

7-5
Gary -

Here is a draft of the pilot plant report. - If I get a budget extension I'll have Ron Hatch interpret the data as well.

The earlier estimate of 960 oz/yr additional Au recovery has been changed to 990 oz/yr. Even when comparing to current excellent Cottrell operation.

Kind.

FINAL REPORT

GIANT YELLOWKNIFE MINES LIMITED

HI TEMPERATURE GAS
FILTRATION PILOT PROJECT

Prepared by Kent Morton

HIGH TEMP GAS FILTRATION PILOT PROJECT

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Hi-Temp Gas Filtration Pilot Project

1.0 Introduction

Following pilot testing at RPC's pilot roasting plant in New Brunswick, it was apparent that high purity arsenic trioxide could be produced by filtering contaminants out of arsenic trioxide vapour. Product grading +99.5% As_2O_3 was routinely produced at RPC by the use of ultra fine sintered metal filters installed in the roaster exhaust gas train. Unfortunately the testwork did not include filter optimization for full scale installation, and there was only cursory examination of the concept of two stage filtration for selectively removing a saleable antimony oxide product.

When the WAROX project design team began to consider the possibility of staged plant construction, using existing plant equipment to combine current production As_2O_3 with material reclaimed from underground, it became clear that more testwork using a sintered metal gas filtration system operating in Giant's roaster exhaust would be required before detailed design and cost estimating could be done.

By coincidence, the need for more testwork corresponded with a query from CANMET about research programs at Giant that might qualify for R&D funding under a Mineral Development Agreement between the GNWT and the Federal Government, the Northern Technology Assistance Program (NTAP). Under the terms of this program, the government will fund up to 75% of the cost of R&D programs qualifying for assistance.

The Hi-Temp Filtration Project, estimated at the time to cost \$100,000, was submitted for assistance under the program, and approval to proceed in two stages was granted in February of 1990.

2.0 Summary

The pilot plant at Giant was built and operated with the assistance of the Northern Technology Assistance Program of the Canada/NWT Mineral Development Agreement, under which the two levels of government agreed to fund up to 75% of the cost of the project. Successful completion of this \$100,000 project was expected to provide the information necessary to build a full scale high temperature gas filtration plant for the purpose of producing a high quality arsenic trioxide byproduct from Giant's fluosolids roasting operation.

Though the objectives of the project were not entirely met, the necessary data for design of phase one of the full scale plant was collected, and it is now possible to prepare a flowsheet, size the equipment, and produce a detailed cost estimate of the plant. The data indicates that filter element selection is not critical, a wide range of filter media being suitable for use in this application. Product purity can be achieved in all filters tested as long as they are operated at pressure drops ranging from 15" to 25" wg, and at face velocities

ranging from 8 to 15 ACFM/sq ft of filter area.

Due to budgetary constraints, it was not possible to complete two stage filtration testwork, which was intended to test the possibility of producing a saleable grade of antimony oxide concentrate by first filtering out the coarse iron oxide contaminants, and then collecting the clean antimony oxide on a second, much finer filter. It is possible that this test will yet be conducted before detailed plant design is completed.

3.0 Project Objectives

As outlined in the MDA application proposal, completion of the testwork would enable the company to detail full scale plant design. Some of the more important design features of a high temperature gas filtration plant relate to pressure drop across the filter, collection efficiency, face velocity (acfm/sq ft surface area), etc.. All of these items require that a variety of filter media be tested under actual operating conditions.

Product purity specifications may vary for each customer, but objectives of <0.05% Fe and <.5% Sb would satisfy most requirements. To achieve these results, Sb collection efficiency in the filters must, under normal conditions, exceed 65%, while Fe collection efficiency must exceed 99.8%. Iron oxide particles are much coarser than antimony oxide particles and are therefore easier to collect in the filters.

Increasing collection efficiency to achieve a high purity product requires either a large amount of filter area or a large pressure drop as gas passes through the filter media. The former can result in an excessively large plant with a corresponding excessive capital outlay while the latter will require high power input to drive fans and blowers. A well designed gas filtration system is a balance between the two extremes and detailed testing of various filters is required in order to achieve that balance.

Secondary objectives that were not achieved, primarily because of budget limitations, included two stage filtration for antimony oxide recovery, seeding the condenser gas stream to promote As_2O_3 crystal growth, and fuming baghouse dust in the hi-temp filter feed line to examine the full scale potential for this idea.

4.0 Pilot Plant Design

Scale effect in gas handling pilot systems can be quite significant, especially if temperature control must be closely maintained. Small diameter piping has greater surface area for each unit of volume than larger diameter piping and unless external heating is applied, it is difficult to limit heat loss from small diameter gas flues. In the pilot plant it is likely that heat loss from the hot filter feed line caused precipitation of arsenic in the hot filter and consequent high concentrations of arsenic in the filter residue. In most other respects it is possible to predict full scale plant operation from results achieved in quite a small pilot plant. Solids loading, pressure drops,

face velocity, condenser temperatures, etc, etc, are all fairly independent of scale and can be directly transferred to full scale design

The pilot plant at Giant has a number of similarities to the gas handling system used on RPC's 6" fluosolids roaster, though Giant's plant has some enhancements intended to improve data collection and operator convenience. For example there are ports in the cold baghouse exhaust line and the condenser cold air inlet line to permit reading gas velocities and temperatures in the lines. A calculation can then be made to determine gas flowrate through the filter elements. Each operating unit in the pilot plant is equipped with upstream and downstream pressure taps to measure pressure drop across the equipment. In addition, absolute pressure is measured ahead of the filters and behind the cold baghouse, alerting the operator of potential feedline plugging.

5.0 Gas Filtration Design Considerations

As₂O₃ purity is Giant's primary consideration in designing a gas filtration system. In this case, iron and antimony oxides are the only contaminants of real significance in the gas stream, and both can be effectively filtered out using a filter of the correct design. The resulting As₂O₃ product can consistently grade >99.5% purity, with an Fe concentration typically <0.05% and an Sb concentration <.5%.

The roaster exhaust gas from current operations contains a solids loading of approximately 300 mg/m³, which corresponds to a capture of about 20 mtpd of solids in the existing electrostatic precipitator. When baghouse dust from underground storage is recovered, twice the dust loading will be experienced in the filters and the filters must be designed to operate under the more rigorous conditions. This will affect blowback interval, blowback pressure, collection hopper design, and conveying equipment.

At the particle size and solids loading ranges experienced at Giant, a gas filter capable of removing particulates down to 0.1 micron dia is required, owing to the presence of extremely fine antimony oxide particles. Antimony oxide accounts for 1 to 4% of the total weight of solids in the gas before filtration, but it accounts for at least 75% of the weight of solids remaining in the gas stream following filtration. As these ultra fine antimony oxide particles are subsequently captured in the cold baghouse along with arsenic trioxide, it is clear that full scale filter design must consider antimony removal efficiency.

The four filters tested at Giant had the following design features as presented in the manufacturers' literature or as stated by their representatives.

Table 1

Manuf	Mott	Pall	Fluid Dyn#1	Fluid Dyn#2
Manuf Desig	2 AB	S 200	XS37	XT69

filter area (sq Ft)	2.2	2.0	2.0	2.0
Pore size (abs)	2.0	10.0	1.3	0.4
Delta P @ 20 ACFM	13"wg	8.3"wg	3.5"wg	40"wg
Filter medium	powder	powder	fiber	fiber
Sugg f veloc	8-12	15-50	10-20	<15

Actual pressure drops at maximum flowrate through the system when the filters were installed were as follows.

Mott	Pall	Fluid Dyn#1	Fluid Dyn#2
20-24"wg	11"wg	27-49"wg	26-40"wg

One interesting possibility for full scale plant design is that of using the excess heat in the roaster exhaust gas to fume additional crude As_2O_3 bearing baghouse dust recovered from underground storage. The gas temperature would be reduced to 370° C from 430° C as As_2O_3 in the baghouse dust vaporizes. Under the proposed scheme volumetric flows in the roaster off gas system would be much reduced, as follows.

	<u>Current ACFM</u>	<u>Proposed ACFM</u>
Hot filtration (ESP)	8,700	7,970
Cooling Air (20° C)	26,160	10,514
Baghouse/stack (110° C)	35,000	18,446

If properly utilized, the gas has sufficient excess heat to treat 8,000 tons per year of crude dust to produce 4,000 tons per year of purified As_2O_3 product. The detailed heat balance can be found in appendix D.

One of the unrealized objectives of the pilot test was to examine the effects of feeding crude baghouse dust directly into the hot roaster exhaust gas stream. It is felt that volatilization may occur almost instantaneously provided that the very fine baghouse dust particles are adequately dispersed in the gas stream.

The test was not conducted because of excessive heat loss in the filter feed line, and because of budget constraints.

6.0 Plant Operation

Following plant construction, commissioning took place during the period June 25 to July 16, during which time systems were calibrated, additional instrumentation was installed, the cold baghouse was replaced, etc, etc. Once the plant was finally started under actual test conditions, it was operated round the clock to simulate normal operating conditions and to minimize upsets caused by frequent startups and shutdowns. Overall, four sets of filters were tested for a total of 301 hours under a variety of operating conditions during the period July 16 to August 15, 1990. The plant was not difficult to operate but did require fairly close attention for the following reasons.

1. Temperature control was not automated.
2. Operating conditions were recorded every half hour.

3. Manual filter blowback was required during the first few days.
4. Occasional dust hangups occurred in the filter assembly.
5. Samples were collected every two hours.

Temperature control proved to be the single most difficult operating problem and was never entirely satisfactory. The temperature gradient in the filter assembly, even after installation of six heating elements totalling 11,000 watts, was approximately 317° C (approximately 304° C at the bottom and 621° C at the top). Though filter inlet temperature was not recorded, it is assumed that a great deal of heat loss occurred in the 2" inlet line between the roaster flue and the filter assembly, accounting for the low temperatures at the bottom of the filter. There is also some speculation that the very high temperatures maintained at the top of the filters in an attempt to prevent arsenic precipitation and consequent high arsenic levels in the filter residue, may have caused volatilization of the antimony in the filter housing and poor antimony capture in the filter elements. There is some justification for this theory in that filter porosity appears to have had very little effect on antimony collection efficiency.

