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STUDY OF PROCESSING PLANT WASTE AND TPP ASH WITH DETERMINATION OF METAL CONTENT

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Introduction. The waste accumulated during the existence of the Angren and Novoangren thermal power plants is stored in two landfills located near the city of g Angren and Ahangaran and the Angren River and occupying 120 hectares of fertile land [1].

The use of such waste for economic purposes is still limited, including due to its toxicity. Dumps are constantly polluted, mobile forms of elements are actively washed out by precipitation, polluting the air, water and soil [2].

The non-use of KZSOS is based on a well-established concept of ash as a waste product. The use of ash is hindered by intensive dust-dirt-gas formation. The use of KZSHO in construction is hindered by the increased content of underburning in ash, a complex granulometric composition, and the presence of toxic metals [2].

Among industrial waste, one of the first places in terms of volume is occupied by composite ash and slag from the combustion of solid fuels (various types of coal, oil shale, peat) at thermal power plants. Huge amounts of composite ash and slag accumulated in the dumps that occupy valuable land. The maintenance of composite ash and slag dumps requires significant costs. At the same time, composite ash and slag from thermal power plants can be effectively used in the production of various building materials, which is confirmed by numerous scientific studies and practical experience [3].

Composite ash and slags can be used to produce a large number of building materials, products and structures necessary for the construction of residential and industrial buildings, agricultural facilities, road and hydraulic structures, etc. The need to use ash and slags is dictated not only by economic considerations, but also by environmental requirements.

Objects of research and technological sampling.

The objects of research are ash obtained from coal burning at Novo-Angrenskaya TPP and Angrenskaya TPP.

Sampling method: At the ash waste of thermal power plants, sampling sites were selected. To ensure the representativeness of the technological sample, the sampling site (the surface of the dumps) was leveled and divided (a square of 10x10 m). As a result, we got 100 squares. Further, by dividing the network after 1 m, samples were taken from the centers of each square weighing 3 kg. That is^2, 300 kg was taken from 10 m2.

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Research results and their discussion. We took 6 samples, including 2 samples from the ash and slag dumps of the Angren TPP and 2 samples from the ash and slag dumps of the Novo-Angren TPP. In addition, 2 samples were taken from the fly ash of 100 kg electric filters at the Novo-Angrenskaya TPP and Angrenskaya TPP, the study of which is important.

Table 1

Information on process samples taken from the Angrenskaya TPP's ZSHO

№ n /	**Sampling location**	**Code Sampling**	**Coordinates Sample**	**weight, kg**
1	ZSHO-1	A-1	H-900; N-40°59’51; E-70°06’14	300
2	ZSHO - 2	A-2	H-903; N-40°59’52,6; E-70°06’18,1	300
3	Fly ash from electrofilters	A-3	-	100
Total				**700**

Table 2

Information on process samples taken from the Novo-Angrenskaya TPP's ZSHO

№ n /	**a Sampling location Sample**	**code Sampling**	**coordinates Sample**	**weight, kg**
1	Old ash from dump No. 2	NA -4	H-717; N-40°55’36,3; E-69°47’50,3	300
2	New ash from dump No. 2	NA -5	H-680; N-40°55’26; E-69°47’00,6	300
3	Fly ash from electric filters	NA-6	-	100
Total				700

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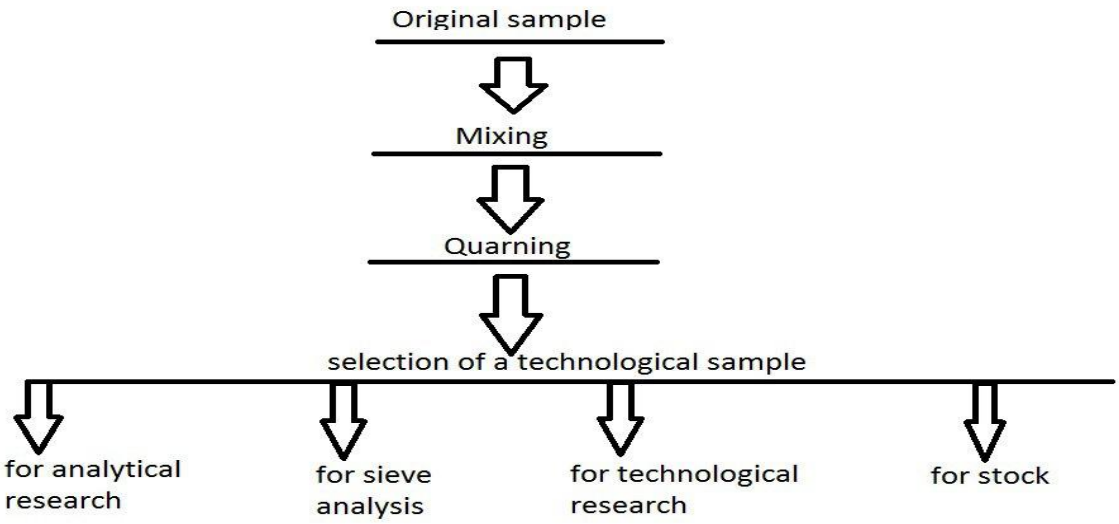

