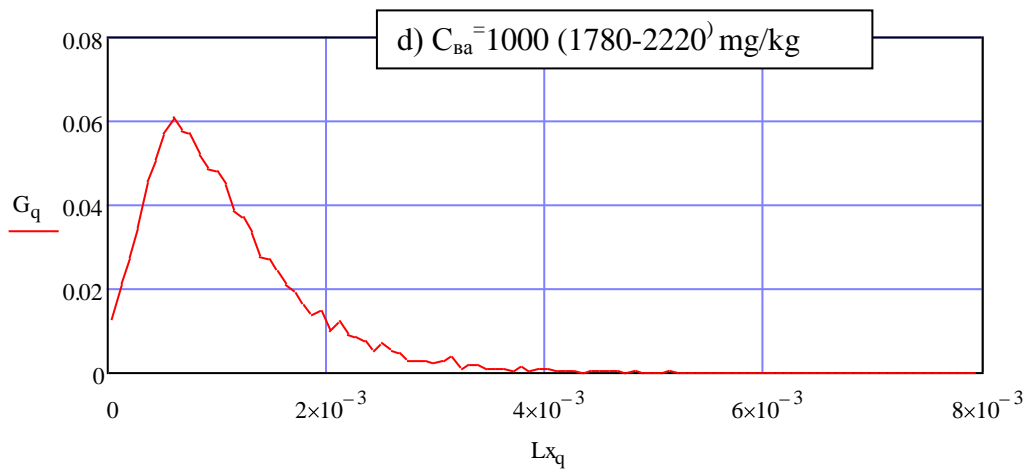


Рис. Плотность вероятности ЛАДД для различных концентраций бария в почве:

Propability density of LADD for different Ba concentrations

a) $C_{Ba} = 50$ (45-55) mg/kg

б) $C_{Ba} = 300$ (250-350) mg/kg

с) $C_{Ba} = 600$ (550-650) mg/kg

д) $C_{Ba} = 1000$ (1780-2220) mg/kg