The 2" line between the filter outlet and the condenser was also equipped with 1500 watts of heat tracing. The temperature in the cold baghouse was difficult to maintain above the acid dew point and it was usually unnecessary to add quench air to the condenser to reduce the gas temperature. The effect of this was a high concentration of SO₂ in the gas at a temperature below the acid dew point. Fairly extensive corrosion of the walls of the cold baghouse were experienced, and on some occasions, large flakes of rust were found in the arsenic product. Scaling in the cold baghouse exhaust line caused some buildup on the lobes of the rotary vacuum pump. Acid treatment using a 25% solution of nitric acid, was effective in cleaning the lobes of the vacuum pump.

7.0 Operating Results

The four filters tested were surprisingly similar in antimony collection efficiency and three of the four had similar pressure drops for a given flow rate. This in spite of substantially different design and operating characteristics indicated in the manufacturers' literature.

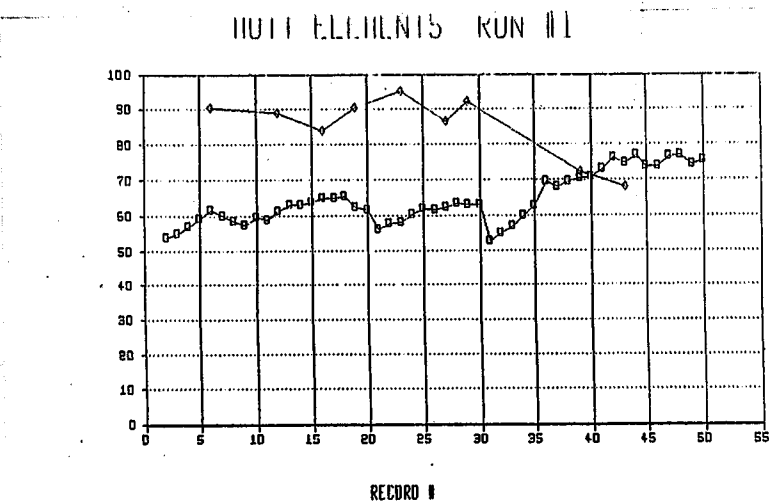
There was no major difference in iron capture in the filters and all filters were capable, when operated at pressure drops exceeding 24", of producing an arsenic product meeting an Fe specification of 0.05%. One exception was the Fluid Dynamics .4 micron filter, which achieved good iron collection at a pressure drop of only 15". When operated at similar pressure drops by controlling blowback intervals, there was little difference in antimony collection efficiency, and none of the filters achieved consistent collection efficiencies exceeding 75%. This resulted in an antimony concentration in the arsenic product ranging from 0.5 to 1.0%, not quite the performance hoped for. As mentioned earlier, the possibility of antimony volatilization caused by excessive heating of the filters may be a factor. The theory is supported by the fact that during the first two days of operation, and only during this period, filter temperatures did not exceed 343° C. As shown in fig 1 below, antimony concentration in the CBH product did not exceed 0.2% during this period. This was the only time during the test that the

filters were operated at such a low temperature, and the only time that antimony concentrations were anywhere near this low. The theory is further supported by the results obtained from the Fluid Dynamics test run in which the .4 micron filter elements were in use at high filter temperatures. In this case, Fe capture was almost twice as good for a given pressure drop as in other tests, yet antimony capture was similar to that of other tests.

Gold capture in the filters was excellent, reducing gold in baghouse dust from the full scale average of 0.123 oz/t to <0.01 oz/t. Current gold losses to baghouse dust average about 720 oz/yr. Installation of hi-temp filters would reduce this to about 60 oz/yr.

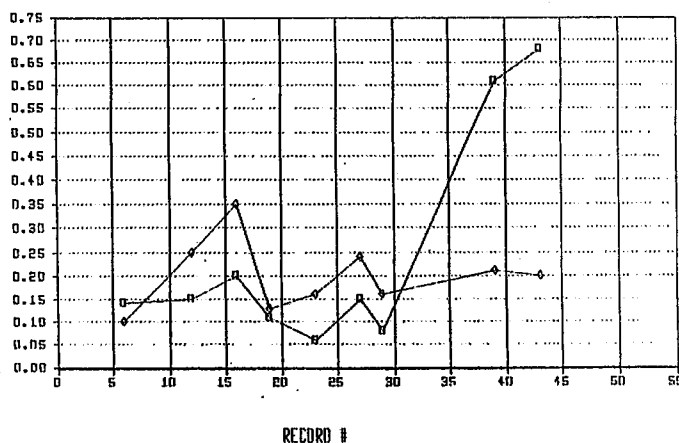
Fig 1

Temperature Effect on Antimony Collection



—○— SB REMOVAL EFFICIENCY — TEMP FACTOR

MOTT ELEMENTS RUN #1



—○— CBH IE

—□— CBH SB

The following table summarizes some of the more interesting test results. On the evidence of these results, there is little to choose between the very coarse Pall filter operated under conditions as in Run #2, and the very fine Fluid Dynamics filter operated under quite similar conditions.

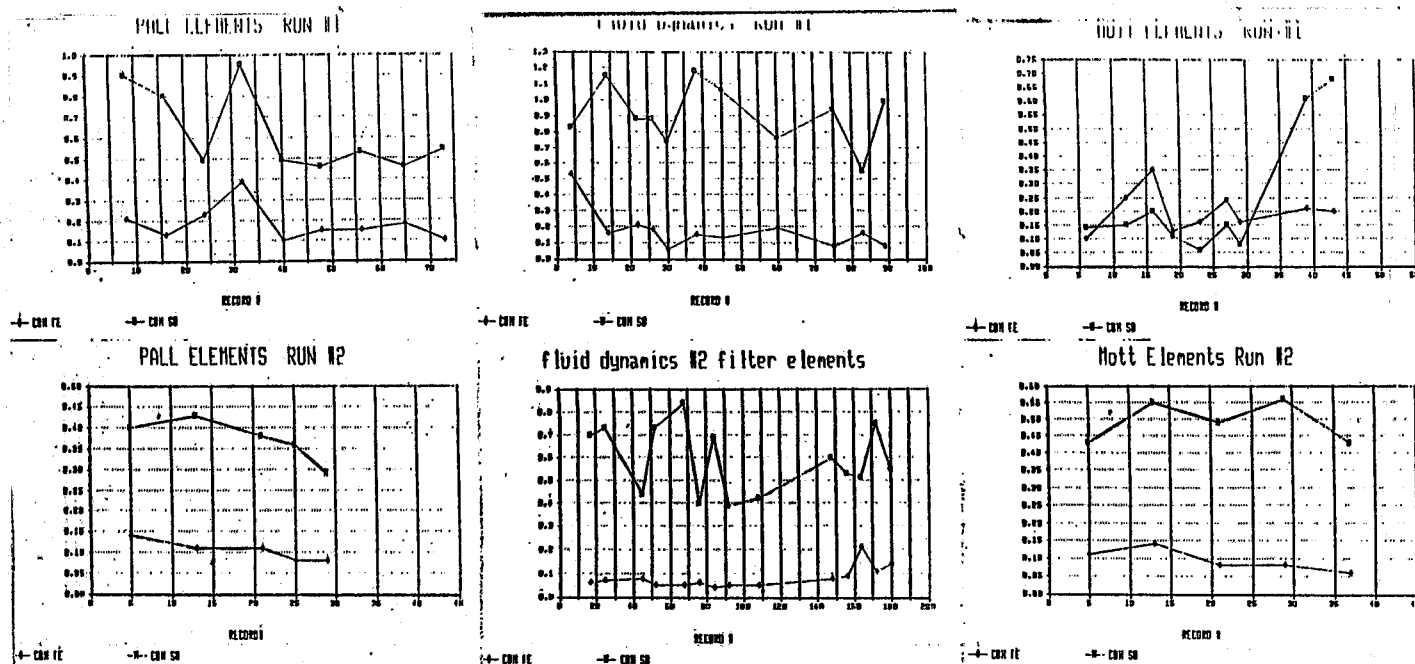
Table 2

Filter	Mott Run#1	Mott Run#2	Pall Run#1	Pall Run#2	FD 1.3m	FD 0.4m
Blowback Int (min)	10	30	10	30	10	30
B'back Press (psi)	30	60	50	60	30	60
Avg Delta P	25	25	10	20	20	15
Avg F Veloc	14	12	10	19	11	14
Avg Temp (deg C)	337	399	428	428	379	467
Fe in CBH (%)	.20	.09	.16	.10	.18	.08
Sb in CBH (%)	.24	.49	.65	.37	.91	.59

The concentration of Fe and Sb in the cold baghouse product during the various test runs is illustrated in the graphs shown in Fig 2.

Fig 2

Iron and Antimony Concentration in CBH Product



Blowback interval of the filters is a function of the dust loading of the gas and the pressure drop desired. In pilot scale, the filters were blown back sequentially at timed intervals but in full scale, blowback of a set of filters (out of several sets in operation) would take place only when a specified pressure drop was exceeded. In the pilot plant, the pressure drop changed with the dust loading on the filters and the flow rate through the filters also changed. The feed to the filter was a bleed stream from the main flue, drawn through the filter by induced draft and affected by pressure changes across the filters. This caused some fluctuations in face velocity that would not occur at full scale.

Data from pilot plant operations was compared to full scale plant operation to ensure that standard operating conditions applied during the test program. It was encouraging to note that the important control elements were in very close agreement. As_2O_3 upgrading in the filters was much more effective than in the full scale electrostatic precipitators, and a grade of 99.23% As_2O_3 was achieved in the pilot plant, vs an average grade of 93.88% As_2O_3 at full scale. Antimony removal efficiency averaged 62.44% in the pilot plant vs 56.04% in the main plant. Iron removal efficiency in the pilot plant was not calculated because of contamination of the product by rust flakes during periods of low temperature baghouse operation, however iron concentration in pilot CBH product averaged 0.14% vs an average of 1.31% in full scale CBH product..

Gold extraction testwork, using composite samples of hot filter dust to correspond with daily hot cottrell dust production, yielded excellent results. The following table shows gold recoveries as compared to full scale plant experience. It should also be noted that carbon plant recoveries have recently been much better than is usual, probably owing to the recent cottrell overhaul.