Fig. 1. Sample preparation scheme before technological tests

Slags are artificial silicates. They consist of oxides of silicon, aluminum, iron, calcium, magnesium, manganese, sulfur, and others. The same oxides are found in natural deep rocks. Depending on the quantitative ratio of oxides, as well as on the conditions and cooling rate of slag melts, slags can have the properties of granite or volcanic pumice. And the color of the slags is close to the rocks. They can be blue-black, snow-white, green, yellow, pink, gray. Often they have silver, mother-of-pearl and lilac shades. Slags can be dense and porous, heavy like basalt, and light like tuff or shell rock. The slag density ranges from 3200kg/^{m3} to 800kg/^{m3} [4].

The chemical laboratories of the State Enterprise "NIIMR" and the State Enterprise "Central Laboratory" performed: spectral, mass-spectral (ICP-MS), chemical analysis of technological samples.

The results of semi-quantitative analysis of the initial technological samples are shown in Table 3.

Table 3

Results of semi-quantitative analysis of initial technological samples (SE "NIIMR")

Elements	**Content, 10-3^{-3}%**						
	A-1	**A-2**	**A-3**	**NA-4**	**NA-5**	**NA-6**	**Exodus coal**

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1	2	3	4	5	6	7	8
Ba	1000	200	30	50	30	10	100
Be	0,15	0,5	0,2	0,2	0,3	0,2	1
V	7	10	15	15	15	10	5
Bi	<0,2	<0,2	<0,2	<0,2	<0,2	<0,2	<0,2
W	7	5	1,5	1,5	2	0,7	0,5
Ga	0,5	3	1,5	5	5	2	1,5
Ge	<0,1	0,5	0,5	0,5	0,2	0,2	<0,1
Cd	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
Co	0,3	0,5	0,3	0,5	0,5	<0,1	0,5
Mn	30	150	30	30	20	7	30
1	2	3	4	5	6	7	8
Cu	<0,8	10	10	10	10	7	1,5
Mo	7	0,5	0,2	<0,1	<0,1	<0,1	0,2
As	3	<2	<2	<2	10	<2	<2
Ni	<0,6	<0,6	<0,6	<0,6	<0,6	<0,6	<0,6
Sn	<0,6	<0,6	<0,6	<0,6	<0,6	<0,6	<0,6
Pb	70	15	7	10	7	5	2
Ag	0,07	0,05	0,02	0,02	0,15	0,01	<0,005
Sb	5	5	7	7	10	7	7
Ti	300	500	300	300	300	200	500
Cr	5	5	10	5	15	5	3
Zn	30	30	20	15	15	10	<3
Au	<0,03	<0,03	<0,03	<0,03	<0,03	<0,03	<0,03
Nb	<0,4	2	1	1,5	2	2	1,5
Ta	<10	<10	<10	<10	<10	<10	<10

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Li	10	10	3	5	3	<3	<3

The Elan-6000 Induction Coupled Plasma Mass spectrometer (ICP-MS) Elanis a state - of-the-art, highly sensitive, fully automated instrument for precise elemental and isotopic analysis of liquids and solids for the content of any elements of the periodic table.

Mass-spectral analysis of process samples (ICP-MS) was performed in the State Enterprise "Central Laboratory".

Table 4

Results of mass spectrometric (ICP-MS) analysis

initial technological samples (GP "TSL")

Elements	Content, g / t							Content (g/t) in ore (of industrial significance)
	A-1	A-2	A-3	NA-4	NA-5	NA-6	**Exodus coal**	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Li	37	73	87	82	78	77	18	
Be	1,20	2,50	3,20	3,30	3,10	2,90	0,89	
Na	2400	2300	2600	2200	1600	1300	1300	
Mg	1400	4400	5900	5200	3900	2200	2600	
Al	37000	42000	78000	74000	54000	27000	22000	280000
P	370	450	610	510	510	410	230	
K	7900	8500	10000	11000	9500	8400	2300	
Ca	18000	20000	30000	17000	12000	7400	10000	
Sc	5,20	7,90	11,00	12,00	8,00	4,90	4,30	
Ti	1700	2800	4400	3900	3500	3500	700	
V	49	71	97	100	90	82	36	
Cr	43	52	86	57	79	44	34	

