Test Number FA-6

Chromium Mining and Smelting Corporation Memphis, Tennessee

by

C.C. Gonzalez/R.N. Allen

June, 1972

RESOURCES RESEARCH, INC.

A SUBSIDIARY OF TRW INC.

WESTGATE PARK • 7600 COLSHIRE DRIVE • McLEAN, VIRGINIA 22101

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III. SUMMARY OF RESULTS

Shown below in Table 1 are the results and averages of the Inlet and Outlet tests performed on the Aronetics scrubber system, along with the corresponding particulate removal efficiencies.

TABLE 1

Overall Summary of Results and Particulate Removal Efficiency

Date	Test No.	Scrubber Outlet (Exhaust) Total Particulate		Scrubber Inlet Duct Total Particulate		% Efficiency
		Grains/SCF	lb/hr	Grains/SCF	lb/hr	
2/1/72	One	0.0489	7.08	2.19	301.6	97.6
2/2/72	Two	0.101	13.42	1.40	197.6	93.2
2/2/72	Three	0.107	14.21	1.35	190.9	92.6
	Average	0.0856	11.57	1.65	230.0	94.5

The best particulate removal efficiency occurred during Test No. One, in which both the highest inlet, and lowest outlet, particulate emission rates were observed. Correlation of the data in Table 1 and Table 2 as follows substantiates the variation in particulate grain loading. Note that in Test No. One low grain loading at the outlet, high grain loading at the inlet and high percent solids in the scrubber water going to the clarifier are all consistent with the overall result.

Reasons for the unusual results during the first test are hypothetical, however, there were several differences in test data and conditions for this run. The condensible portion of inlet sample, as well as that in the exhaust sample, were greater during this period. There was appreciably lower moisture content measured from the exhaust stack, although it is possible this was either coincidental or due to an early problem with the box heater, allowing condensate to form in the cyclone/filter area. At the inlet duct location water filled impingers collected enough material to affect the color and clarity of the solution. The filter being used with the particle size sampler caused extreme difficulty due to clogging with a wax like material. Dust that was collected on the filters was a slightly different color (more brown or pink) on the second day of testing. The filters in the particulate train also had a wax like material on them.

Upon questioning, the operators stated that occasionally there is a very heavy coating of oil associated with the iron and steel turnings, that are part of the standard furnace feed mix. There was no possible way to ascertain that this actually occurred on the previous day, however the above factors indicate that such an occurrence may have been the cause of the inconsistent results for Run No. 1.

TABLE 2

Inlet Total Catch versus Percent Solids
in Scrubber Water Going to the Clarifiers

Run No.	Inlet Total Catch (grains/CF, dry STD)	% Solids in Scrubber Water Going to the Clarifiers
CSD-1	2.19	20
CSD-2	1.40	10
CSD-3	1.35	7

Scrubber and furnace operation was stable throughout the entire survey.

Particulate and gaseous emission summaries for the scrubber inlet duct and exhaust are shown in Table 3 and 4 on the following pages. Flue gas conditions are included, and percent particulate matter in the impinger train has been calculated. The condensible portion was less than 2 percent prior to the collection system. At the outlet the condensible fraction ranged from 5 to 18 percent, and averaged slightly less than 10 percent.

Gas temperatures and velocities remained rather stable at the outlet location, but underwent fairly wide variations from point to point, as well as with time, at the inlet location. Considering the normal variation in operating conditions, and the configuration of the inlet sample port location, inlet and outlet flue gas volumes agreed rather well.

Carbon dioxide values appeared to be approximately eight times greater at the exhaust than at the inlet duct. There was no reason for this ab-

TABLE 3

Scrubber Exhaust

SUMMARY OF RESULTS

Run Number	CSE-1	CSE-2	CSE-3			
Date	2/1/72	2/2/72	2/2/72			
Stack Flow Rate - SCFM * dry	16,890	15,500	15,500			
% Water Vapor - % Vol.	10.3	15.5**	15.5**			
% CO_2 - Vol % dry	4.3	4.0	4.0			
% O_2 - Vol % dry	16.9	17.2	17.2			
% Excess air @ sampling point	416	457	457			
SO_2 Emissions - ppm dry	N/M	N/M	N/M			
NO_x Emissions - ppm dry	N/M	N/M	N/M			
Particulates Probe, Cyclone, & Filter Catch gr/SCF* dry	0.0403	0.0932	0.102			
gr/CF @ Stack Conditions	0.0340	0.0701	0.0767			
lbs./hr.	5.83	12.38	13.55			
Particulate from impinger train (% of total)	17.6	7.7	4.6			
Total Catch gr /SCF * dry	0.0489	0.101	0.107			
gr /CF @ Stack Conditions	0.0386	0.0759	0.0804			
lbs./hr.	7.08	13.42	14.21			
Percent Efficiency	97.6	93.2	92.6			

N/M = not measured

* 70°F, 29.92" Hg

** at Saturation Point

TABLE 4

Inlet Duct to Scrubber

SUMMARY OF RESULTS

Run Number				CSD-1	CSD-2	CSD-3
Date				2/1/72	2/2/72	2/2/72
Stack Flow Rate - SCFM * dry				16,070	16,470	16,500
% Water Vapor - % Vol.				4.19	4.23	4.24
% CO_2 - Vol % dry				0.6***	0.5***	0.5***
% O_2 - Vol % dry				20.4	20.5	20.5
% Excess air @ sampling point				3322***	3988***	3988***
SO_2 Emissions - ppm dry				N/M	N/M	N/M
NO_x Emissions - ppm dry				N/M	N/M	N/M
Particulates Probe, Cyclone, & Filter Catch gr/SCF* dry				2.15	1.38	1.33
gr/CF @ Stack Conditions				0.675	0.444	0.426
lbs./hr.				296.1	194.8	188.1
Particulate from impinger train (% of total)				1.8	1.4	1.5
Total Catch gr /SCF * dry				2.19	1.40	1.35
gr /CF @ Stack Conditions				0.688	0.450	0.433
lbs./hr.				301.6	197.6	190.9
Percent Efficiency						

N/M = not measured

* 70°F, 29.92" Hg

*** See results; believed to be in error

normality. All hypothetical explanations had a major flaw, and it was impossible to satisfactorily explain these results at a later time. It might be possible that there was insufficient mixing, and air stratification at the inlet duct caused the low readings, but this was not expected due to the visual appearance of the system. The same individual ran all analyses, and would hardly be able to produce such close duplication of results and yet allow such flagrant errors. Since a scrubber of this type is not likely to generate CO_2 gas, the better mixed, outlet gas is believed to offer more realistic results. The CO infrared analyzer was set up at the inlet location, but an electrical malfunction caused it to be set aside. No CO analyses were then performed, except for the zero reading by the Orsat analyzer during each particulate run.

Fume capture by the hood over Furnace 21 was 95 to 100 percent during normal operation. During the short periods in which the side doors were opened to charge feed materials and stoke the furnace, the air flow patterns were disrupted, and large volumes of the fumes would escape. Fume capture by the tapping exhaust hood was estimated to be in the order of 20 percent, with the remainder escaping to the atmosphere from various openings in the building.