Table 3

Date	Carbon plant recovery	Pilot plant recovery	
		#1	#2
Jul 16	87.35	94.9	94.8
Jul 19	87.60	87.5	87.8
Jul 20	83.61	87.4	89.6
Jul 22	-	86.9	89.5
Jul 26	87.50	90.1	91.3
Jul 31	88.74	90.4	89.3
Aug 07	88.94	92.1	92.9
Aug 9-11	88.04	91.1	91.2
Average	87.40	90.05	90.80

At an annual feed rate of 11,000 oz in the cottrell dust, the 3.0% difference in recovery amounts to about 330 oz in additional gold. It is likely that the differential in gold extraction from a full scale hi-temp filter installation would be greater than 3% because of reduced arsenic collected in the filter residue.

8.0 Conclusions

Given the similarity in antimony removal efficiencies achieved by all filter elements, none of which were more than adequate, with the single exception discussed below, choice of filter element should be a matter of iron removal efficiency, selecting the filter media that will do the job under normal operating conditions at the lowest pressure drop.. As demonstrated, the Pall filters, with a pore opening of 10 microns and a delta P of only 7"-9" wg, achieved an antimony collection efficiency almost equal to the Fluid Dynamics filter with a pore size of only 0.4 micron and a pressure drop exceeding 16" wg, though iron collection efficiency in the Pall filter was only about half that of the Fluid Dynamics filter. Collection efficiency can be varied by modifying the blowback frequency and controlling the filter cake thickness. It is possible that good antimony removal efficiency (>90%), may be achieved only under very high differential pressure conditions, possibly as high as 60" wg as demonstrated at RPC, though for some reason, the Mott 2 micron filters operated at a high Sb collection efficiency at a pressure drop of only 25" wg..

The evidence suggests that, due to the necessity of applying external heating, volatilization of antimony in the filter assembly introduced an error in the antimony collection efficiency achieved by the filter elements, but this is only speculation at this time.

9.0 Recommendations

It is recommended that the full scale plant be designed to operate at a normal pressure drop of 15" wg, with the ability to operate at pressures up to 30" wg continuously by installing a booster fan downstream of the filters. This will provide adequate antimony removal under normal conditions and will help in treating underground feedstocks containing antimony concentrations up to four times as high as at present. Additional power requirements are expected to be in the order of 220 kw at maximum pressure, an operating cost of approximately \$150,000/yr.

The filters installed should be relatively fine, having an absolute pore opening of perhaps 0.4 - 0.8 microns. Under conditions of low antimony in the feed, or when product quality is not critical, the filters can be operated at a quite a low pressure drop (<10"wg) by frequent blowback. At other times, the pressure drop can be allowed to rise to the point where the necessary collection efficiency is achieved. Design face velocity for these fine filters should not exceed 10 acfm/sq ft, and given the low cost of the filter assemblies, even more conservative design would be appropriate; especially if future plant expansion is contemplated.

The capital cost of the installation is an important factor in selection of a filter assembly, but should not override all other considerations. It seems there is little to choose among the various products, as far as antimony removal is concerned, but it is apparent that the Fluid Dynamics .4 micron filters demonstrated a superior iron collection efficiency for a given pressure drop than any of the other filters.

Too, the Fluid Dynamics people have shown more interest than either Mott or Pall, going so far as to provide a set of filters at their expense, and to send a representative from their plant in Florida to observe the testwork. Fluid Dynamics have also quoted the lowest price for an earlier budget estimate of a full scale system.

Additional pilot testing would be useful to answer the following questions; can antimony be recovered in two stage filtration, and is it likely that antimony was volatilized in the filter during the pilot testing by applying heat to the filter assembly? Such a test could be conducted in approximately 3 days of operation following approximately 6 manshifts of plant modifications. The total cost of additional testwork would be \$7,000 - \$10,000.

Appendix A

Production Data

GIANT YELLOWKNIFE MINES LIMITED
ARSENIC PURIFICATION PILOT PLANT
OPERATOR'S LOG

DATE: JULY 16, 1990

Mott 2 micron filters. 30 psi blowback

DATE: JULY 16, 1990

38 hours

Time	Gas Flow (loaded) ACFM	Gas Flow (clean) ACFM	Face Vel Avg ACFM/sq ft	Filter Temp Deg F	Diff Press (loaded) *H2O	Diff Press (clean) *H2O	Diff Press Avg *H2O	Condenser Temp Deg C	Diff Pres *H2O	Cold RH Diff Pres *H2O	Time
9:00 AM	98	114	16.06	527	24	21	22.5	50	0	0	9:00
9:30	90	119	15.83	537	24	20	22	52	0	0	9:30
10:00	83	116	15.08	547	27	23	25	62	0	0	10:00
10:30	76	110	14.09	567	27	22	24.5	66	0	0	10:30
11:00	78	104	13.79	591	27	22	24.5	70	0	0	11:00
11:30	80	119	15.08	615	27	23	25	72	0	0	11:30
12:00	79	122	15.23	600	26	22	24	73	0.25	0	12:00
2:00	86	120	15.61	583	27	23	25	71	0.5	0	2:00
2:30	70	119	14.32	572	28	24	26	74	0.25	0	2:30
3:00	91	121	16.06	595	27	22	24.5	76	0.25	0	3:00
3:30	91	121	16.06	589	27	23	25	76	0.5	0	3:30
4:00	79	119	15.00	612	27	22	25	77	0.5	0	4:00
4:30	81	121	15.30	628	26	21	23.5	78	0.5	0	4:30
5:00	90	117	15.68	631	26	19	22.5	77	1.5	0	5:00
5:30	90	127	16.44	638	24	22	23	78	4.5	0	5:30
6:00	91	128	16.59	648	27	23	25	81	0.5	0	6:00
6:30	101	128	17.35	651	27	24	25.5	84	0.5	0	6:30
7:00	92	124	16.36	652	26	22	24	86	0.5	0	7:00
7:30	89	120	15.83	622	26	21	23.5	89	0.5	0	7:30
8:00	80	115	14.77	613	26	22	24	90	0.5	0	8:00
AVG	85.8	119.2	15.5	600.9	26.3	22.1	24.2	74.1	0.6	0.0	AVG

JULY 17, 1990

9:00 AM				578	29	22	25	56	0.5	0	9:00
9:30	76	97	13.11	562	26	23	24.5	57	0.5	0	9:30
10:00	68	98	12.58	577	27	22	24.5	64	0.5	0	10:00
10:30	69	103	13.03	581	26	23	24.5	70	0.5	0	10:30
11:00	74	109	13.86	602	26	23	24.5	72	0.5	0	11:00
11:30	67	107	13.18	619	26	21	23.5	75	0.5	0	11:30
12:00	94	106	14.39	616	26	21	23.5	76	0.5	0	12:00
12:30	80	107	14.17	621	26	22	24	77	1	0	12:30
1:00	90	122	16.06	634	26	22	24	81	1	0	1:00
1:30	81	108	14.32	630	25	21	23	81	1	0	1:30
2:00	90	108	15.00	630	24	20	22	81	2	0	2:00
2:30				634	25	24	24.5	81	3.5	0	2:30
3:00				629	26	21	23.5	80	1.5	0	3:00
AVG	77.9	106.5	14.0	608.7	25.9	21.9	23.9	73.2	1.0	0.0	AVG

JULY 17, 1990

Sample Number	Sample Period	Filter Au As Sb	CBH Au Fe As2O3 Sb	Sb Removal Efficiency
#4	10:00-11:30	1.64 5.92 0.57	0.01 0.1 99.96	0.14 90.35
#5	2:30-4:00	1.74 2.62 0.52	0.015 0.25 100.5	0.15 88.86
#6	4:30-6:00	1.66 2.18 0.45	0.01 0.35 100.6	0.2 83.81
#7	6:30-8:00	1.6 2.06 0.46	0.01 0.13 99.87	0.11 90.58
		1.66 3.20 0.50	0.01 0.21 100.23	0.15 88.46
#8	9:30-11:00	1.54 5.11 0.52	0.01 0.16 99.54	0.06 95.22
#9	11:30-1:00	1.56 2.06 0.42	0.01 0.24 100.72	0.15 86.56
#10	1:30-2:00	1.5 1.84 0.4	0.01 0.16 100.67	0.08 92.00
		1.53 3.00 0.45	0.01 0.19 100.31	0.10 91.40

3

July 19, 1990

Startup using new strip heating elements on filter

Coil heater on filter exhaust line.

July 19, 1990

Time	Filter			Temp	Diff Press			Condenser		Cold BH		Time	Sample Number	Sample Period	Filter			CBH			Sb Removal Efficiency	
	Gas Flow (loaded)	Gas Flow (clean)	Face Vel Avg		Diff Press (loaded)	Diff Press (clean)	Diff Pres Avg	Temp	Diff Pres	Diff Pres	Diff Pres				Au	As	Sb	Au	Fe	As203		Sb
	ACFM	ACFM	ACFM/sq ft		Deg F	*H2O	*H2O	*H2O	Deg C	*H2O	*H2O											
59 10:00 A	101	105	15.61	526	27	25	26	52	0	0	10:00 AM											
10:30	66	91	11.99	549	29	27	28	72	0	0	10:30											
11:00	64	80	10.91	569	29	26	27.5	86	0	0	11:00											
11:30	61	78	10.53	598	30	27	28.5	110	0	0	11:30											
12:00	71	80	11.44	626	31	30	30.5	106	0	0	12:00											
12:30	Velocity meter U/S			694	27	25	26	110	0	0	12:30											
1:00 PM				680	27	25	26	110	0	0	1:00 PM											
1:30	81	90	12.95	695	26	25	25.5	111	0	0	1:30											
2:00	52	86	11.21	705	26	24	25	110	0	0.5	2:00	#11	10:30-2:00	1.6	3.71	0.69	0.01	0.21	100.9	0.61	72.23	
2:30	77	82	12.05	709	26	25	25.5	108	0	0	2:30											
3:00	74	98	13.03	731	26	24	25	106	0	0	3:00											
3:30	80	80	12.12	760	26	24	25	104	0	0.5	3:30											
4:00	60	90	11.36	748	26	24	25	105	0	0.5	4:00	#12	2:30-4:00	1.58	2.45	0.63	0.01	0.2	100.9	0.68	68.06	
4:30	71	81	11.52	770	26	25	25.5	106	0	0.5	4:30											
5:00	59	84	10.83	738	25	23	24	108	0	0.5	5:00											
5:30	69	73	10.76	737	25	24	24.5	110	0	0.5	5:30	#13	4:30-5:30									
6:00	91	101	14.55	766	26	24	25	110	0	0.5	6:00											
6:30	86	111	14.92	768	25	24	24.5	109	0	0	6:30											
7:00	89	107	14.85	741	24	23	23.5	110	0	0	7:00											
7:30	98	107	15.53	752	24	23	23.5	110	0	0.5	7:30											
8:00	Velocity meter U/S			774	22	20	21	110	0	0	8:00	#14	6:30-8:00									
8:30				750	22	20	21	110	0	0	8:30											
9:00				737	24	29	26.5	113	0	0	9:00											
9:30				735	21	20	20.5	108	0	1	9:30											
10:00				735	25	24	24.5	100	0	1.5	10:00	#15	8:30-10:00									
10:30				767	29	28	28.5	100	0	0.5	10:30											
11:00				772	29	29	29	109	0	0.5	11:00											
11:30				752	30	26	28	113	0	0.5	11:30											
12:00 AM				743	24	23	23.5	108	0	0.5	12:00 AM	#16	10:30-12:00	1.46	0.9	0.55	0.01	0.38	99.59	0.85	59.81	
14.5 PM AVG	68.0	90.2	12.6	711.3	26.1	24.7	25.4	104.3	0.0	0.3				1.55	2.35	0.62	0.01	0.26	100.46	0.71	66.70	