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Mn	590	1400	600	470	350	180	530	
Fe	**150000**	**28000**	**55000**	**21000**	**21000**	**11000**	**7300**	**Minimum 140000-250000**
Co	5,40	6,60	11,00	8,20	7,10	7,00	2,50	
Ni	9,0	12,0	28,0	12,0	14,0	8,9	4,7	
Cu	47,0	35,0	49,0	40,0	36,0	29,0	9,8	
Zn	170	210	100	88	52	63	40	
As	31,0	11,0	27,0	13,0	13,0	19,0	3,8	
Se	2,5	4,0	4,8	3,0	3,0	2,2	1,3	
Rb	46,0	38,0	31	58	38	12	20	
Sr	290	280	450	360	230	100	270	
Y	14,0	16,0	23,0	20,0	17,0	10,0	9,3	
Zr	60	86	120	110	100	94	27	
Nb	13,0	19,0	24,0	22,0	22,0	23,0	4,3	
Mo	50,0	20,0	15,0	9,1	6,6	4,5	18,0	
Pd*	0,84	0,96	1,20	0,97	0,74	0,44	0,68	
Ag	0,72	0,70	0,86	0,85	1,20	0,76	0,27	
Cd	0,47	0,32	0,20	0,15	0,11	0,11	0,06	
Sn	2,70	2,70	3,00	2,80	2,50	2,90	0,93	
Sb	4,70	2,90	3,60	3,40	22,00	3,00	0,67	
Te	0,17	0,17	0,17	0,14	0,05	0,10	0,05	
Cs	11,0	8,6	8,0	15,0	13,0	7,3	5,6	
Ba	510	1700	1900	1400	1000	710	320	
La	18	29	37	36	30	12	15	
Ce	33	44	67	63	47	19	24	
Pr	4,7	6,6	8,6	8,5	6,9	3,0	3,4	

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Nd	16,0	23,0	31,0	30,0	24,0	11,0	12,0	
Sm	3,40	4,40	6,00	5,60	4,80	2,60	2,30	
Eu	0,51	1,10	1,40	1,30	1,10	0,59	0,48	
Gd	3,00	4,10	5,80	5,40	4,50	2,40	2,20	
Tb	0,41	0,58	0,86	0,76	0,65	0,39	0,32	
Dy	2,60	3,50	5,10	4,80	3,90	2,50	1,80	
Ho	0,48	0,67	0,99	0,83	0,71	0,50	0,34	
Er	1,50	1,90	2,90	2,50	2,10	1,50	1,00	
Tm	0,21	0,27	0,43	0,35	0,30	0,23	0,15	
Yb	1,30	1,80	2,60	2,20	2,00	1,50	0,87	
Lu	0,21	0,25	0,38	0,33	0,30	0,21	0,13	
Hf	2,2	3,1	4,3	4,2	3,7	3,5	1,0	
Ta	0,90	1,30	1,80	1,60	1,60	1,70	0,29	
W	26,0	23,0	12,0	9,1	6,6	4,7	7,2	
Tl	4,20	1,40	1,40	1,20	0,84	0,91	0,39	
Pb	470	73	47	47	31	37	16	
Bi	0,61	0,33	0,42	0,41	0,24	0,32	0,27	
Th	10,0	13,0	19,0	19,0	16,0	9,3	7,0	
U	4,8	7,1	11,0	9,8	8,3	7,3	4,2	
Re*	0,001	0,0024	0,007	0,002	0,003	0,001	0,001	
Pt*	0,002	0,002	0,002	0,003	0,002	0,001	0,001	
Au*	0,013	0,011	0,006	0,022	0,033	0,005	0,008	
Ga*	9,30	18,00	23,00	23,00	19,00	19,00	5,50	
Ge*	**14,00**	**3,70**	**5,90**	**2,70**	**2,60**	**1,60**	**0,99**	**100-1000**
Rh*	0,01	0,0090	0,0320	0,0190	0,0130	0,0043	0,0130	
In*	0,046	0,034	0,057	0,057	0,046	0,040	0,018	

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Note: * Elements marked with the sign have a semi-quantitative definition

As can be seen from Table 4, thetrend analysis of the distribution of the main elements that make up ash showed that they mainly consist of Si, Al, Fe, and C in their mass, Ca, Mg, Na, K, Ti, Ba, gallium, lead, and zinc are present in a subordinate amount, just below Clark – selenium, titanium, vanadium, chromium, nickel, cobalt, copper, and manganese.

Conclusion. Thus, we can conclude that the average concentrations of trace elements in coals fluctuate at the level of their clarks or slightly exceed them. The content of harmful and toxic elements does not exceed the background values for coal ash and the maximum permissible concentrations. At the same time, the concentrations of such elements as Cu, Zn, V, Ga, Sn, Zr, and Ware almost two times lower than the background values in the country's coal ash. The concentrations of Pb, Mo, Be, P, Ge, and Bi. Ag are particularly low (an order of magnitude lower than the background values in coal ash), P, Ge, Bi. Ag.

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