July 20, 90

July 20, 90

12:30 AM	687	26	24	25	102	0	1	12:30													
1:00	663	27	26	26.5	100	0	0.5	1:00													
1:30	661	30	29	29.5	105	0	0	1:30													
2:00	648	32	29	30.5	114	0	0	2:00	#17	12:30-2:00											
2:30	653	30	28	29	119	0	0	2:30													
3:00	647	31	29	30	99	0	1.5	3:00													
3:30	645	34	31	32.5	98	0	0	3:30													
4:00	638	29	28	28.5	102	0	0	4:00	#18	2:30-4:00											
4:30	642	33	30	31.5	107	0	0	4:30													
5:00	599	32	30	31	110	0	0	5:00													
5:30	591	29	28	28.5	110	0	0	5:30													
6:00	603	28	27	27.5	111	0	0	6:00	#19	4:30-6:00	1.68	1.91	0.69	0.01	0.08	99.45	0.84	65.39			
6:30	597	27	28	25	112	0	0	6:30													
7:00	609	27	26	26.5	112	0	0	7:00													
7:30	616	26	24	25	110	0	0	7:30													
8:00 AM	613	25	23	24	110	0	0	8:00	#20	6:30-8:00	1.6	2.27	0.97	0.01	0.18	99.93	0.75	74.84			
AVE	632	29	27	28	108	0	0				0	0	0	2	2	1 ERR	0	0	100	1	70

July 21, 1990

Fluid Dynamics GSE Filters, 30 psi blowback
Began gas particulate loading determinations

Replaced burnt leads on strip heaters

July 21, 1990

44 hr run

Time	Filter			Diff Press			Condenser		Cold BH		Time
	Gas Flow	Gas Flow	Face Vel	Diff Press	Diff Press	Diff Press	Temp	Diff Pres	Diff Pres	Diff Pres	
	(loaded) ACFM	(clean) ACFM	Avg ACFM/sq ft	(loaded) *H2O	(clean) *H2O	Avg *H2O	Deg C	*H2O	*H2O	*H2O	
12:00				746	27	23	25	100	0	0.5	12:00
12:30 AM											12:30 AM
1:00				702	27	22	24.5	100	0	1	1:00
1:30				714				102	0	0	1:30
2:00	67	114	15.08	700	26	14	20	99	0	0	2:00
2:30	59	89	12.33	737	24	12	18	94	0	0	2:30
3:00	54	87	11.75	759	18	14	16	93	0	0	3:00
3:30	62			727	21			100	0	0	3:30
4:00				691	16			117	0	0	4:00
4:30				690					0	0	4:30
5:00	152	202	29.50	712	29	28	28.5	95	0	0	5:00
5:30	115	68	15.25	726	20	18	19	110	0	0	5:30
6:00				724	14			100	0	3	6:00
6:30	110	151	21.75	724	20	20	20	100	0	0	6:30
7:00	113	117	19.17	686	15	15	15	108	0	0	7:00
7:30	78	144	18.50	724	20	20	20	117	0	0	7:30
8:00	50	70	10.00	761	15	15	15	98	0	0	8:00
8:30	31	27	4.83	717	16	16	16	94	0	0	8:30
9:00	40	54	7.83	750	18	17	17.5	96	0	0	9:00
9:30	37	54	7.58	738	18	17	17.5	101	0	0	9:30
10:00	39	39	6.50	719	18	17	17.5	106	0	0	10:00
10:30	40	49	7.42	736	20	19	19.5	108	0	0	10:30
11:00	43	54	8.08	725	22	20	21	111	0	0	11:00
11:30	48	53	8.42	718	22	21	21.5	113	0	0	11:30
12:00	43	50	7.75	726	23	20	21.5	113	0	0	12:00 PM
12:30 P	46	64	9.17	738	23	21	22	112	0	0	12:30
1:00	40	67	8.92	724	23	21	22	109	0	0	1:00
1:30	47	68	9.58	719	24	21	22.5	109	0	0	1:30
2:00	79	62	11.75	711	24	20	22	110	0	0.5	2:00
2:30	61	94	12.92	734	24	21	22.5	110	0	0	2:30
3:00	75	102	14.75	713	24	21	22.5	109	0	0.5	3:00
3:30	61	75	11.33	726	22	20	21	108	0	0.5	3:30
4:00	59	54	9.42	744	21	18	19.5	108	0	0.5	4:00
4:30	56	83	11.58	680	22	20	21	106	0	0.5	4:30
5:00	67	78	12.08	706	22	21	21.5	106	0	0.5	5:00
5:30	55	94	12.42	740	21	19	20	104	0	0.5	5:30
6:00	58	78	11.33	761	21	20	20.5	106	0	0.5	6:00
6:30	57	73	10.83	768	21	20	20.5	107	0	0.5	6:30
7:00	63	77	11.67	738	21	20	20.5	109	0	0	7:00
7:30	92	104	16.33	713	20	19	19.5	109	0	0	7:30
8:00	71	49	10.00	691	20	20	20	106	0	0	8:00
8:30	52	40	7.67	754	20	18	19	107	0	0	8:30
9:00	25	56	6.75	763	19	19	19	108	0	0	9:00
9:30	Power outage			708	25			112	0	0	9:30
AVG	61	78	12	725	21	19	20	105			AVG

Sample Number	Sample Period	Filter			CBH			Sb Removal	
		Au	As	Sb	Au	Fe	As203	Sb	Efficiency
#22	12:00-1:30		3.54	0.62		0.53		0.83	63.21
#23	2:00-3:30								
#24	4:30-6:00		2.37	0.58		0.16		1.15	53.70
#25	6:30-8:00								
#26	8:30-10:00	1.58	3.97	0.69	0.01	0.21	98.25	0.88	64.33
#27	10:30-12:00	1.62	2.28	0.87	0.01	0.18	99.41	0.88	69.46
#28	12:30-2:00		3.36	0.65		0.06		0.74	66.89
#29	2:30-4:00								
#30	4:30-6:00		2.57	0.65		0.15		1.18	55.89
#31	6:30-8:00								
#32	8:30-9:30		3.75	0.63		0.13		1.06	57.75
AVG		1.60	3.04	0.69	0.01	0.27	98.83	0.94	62.67

July 22, 1990

July 22, 1990

Time	Gas Flow (loaded) ACFM	Gas Flow (clean) ACFM	Face Vel Avg ACFM/sq ft	Filter Temp Deg F	Diff Press (loaded) *H2O	Diff Press (clean) *H2O	Diff Press Avg *H2O	Condenser Temp Deg C	Diff Press *H2O	Cold RH Diff Press *H2O	Time
5:00 AM	67			565		14		61	0	0	5:00 AM
5:30	65	69	11.17	592	15	14	14.5	72	0	0	5:30
6:00	74	74	12.33	662	15	14	14.5	93	0	0	6:00
6:30	55	65	10.00	661	15	15	15	104	0	0	6:30
7:00	47	60	8.92	722	15	15	15	111	0	0	7:00
7:30				730	15	15	15	111	0	1	7:30
8:00	79	100	14.92	704	26	12	19	92	0	0	8:00
8:30	82	85	13.92	711	20	20	20	110	0	0	8:30
9:00	54	68	10.17	725	20	19	19.5	110	0	0	9:00
9:30	68	73	11.75	727	20	19	19.5	110	0	0.5	9:30
10:00	51	68	9.92	728	20	19	19.5	101	0	0.5	10:00
10:30	53	68	10.08	720	21	20	20.5	99	0	0.5	10:30
11:00	49	68	9.75	722	22	21	21.5	97	0	0.5	11:00
11:30	44	65	9.08	732	22	21	21.5	99	0	0.5	11:30
12:00	55	63	9.83	700	23	22	22.5	100	0	0.5	12:00
12:30 P	44	66	9.17	691	23	21	22	110	0	0	12:30 PM
1:00	51	65	9.67	740	23	22	22.5	100	0	0.5	1:00
1:30	46	55	8.50	771	23	22	22.5	100	0	0.5	1:30
2:00				730	22	21	21.5	100	0	0.5	2:00
7:30				744	26	24	25	101	0	0	7:30
8:00	76	82	13.17	699	24	24	24	106	0.2	0	8:00
9:00	Air leak at bottom of filter			675	24	14	19	110	0.2	0.5	9:00
9:30	68	106	14.50	714	14	14	14	113	0.2	0.5	9:30
10:00	29	31	5.00	705	18	18	18	80	0.2	0.5	10:00
10:30	40	57	8.08	693	20	19	19.5	82	0	0	10:30
11:00	51	56	8.92	683	24	22	23	92	0	0	11:00
11:30	50	56	6.00	743	24	24	24	103	0	0	11:30
12:00 A	35	54	7.42	743	22	20	21	107	0	0	12:00 AM
AVE	53	68	10	705	21	19	20	99	0.0	0.3	

July 23, 1990

July 23, 1990

12:30 A	44	52	8.00	694	21	20	20.5	107	0	0	12:30
1:00	23	44	5.58	693	20	19	19.5	107	0	0	1:00
1:30	59	68	10.58	693	22	19	20.5	103	0	0	1:30
2:00	50	59	9.08	701	21	21	21	101	0	0	2:00
2:30	57	57	9.50	742	23	20	21.5	100	0	0	2:30
3:00	63	66	10.75	727	23	22	22.5	101	0	0	3:00
3:30	71	77	12.33	712	23	21	22	103	0	0	3:30
4:00	64	64	10.67	678	22	20	21	103	0	0	4:00
4:30	62	66	10.67	718	20	19	19.5	103	0	0	4:30
5:00	73	85	13.17	740	21	20	20.5	104	0	0	5:00
5:30	32	43	6.25	674	20	20	20	104	0	0	5:30
6:00	34	48	6.83	650	22	21	21.5	103	0	0	6:00
6:30	30	42	6.00	709	21	20	20.5	100	0	0	6:30
7:00	49	57	8.83	701	23	21	22	100	0	0	7:00
7:30	60	61	10.08	720	19	18	18.5	100	0	0	7:30
8:00 AM	51	68	9.92	724	15	14	14.5	100	0	0	8:00
AVE	51.38	59.81	9.27	705.38	21.00	19.69	20.34	102.44	0.00	0.00	

Sample Number	Sample Period	Filter Au As Sb			CBH Au Fe As203			Sb	Removal Efficiency
#33	8:30-10:00								
#34	10:30-12:00	1.68	3.51	0.85	0.01	0.19	99.3	0.76	72.01
#35	12:30-2:00								
		1.68	3.51	0.85	0.01	0.19	99.30	0.76	72.01
#36	11:30-1:00	4.95	0.7		0.08			0.94	63.14
#37	1:30-3:00								
#38	3:30-5:00	1.64	3.45	0.68	0.01	0.16	99.31	0.55	73.98
#39	5:30-7:00								
#40	7:30-8:00	4.95	0.7		0.08			0.99	61.92
		1.64	4.45	0.69	0.01	0.11	99.31	0.83	66.35

July 24, 1990 Pall S200 Filters, 50 psi blowback

Relocated hot filter thermocouple

July 24, 1990

98 hr run

Time	Gas Flow (loaded) ACFM	Gas Flow (clean) ACFM	Face Vel Avg ACFM/sq ft	Filter Temp Deg F	Diff Press (loaded) *H2O	Diff Press (clean) *H2O	Diff Press Avg *H2O	Condenser Temp Deg C	Diff Pres *H2O	Cold RH Diff Pres *H2O	Time
8:30 PM	48	78	10.50	717	8	6	7	110	0	0	8:30 PM
9:00	31	60	7.58	849	7	6	6.5	101	0	0	9:00
9:30	41	65	8.83	796	7	7	7	100	0	0	9:30
10:00	28	69	8.08	725	7	6	6.5	96	0	0	10:00
10:30	37	89	10.50	812	7	5	6	93	0	0	10:30
11:00	31	73	8.67	802	8	6	7	93	0	0	11:00
11:30	25	69	7.83	735	8	6	7	93	0	0	11:30
12:00	36	71	8.92	778	8	7	7.5	93	0	0	12:00
AVG	34.6	71.8	8.9	776.8	7.5	6.1	6.8	97.4	0.0	0.0	

July 25, 1990

July 25, 1990

Time	Gas Flow (loaded) ACFM	Gas Flow (clean) ACFM	Face Vel Avg ACFM/sq ft	Filter Temp Deg F	Diff Press (loaded) *H2O	Diff Press (clean) *H2O	Diff Press Avg *H2O	Condenser Temp Deg C	Diff Pres *H2O	Cold RH Diff Pres *H2O	Time
12:30 A	36	72	9.00	792	8	7	7.5	95	0	0	12:30 AM
1:00	39	69	9.00	730	8	7	7.5	98	0	0	1:00
1:30	50	74	10.33	744	9	7	8	100	0	0	1:30
2:00	52	74	10.50	816	9	7	8	101	0	0	2:00
2:30	51	66	9.75	782	9	7	8	102	0	0	2:30
3:00	53	77	10.83	715	9	7	8	104	0	0	3:00
3:30	58	75	11.08	758	9	7	8	105	0	0	3:30
4:00	62	80	11.83	833	9	7	8	105	0	0	4:00
4:30	52	72	10.33	791	9	8	8.5	106	0	0	4:30
5:00	51	69	10.00	733	9	8	8.5	106	0	0	5:00
5:30	51	71	10.17	767	9	7	8	107	0	0	5:30
6:00	53	74	10.58	823	9	7	8	107	0	0	6:00
6:30	59	72	10.92	784	9	7	8	108	0	0	6:30
7:00	56	67	10.25	711	9	7	8	108	0	0	7:00
7:30	59	67	10.50	736	9	8	8.5	108	0	0	7:30
8:00	59	81	11.67	782	9	8	8.5	108	0	0	8:00
8:30	60	80	11.67	752	9	8	8.5	110	0	0	8:30
9:00	65	77	11.83	786	9	8	8.5	110	0	0	9:00
9:30	54	74	10.67	740	9	8	8.5	111	0	0	9:30
10:00	57	78	11.25	781	9	8	8.5	110	0	0	10:00
10:30	62	74	11.33	741	9	8	8.5	112	0	0	10:30
11:00	62	75	11.42	751	9	8	8.5	112	0	0	11:00
11:30	64	78	11.83	810	9	8	8.5	113	0	0	11:30
12:00	61	82	11.92	802	9	8	8.5	113	0	0	12:00
12:30 P	60	68	10.67	768	8	8	8	114	0	0	12:30 PM
1:00	45	77	10.17	732	9	8	8.5	114	0	0	1:00
1:30	61	83	12.00	756	9	8	8.5	114	0	0	1:30
2:00	58	81	11.58	737	8	8	8	112	0	0	2:00
2:30	67	103	14.17	731	8	8	8	110	0	0	2:30
3:00	68	98	13.83	753	8	8	8	110	0	0	3:00
3:30	66	95	13.42	748	8	8	8	109	0	0	3:30
4:00	66	97	13.58	735	9	8	8.5	107	0	0	4:00
4:30	71	106	14.75	726	8	8	8	108	0	0	4:30
5:00	71	86	13.08	758	8	8	8	110	0	0	5:00
5:30	62	77	11.58	740	8	8	8	107	0	0	5:30
6:00	61	86	12.25	766	8	8	8	107	0	0	6:00
AVG	57.8	78.8	11.4	761.4	8.7	7.7	8.2	107.8	0.0	0.0	

Sample Number	Sample Period	Filter Au As Sb	CBH Au Fe As203 Sb	Sb Removal Efficiency
#41	8:30-10:00			
#42	10:30-12:00	9.29 0.59	0.21	0.9 60.12
		9.29 0.59	0.21	0.90 60.12

Sample Number	Sample Period	Filter Au As Sb	CBH Au Fe As203 Sb	Sb Removal Efficiency
#43	12:30-2:00			
#44	2:30-4:00	13.25 0.58	0.13	0.8 62.51
#45	4:30-6:00			
#46	6:30-8:00	12.81 0.54	0.23	0.49 71.71
#47	8:30-10:00			
#48	10:30-12:00	9.9 0.52	0.39	0.95 55.73
#49	12:30-2:00			
#50	2:30-4:00	7.58 0.53	0.1	0.49 71.33
#51	4:30-6:00			
		10.89 0.54	0.21	0.68 65.32

July 25, 1990 Pall S200 Filters, 50 psi blowback

July 25, 1990

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Time	Gas Flow (loaded) ACFM	Gas Flow (clean) ACFM	Face Vel Avg ACFM/sq ft	Filter Temp Deg F	Diff Press (loaded) *H2O	Diff Press (clean) *H2O	Diff Press Avg *H2O	Condenser Temp Deg C	Diff Pres *H2O	Cold RH Diff Pres *H2O	Time
6:30	59	79	11.50	737	8	8	8	109	0	0	6:30
7:00	61	81	11.83	770	9	8	8.5	110	0	0	7:00
7:30	70	90	13.33	754	9	8	8.5	110	0	0	7:30
8:00	56	90	13.00	687	8	7	7.5	112	0	0	8:00
8:30	75	90	13.75	749	8	7	7.5	112	0	0	8:30
9:00	73	94	13.92	810	8	8	8	113	0	0	9:00
9:30	71	91	13.50	773	8	8	8	113	0	0	9:30
10:00	72	92	13.67	784	8	6	7	112	0	0	10:00
10:30	71	92	13.58	776	7	7	7	113	0	0	10:30
11:00	62	91	12.75	707	8	7	7.5	114	0	0	11:00
11:30	45	61	8.83	746	8	7	7.5	114	0	0	11:30
12:00	47	65	9.33	792	8	7	7.5	114	0	0	12:00
AVG	64.3	84.7	12.4	757.1	8.1	7.3	7.7	112.2	0.0	0.0	

July 26, 1990 Lots of scale in CBH product.

July 26, 1990

12:30 A	40	60	8.33	773	7	7	7	114	0	0	12:30 AM
1:00	56	66	10.17	710	7	6	6.5	113	0	0	1:00
1:30	42	60	8.50	787	7	6	6.5	112	0	0	1:30
2:00	66	70	11.33	850	8	5	6.5	110	0	0	2:00
2:30	Plant down, exhaust line plugged. Installed blowback PLC and two more thermocouples. Will operate CBH at higher temperature to reduce scale problem.										2:30

5:00 PM

Startup. Filter temperatures will now be the average of high and low thermocouples. With 10 minute blowback interval, diff press and face velocity is quite consistent. With Pall filters in service we will not differentiate between clean and loaded filter conditions.

9.4h

Date Time	ACFM	Face Velocity	Filter Temp	Filter Delta P	Condenser Temp	Condense Delta P	Baghouse Temp	Baghouse Delta P	Date Time
6:00	74	12.33	845	10	84	0	184	0	6:00
6:30	49	8.17	857	7	100	0	196	0	6:30
7:00	57	9.50	896	8	110	0	210	0	7:00
7:30	52	8.67	819	8	118	0	212	0	7:30
8:00	80	13.33	861	5	123	0	218	0	8:00
8:30	78	13.00	895	6	118	0	224	0	8:30
9:00	19	3.17	880	6	115	0	225	0	9:00
9:30	4	0.67	847	6	110	0	222	0	9:30
10:00	28	4.67	814	7	111	0	222	0	10:00
10:30	23	3.83	806	7	113	0	227	0	10:30
11:00	28	4.67	786	8	114	0	222	0	11:00
11:30	23	3.83	778	8	115	0	224	0	11:30
12:00	32	5.33	760	8	116	0	217	0	12:00
AVG	42.1	7.0	834.2	7.2	111.3	0.0	215.7	0.0	

Sample Number	Sample Period	Filter Au As Sb	CBH Au Fe As203 Sb	Sb Removal Efficiency
#52	6:30-8:00	13.07 0.54	0.15	0.46 72.97
#53	8:30-10:00			
#54	10:30-12:00	1.44 10.31 0.58	0.02 0.15 99.61	0.53 71.57
		1.44 11.69 0.56	0.02 0.15 99.61	0.50 72.27
#56	6:30-8:00	5.02 0.41	0.18	0.46 67.21
#57	8:30-10:00			
#58	10:30-12:00	6.2 0.5	0.1	0.54 68.05
		5.61 0.46	0.14	0.50 67.63

July 27, 1990

Date Time	ACFM	Face Velocity	Filter Temp	Filter Delta P	Condenser Temp	Condense Delta P	Baghouse Temp	Baghouse Delta P	Date Time	Sample Number	Sample Period	Hot Filter			CBH			Sb Collecti Efficiency	
												Au	As	Sb	Au	Fe	As2O3		Sb
12:30 AM	23	3.83	754	10	115	0	226	0	12:30 AM										
1:00	30	5.00	744	10	115	0	224	0	1:00										
1:30	24	4.00	802	11	114	0	224	0	1:30										
2:00	48	9.00	798	12	112	0	220	0	2:00	#59	12:30-2:00								
2:30	39	6.50	780	13	113	0	222	0	2:30										
3:00	20	3.33	772	13	113	0	220	0	3:00										
3:30	46	7.67	760	15	115	0	222	0	3:30										
4:00	65	10.83	760	14	118	0	232	0	4:00	#60	2:30-4:00		2.71	0.43		0.09		0.66	59.98
4:30	55	9.17	743	14	117	0	226	0	4:30										
5:00	58	9.67	740	14	116	0	222	0	5:00										
5:30	61	10.17	739	13	114	0	229	0	5:30										
6:00	63	10.50	736	14	113	0	219	0	6:00	#61	4:30-6:00								
6:30	66	11.00	747	14	112	0	225	0	6:30										
7:00	62	10.33	744	12	111	0	218	0	7:00										
7:30	60	10.00	747	13	110	0	229	0	7:30										
8:00	63	10.50	745	14	110	0	224	0	8:00	#62	6:30-8:00								
8:30	65	10.83	744	14	109	0	236	0	8:30 AM										
9:00	69	11.50	740	13	109	0	229	0	9:00										
9:30	67	11.17	753	13	109	0	230	0	9:30										
10:00	73	12.17	815	13	107	0	233	0	10:00	#63	8:30-10:00								
10:30	72	12.00	798	13	106	0	228	0	10:30										
11:00	45	7.50	734	12	105	0	226	0	11:00										
11:30	42	7.00	769	12	105	0	240	0	11:30										
12:00	77	12.83	793	12	102	0	236	0	12:00	#64	10:30-12:00		2.3	0.38		0.06		0.69	55.88
12:30	65	10.83	774	10	98	0	222	0.5	12:30										
1:00	62	10.33	804	12	98	0	226	0.5	1:00										
1:30	35	5.83	814	12	100	0	226	0.5	1:30										
2:00	60	10.00	787	12	100	0	237	0.5	2:00	#65	12:30-2:00								
2:30	44	7.33	773	12	102	0	229	0	2:30										
3:00	60	10.00	824	12	103	0	231	0	3:00										
3:30	90	13.00	818	13	102	0	236	0.5	3:30										
4:00	56	9.33	800	13	102	0	234	0.5	4:00	#66	2:30-4:00		2.17	0.38		0.08		0.74	54.15
4:30	35	5.83	763	14	101	0.5	225	0.5	4:30										
5:00	32	5.33	808	13	101	0.5	221	0.5	5:00										
5:30	43	7.17	831	14	102	0.5	236	0.5	5:30										
6:00	57	7.50	794	15	103	0.5	224	0.5	6:00	#67	4:30-6:00								
6:30	45	7.50	826	15	108	0.5	232	0	6:30										
7:00	63	10.50	868	15	109	0.5	235	0	7:00										
7:30	73	12.17	900	13	107	0.5	235	0.5	7:30										
8:00	91	15.17	925	13	109	0.3	238	0.5	8:00	#68	6:30-8:00		10.02	0.42		0.06		0.75	56.29
8:30	108	18.00	932	13	97	0.3	244	0.6	8:30										
9:00	41	6.83	881	9	93	0.2	220	0.5	9:00										
9:30	76	12.67	858	10	91	0.2	230	0.5	9:30										
10:00	73	12.17	759	10	90	0.2	227	0.7	10:00	#69	8:30-10:00								
10:30	33	5.50	906	10	89	0.2	221	0.5	10:30										
11:00	38	6.33	941	12	91	0.2	230	0.5	11:00										
11:30	44	7.33	942	13	95	0.2	222	0.5	11:30										
12:00	42	7.00	963	13	100	0.2	226	0.5	12:00	#70	10:30-12:00								
AVG	55.4	9.2	803.1	12.6	105.4	0.1	227.9	0.2											

July 28, 1990

Date Time	ACFM	Face Velocity	Filter Temp	Filter Delta P	Condenser Temp	Condense Delta P	Baghouse Temp	Baghouse Delta P	Date Time
12:30 AM	41	6.83	835	13	115	0.2	226	0.3	12:30 AM
1:00	34	5.67	790	13	107	0.2	218	0.5	1:00
1:30	37	6.17	840	13	110	0.2	234	0.2	1:30
2:00	46	7.67	850	12	112	0.1	223	0.4	2:00

Plant shut down, blower noisy. Acid washed blower lobes to remove scale.
Installed 2 strip heaters on filter cone to eliminate cold spots causing arsenic precipitation.

July 30, 1990

7:00 PM	Startup								7:00 PM
8:00	78	13.00	792	10	81	0	152	0	8:00
8:30	66	11.00	845	9	94	0	156	0	8:30
9:00	82	13.67	843	9	105	0	162	0	9:00
9:30	78	13.00	789	10	115	0	166	0	9:30
10:00	76	12.67	804	10	122	0	185	0	10:00
10:30	65	10.83	848	9	125	0	193	0	10:30
11:00	64	10.67	837	6	121	0	202	0	11:00
11:30	42	7.00	810	7	111	0	211	0	11:30
12:00	56	9.33	790	7	106	0	206	0	12:00

July 31, 1990

12:30 AM	39	6.50	774	8	104	0	209	0	12:30 AM
1:00	46	7.67	804	9	105	0	204	0	1:00
1:30	55	9.17	775	9	107	0	208	0	1:30
2:00	53	8.83	824	9	115	0	206	0	2:00
2:30	55	9.17	821	9	117	0	213	0	2:30
3:00	51	8.50	787	9	119	0	208	0	3:00
3:30	65	10.83	805	10	123	0	218	0	3:30
4:00									4:00
4:30	43	7.17	852	10	124	0	214	0	4:30
5:00	59	9.83	866	7	113	0	210	0	5:00
5:30	47	7.83	850	8	110	0	215	0	5:30
6:00	53	8.83	788	8	107	0	206	0	6:00
6:30	50	8.33	808	10	107	0	216	0	6:30
7:00	69	11.50	824	10	109	0	202	0	7:00
7:30	58	9.67	827	11	112	0	213	0	7:30
8:00	58	9.67	852	10	116	0	206	0	8:00
8:30	60	10.00	882	8	116	0	211	0	8:30
9:00	66	11.00	915	7	115	0	214	0	9:00
9:30	66	11.00	890	7	113	0	212	0	9:30
10:00	60	10.00	893	7	110	0	199	0.5	10:00
10:30	75	12.50	896	8	111	0	202	0.5	10:30
11:00	88	14.67	871	6	110	0	201	0	11:00
11:30	77	12.83	810	7	110	0	202	0	11:30
12:00	76	12.67	828	6	112	0	206	0	12:00
12:30			347	6	109	0	193	0	12:30

Plant down. Feed line plugged

7:15 PM	Startup								7:15 PM
8:30	65	10.83	898	12	103	0	176	0	8:30
9:00	61	10.17	814	13	111	0	170	0	9:00
9:30	81	13.50	810	13	123	0	199	0	9:30
10:00	41	6.83	804	5	130	0	194	0.5	10:00
10:30	63	10.50	817	5	105	0	207	0.5	10:30
11:00	33	5.50	810	10	105	0	201	0	11:00
11:30	29	4.83	816	12	113	0	212	0	11:30
12:00	49	8.17	813	15	122	0	217	0	12:00

AVG 57.1 10.0 830.0 3.8 111.7 0.0 199.9 0.0

Sample Number Sample Period Hot Filter Au As Sb CBW Au Fe As203 Sb Sb Collecti Efficiency

#71 12:30-2:00

#72 9:30-11:00

#73 11:30-1:00

#74 1:30-3:00

#75 3:30-5:00

#76 5:30-7:00

#77 7:30-9:00

#78 9:30-11:00

#79 11:30-1:00

#80 9:30-11:00

2.06

4.45 0.43 0.05 0.63 61.09

0.03 0.61

10.92 0.55 0.2 0.55 69.70

246

August 1, 1990

August 1, 1990

12:30 AM	43	7.17	832	18	126	0	237	0.5	12:30 AM
1:00	107	17.83	835	14	119	0	231	0.5	1:00
1:30	69	11.50	837	14	105	0	233	1	1:30
2:00	107	17.83	836	14	99	0	218	1.5	2:00
2:30	75	12.50	839	12	94	0	214	1.5	2:30
3:00	32	5.33	855	11	92	0	213	1.5	3:00
3:30	43	7.17	830	14	94	0	207	1	3:30
4:00	81	13.50	854	16	99	0	220	1.5	4:00
4:30	75	12.50	844	15	101	0	215	1.8	4:30
5:00	75	12.50	849	15	103	0	222	1.8	5:00
5:30	26	4.33	824	15	108	0	220	1	5:30
6:00	74	12.33	828	18	111	0	231	1.5	6:00
6:30	63	10.50	820	17	113	0	230	2	6:30
7:00	53	8.83	838	17	112	0	239	2.5	7:00
7:30	64	10.67	836	18	113	0	230	2	7:30
8:00	58	9.67	831	18	110	0	225	2.5	8:00
8:30	75	12.5	836	18	110	0	226	1.5	8:30
9:00	81	13.5	846	21	108	0	224	1.5	9:00
9:30	74	12.3	825	20	118	0	228	0.5	9:30
10:00	74	12.3	816	19	122	0	232	0.5	10:00
10:30	98	16.3	798	18	121	0	233	1.0	10:30
11:00	88	14.7	796	17	119	0	233	1.0	11:00
11:30	57	9.5	805	15	117	0	230	0.5	11:30
12:00	78	13.0	803	16	118	0	227	0.5	12:00
12:30									12:30
AVG	69.6	11.6	829.7	16.3	109.7	0.0	225.8	1.3	

#81 11:30-1:00

#82 1:30-3:00

#83 3:30-5:00

#84 5:30-7:00

#85 7:30-9:00

#86 9:30-11:00

#87 11:30-12:30

5.01 0.5 0.09 0.83 58.08

HI-TEMP FILTER TEST
FLUID DYNAMICS #2 FILTER ELEMENTS

88.5 hr

DATE	RECORD #	TIME	ACFM	F VELOC	UPPER TE	LOWER TE	AVERAGE	DELTA P	SAMPLE #	PERIOD	FILTER A	FILTER A	FILTER S	CBH AU	CBH FE	CBH AS20	CBH SB	SB REMOV	COMMENTS
AUGUST 7	1	1:00 PM	86	14.3	1091	588	840	16.0										ERROR	
AUGUST 7	2	1:30	87	14.5	1106	607	857	16.0										ERROR	
AUGUST 7	3	2:00	81	13.5	1106	606	857	17.0										ERROR	
AUGUST 7	4	2:30	76	12.7	1096	610	853	18.0										ERROR	
AUGUST 7	5	3:00	94	15.7	1125	628	877	17.0										ERROR	
AUGUST 7	6	3:30	80	13.3	1056	625	841	17.0										ERROR	
AUGUST 7	7	4:00	97	16.2	1065	620	843	17.0										ERROR	
AUGUST 7	8	4:30	87	14.5	1095	625	860	16.0										ERROR	
AUGUST 7	9	5:00	89	14.8	1133	644	889	16.0	88	3:30-5:0								ERROR	
AUGUST 7	10	5:30	94	14.8	1135	642	889	17.0										ERROR	
AUGUST 7	11	6:00	87	14.5	1098	630	864	18.0										ERROR	
AUGUST 7	12	6:30	89	14.8	1116	661	889	18.0										ERROR	
AUGUST 7	13	7:00	91	15.2	1161	684	923	18.0	89	5:30-7:0								ERROR	
AUGUST 7	14	7:30	95	15.8	1130	663	897	17.0										ERROR	
AUGUST 7	15	8:00	102	17.0	1154	680	917	16.6										ERROR	
AUGUST 7	16	8:30	92	15.3	1180	700	940	16.0										ERROR	
AUGUST 7	17	9:00	94	15.7	1217	719	968	14.0	90	7:30-9:0	5.55	0.62	0.06		0.70		67	ERROR	
AUGUST 7	18	9:30	91	15.2	1152	676	924	15.0										ERROR	
AUGUST 7	19	10:00	80	13.3	1192	659	926	9.0										ERROR	
AUGUST 7	20	10:30	81	13.5	1222	675	949	11.0										ERROR	
AUGUST 7	21	11:00	88	14.7	1124	630	877	14.0	91	9:30-11:								ERROR	
AUGUST 7	22	11:30	87	14.5	1144	567	856	14.0										ERROR	
AUGUST 7	23	12:00	88	14.7	1178	572	875	16.0										ERROR	
AUGUST 8	24	12:30 AM	88	14.7	1195	557	876	15.0										ERROR	
AUGUST 8	25	1:00	87	14.5	1210	521	866	16.0	92	11:30-1:	7.75	0.72	0.07		0.73		69	ERROR	
AUGUST 8	26	1:30	87	14.5	1133	587	860	13.0										ERROR	
AUGUST 8	28	2:00	82	13.8	1148	610	879	12.0										ERROR	
AUGUST 8	29	2:30	79	13.2	1180	643	934	11.0										ERROR	
AUGUST 8	30	3:00	80	13.3	1200	668	934	12.0	93	1:30-3:0								ERROR	
AUGUST 8	31	3:30	78	13.0	1217	585	901	15.0										ERROR	
AUGUST 8	32	4:00	74	12.3	1220	526	823	14.0										ERROR	
AUGUST 8	33	4:30	79	13.2	1129	517	823	15.0										ERROR	
AUGUST 8	34	5:00	75	12.5	1158	524	841	15.0	94	3:30-5:0								ERROR	
AUGUST 8	35	5:30	73	12.2	1175	618	897	12.0										ERROR	
AUGUST 8	36	6:00	74	12.3	1193	646	910	13.0										ERROR	
AUGUST 8	37	6:30	75	12.5	1212	668	940	12.0										ERROR	
AUGUST 8	38	7:00	78	13.0	1133	650	892	13.0	95	5:30-7:0								ERROR	
AUGUST 8	39	7:30	79	12.0	1154	654	904	12.0										ERROR	
AUGUST 8	40	8:00	80	13.3	1182	662	922	13.0										ERROR	
AUGUST 8	41	8:30		0.0			0											ERROR	
AUGUST 8	42	9:00		0.0			0											ERROR	
AUGUST 8	43	9:30		0.0			0		96		9.99	.59	.08		.44			ERROR	
AUGUST 8	44	10:00		0.0			0											ERROR	
AUGUST 8	45	10:30	78	13.0	1044	564	804	15.0										ERROR	
AUGUST 8	46	11:00	80	13.3	1097	583	855	16.0										ERROR	
AUGUST 8	47	11:30	99	14.8	1157	610	884	16.0										ERROR	
AUGUST 8	48	12:00	89	14.8	1180	596	888	17.6	97	10:30-12								ERROR	
AUGUST 8	49	12:30	85	14.2	1195	625	910	17.0										ERROR	
AUGUST 8	50	1:00	91	15.2	1209	646	928	16.0										ERROR	
AUGUST 8	51	1:30	91	15.2	1260	644	922	16.0										ERROR	
AUGUST 8	52	2:00	88	14.7	1123	617	870	16.0	98	12:30-2:	14.89	3.56	0.05		0.73		64	ERROR	
AUGUST 8	53	2:30	83	13.8	1133	627	880	16.0										ERROR	

25 hr

DATE	RECORD #	TIME	ACFM	F VELOC	UPPER TE	LOWER TE	AVERAGE	DELTA P	SAMPLE #	PERIOD	FILTER A	FILTER A	FILTER S	CBH AU	CBH FE	CBH AS20	CBH SB	SB REMOV	COMMENTS
AUGUST 8	54	3:00	90	15.0	1167	649	908	16.0										ERROR	
AUGUST 8	55	3:30	91	15.2	1192	666	929	16.0										ERROR	
AUGUST 8	56	4:00	93	15.5	1101	634	868	17.0	99	2:30-4:0								ERROR	
AUGUST 8	57	4:30	89	14.8	1126	644	876	17.0										ERROR	
AUGUST 8	58	5:00	85	14.2	1180	666	923	16.0										ERROR	
AUGUST 8	59	5:30	85	14.2	1186	662	924	15.0										ERROR	
AUGUST 8	60	6:00	81	13.5	1090	609	850	18.0	100	4:30-6:0								ERROR	
AUGUST 8	61	6:30	83	13.8	1025	575	800	16.0										ERROR	
AUGUST 8	62	7:00	85	14.2	1066	587	827	17.0										ERROR	
AUGUST 8	63	7:30	87	14.5	1109	610	860	17.0										ERROR	
AUGUST 8	64	8:00	89	14.8	1171	621	896	15.0	101	6:30-8:0								ERROR	
AUGUST 8	65	8:30	96	16.0	1197	620	909	18.0										ERROR	
AUGUST 8	66	9:00	87	14.5	1121	605	876	16.0										ERROR	
AUGUST 8	67	9:30	88	14.7	1141	611	912	18.0										ERROR	
AUGUST 8	68	10:00	79	13.2	1181	643	923	12.0	102	8:30-10:	13.07		0.51		0.05		0.84	SB	
AUGUST 8	69	10:30	80	13.3	1209	637	873	14.0										ERROR	
AUGUST 8	70	11:00	82	13.7	1123	622	888	15.0										ERROR	
AUGUST 8	71	11:30	89	14.8	1143	633	913	15.0										ERROR	
AUGUST 8	72	12:00	79	13.2	1183	642	913	11.0	103	10:30-12								ERROR	
AUGUST 9	73	12:30 AM	81	13.5	1215	666	941	12.0										ERROR	
AUGUST 9	74	1:00	82	13.7	1233	688	961	11.0										ERROR	
AUGUST 9	75	1:30	83	13.8	1254	700	977	10.0										ERROR	
AUGUST 9	76	2:00	78	13.0	1264	713	989	10.0	104	12:30-2:								ERROR	
AUGUST 9	77	2:30	80	13.3	1169	677	923	12.0										ERROR	
AUGUST 9	78	3:00	80	13.3	1194	670	932	11.0										ERROR	
AUGUST 9	79	3:30	82	13.7	1221	691	956	11.0										ERROR	
AUGUST 9	80	4:00	87	14.5	1235	682	959	12.0	105	2:30-4:0								ERROR	
AUGUST 9	81	4:30	78	13.0	1136	636	886	12.0										ERROR	
AUGUST 9	82	5:00	78	13.0	1149	638	894	14.0										ERROR	
AUGUST 9	83	5:30	91	15.2	1191	656	924	12.0										ERROR	
AUGUST 9	84	6:00	87	14.5	1214	676	945	12.0	106	4:30-6:0	12.77		0.58		0.04		0.69	66	
AUGUST 9	85	6:30	88	14.7	1125	643	884	12.0										ERROR	
AUGUST 9	86	7:00	89	14.8	1150	646	898	13.0										ERROR	
AUGUST 9	87	7:30	91	15.2	1191	664	928	12.0										ERROR	
AUGUST 9	88	8:00	91	15.2	1180	654	917	16.0	107	6:30-8:0								ERROR	
AUGUST 9	89	8:30	92	15.3	1219	643	931	17.0										ERROR	
AUGUST 9	90	9:00	93	15.5	1232	678	955	13.0										ERROR	
AUGUST 9	91	9:30	104	17.3	1230	664	947	19.0										ERROR	
AUGUST 9	92	10:00	103	17.2	1236	624	930	19.0	108	8:30-10:								ERROR	INCREASED BLOWBACK PRESSURE TO 65 PSI
AUGUST 9	93	10:30	92	15.3	1247	630	939	15.0										ERROR	
AUGUST 9	94	11:00	92	15.3	1251	631	941	18.0										ERROR	
AUGUST 9	95	11:30	87	14.5	1261	640	951	15.0										ERROR	
AUGUST 9	96	12:00	85	14.2	1225	610	918	18.0	109	10:30-12								ERROR	
AUGUST 9	97	12:30 PM	84	14.0	1186	612	899	17.0										ERROR	
AUGUST 9	98	1:00	85	14.2	1199	622	911	17.0										ERROR	
AUGUST 9	99	1:30	85	14.2	1205	631	918	17.0										ERROR	
AUGUST 9	100	2:00	91	15.2	1198	635	917	16.0	110	12:30-2:								ERROR	
AUGUST 9	101	2:30	83	13.8	1150	625	888	16.0										ERROR	
AUGUST 9	102	3:00	88	14.7	1146	617	882	16.0										ERROR	
AUGUST 9	103	3:30	89	14.8	1160	621	891	18.0										ERROR	
AUGUST 9	104	4:00	84	14.0	1163	622	893	20.0	111	2:30-4:0								ERROR	
AUGUST 9	105	4:30	90	15.0	1173	635	904	15.0										ERROR	
AUGUST 9	106	5:00	90	15.0	1175	637	906	16.0										ERROR	
AUGUST 9	107	5:30	94	16.0	1176	633	905	16.0										ERROR	
AUGUST 9	108	6:00	90	15.0	1175	633	904	17.0	112	4:30-6:0								ERROR	
AUGUST 9	109	6:30		0.0			0											ERROR	

DATE	RECORD #	TIME	ACFH	F VELOC	UPPER TE	LOWER TE	AVERAGE	DELTA P	SAMPLE #	PERIOD	FILTER A	FILTER B	FILTER S	CBH AU	CBH FE	CBH AS20	CBH SB	SB REMOV	COMMENTS
AUGUST 9	110	7:00		0.0			0											ERROR	
AUGUST 9	111	7:30		0.0			0											ERROR	
AUGUST 9	112	8:00		0.0			0											ERROR	
AUGUST 9	113	8:30		0.0			0											ERROR	
AUGUST 9	114	9:00		0.0			0											ERROR	
AUGUST 9	115	9:30		0.0			0											ERROR	
AUGUST 9	116	10:00		0.0			0											ERROR	
AUGUST 9	117	10:30		0.0			0											ERROR	
AUGUST 9	118	11:00		0.0			0											ERROR	
AUGUST 9	119	11:30		0.0			0											ERROR	
AUGUST 9	120	12:00		0.0			0											ERROR	
AUGUST 10	121	12:30 aa		0.0			0											ERROR	HEAVY SCALING DUE TO LOW CBH TEMP
AUGUST 10	122	1:00	92	15.3	830	481	656	10.0										ERROR	
AUGUST 10	123	1:30	92	15.3	926	505	716	10.0										ERROR	
AUGUST 10	124	2:00	94	15.7	965	525	745	10.0										ERROR	
AUGUST 10	125	2:30	102	17.0	1004	545	775	8.0										ERROR	
AUGUST 10	126	3:00	93	15.5	1035	559	797	7.0										ERROR	
AUGUST 10	127	3:30	94	15.7	1068	541	805	6.0										ERROR	
AUGUST 10	128	4:00	95	15.8	1076	572	824	6.0	113	2:30-4:0								ERROR	
AUGUST 10	129	4:30	96	16.0	1100	576	838	5.0										ERROR	
AUGUST 10	130	5:00	97	16.2	1112	587	850	5.0										ERROR	
AUGUST 10	131	5:30	92	15.3	1122	585	854	5.0										ERROR	
AUGUST 10	132	6:00	87	14.5	1128	588	858	5.0	114	4:30-6:0								ERROR	
AUGUST 10	133	6:30	87	14.5	1132	590	861	5.0										ERROR	
AUGUST 10	134	7:00	87	14.5	1141	587	864	5.0										ERROR	
AUGUST 10	135	7:30	87	14.5	1139	593	866	19.0										ERROR	
AUGUST 10	136	8:00	87	14.5	1143	593	868	18.0	115	6:30-8:0								ERROR	
AUGUST 10	137	8:30	88	14.7	1147	544	846	18.0										ERROR	CHANGED TO 30 MIN BLOWBACK INTERVAL
AUGUST 10	138	9:00	82	13.7	1151	591	871	18.0										ERROR	
AUGUST 10	139	9:30	88	14.7	1161	599	880	19.0										ERROR	
AUGUST 10	140	10:00	89	14.7	1164	603	884	19.0	116	8:30-10:								ERROR	
AUGUST 10	141	10:30	89	13.8	1166	602	884	19.0										ERROR	
AUGUST 10	142	11:00	89	14.8	1174	601	888	19.0										ERROR	
AUGUST 10	143	11:30	89	14.8	1176	609	893	19.0										ERROR	
AUGUST 10	144	12:00	90	15.0	1175	625	900	19.0	117	10:30-12								ERROR	
AUGUST 10	145	12:30 PM	90	15.0	1182	620	901	18.0										ERROR	
AUGUST 10	146	1:00	90	15.0	1181	636	909	18.0										ERROR	
AUGUST 10	147	1:30	90	15.0	1179	634	907	18.0										ERROR	
AUGUST 10	148	2:00	90	15.0	1182	637	910	19.0	118	12:30-2:				0.08		0.60	0	ERROR	
AUGUST 10	149	2:30	90	15.0	1184	642	913	18.0										ERROR	
AUGUST 10	150	3:00	91	15.2	1183	645	914	18.0										ERROR	
AUGUST 10	151	3:30	87	14.5	1099	619	859	18.0										ERROR	
AUGUST 10	152	4:00	87	14.5	1111	599	855	19.0	119	1:30-4:00								ERROR	
AUGUST 10	153	4:30	89	14.8	1143	628	886	19.0										ERROR	
AUGUST 10	154	5:00	89	14.8	1153	639	896	19.0										ERROR	
AUGUST 10	155	5:30	90	15.0	1164	653	909	19.0										ERROR	
AUGUST 10	156	6:00	86	14.3	1109	589	849	18.0	120	4:30-6:0								ERROR	
AUGUST 10	157	6:30	86	14.3	1123	561	842	19.0										ERROR	REPAIRED CBH HEATING COILS
AUGUST 10	158	7:00	80	13.3	1159	515	837	19.0										ERROR	
AUGUST 10	159	7:30	80	13.3	1026	482	754	20.0										ERROR	
AUGUST 10	160	8:00	85	14.2	1074	573	824	19.0	121	6:50-8:0								ERROR	
AUGUST 10	161	8:30	118	19.7	1100	586	843	12.0										ERROR	
AUGUST 10	162	9:00	57	9.5	1117	608	863	17.0										ERROR	
AUGUST 10	163	9:30	41	6.8	1140	605	873	18.0										ERROR	
AUGUST 10	164	10:00	47	7.8	1153	595	874	20.0	122	8:30-10:	7.22	.43	.21	.57				ERROR	6.4%
AUGUST 10	165	10:30	59	9.8	1157	587	872	24.0										ERROR	

27.5

[illegible]

20 hr.

DATE	TIME	RECORD #	ACFN	F VELOC	UPPER TE	LOWER TE	AVERAGE	DELTA P	SAMPLE #	PERIOD	FILTER A	FILTER A	FILTER S	CBH AU	CBH FE	CBH ASD	CBH SB	SB REMOV	COMMENTS
AUGUST 13	12:00	1	73	11	966	465	723	21											
	12:30 PM	2	68	10	964	477	721	23											
	1:00	3	64	10	989	484	737	23											
	1:30	4	59	9	995	454	725	24											
	2:00	5	69	10	1004	473	739	24	128	12:30-2:	12.18		.49	.11		.43	72%	BLOWBACK PULSE DURATION REDUCED	
	2:30	6	65	10	1004	488	746	28											
	3:00	7	82	12	1014	500	757	26											
	3:30	8	128	19	1028	525	777	23											
	4:00	9	82	12	1033	531	762	23	129	2:30-4:0									
	4:30	10	66	10	1033	525	779	23											
	5:00	11	85	13	1044	540	792	24											
	5:30	12	73	11	1049	545	797	24											
	6:00	13	85	13	1049	548	799	25	130	4:30-6:0	10.74		.45	.14		.55	60%		
	6:30	14	108	16	1053	546	800	28											
	7:00	15	89	13	1053	561	807	28											
	7:30	16	90	14	1051	550	806	28											
	8:00	17	110	17	1054	509	782	28	131	6:30-8:0									
	8:30	18	67	10	1049	559	804	26											
	9:00	19	72	11	1052	515	784	26											
	9:30	20	82	12	1052	543	798	28											
	10:00	21	64	10	1050	537	794	28	132	8:30-10:									
	10:30	22	66	10	1050	550	800	28											
	11:00	23	59	9	1050	561	806	28											
	11:30	24	65	10	1048	550	799	28											
	12:00	25	76	12	1044	543	794	27	133	10:30-12									
AUGUST 14	12:30 AM	26	60	9	1046	528	792	29											
	1:00	27	77	12	1046	548	797	29											
	1:30	28	54	8	1046	555	801	28											
	2:00	29	81	12	1047	558	803	28	134	12:30-2:	3.7		.51	.08		.56	68%		
	2:30	30	70	11	1048	534	791	28											
	3:00	31	78	12	1045	535	790	27											
	3:30	32	74	11	1045	532	789	29											
	4:00	33	86	13	1038	527	783	30	135	2:30-4:0									
	4:30	34	116	18	1043	532	788	28											
	5:00	35	104	16	1049	553	801	26											
	5:30	36	104	16	1053	561	807	22											
	6:00	37	105	16	1058	564	811	19	136	4:30-6:0	5.33		.52	.06		.43	74%		
	6:30	38	95	14	1068	574	821	16											
	7:00	39	84	13	1076	555	816	18											
	7:30	40	79	12	1082	560	821	15											
8:00	41	74	11	1084	567	826	15	137	6:30-8:0										
				0		0													
				0		0													

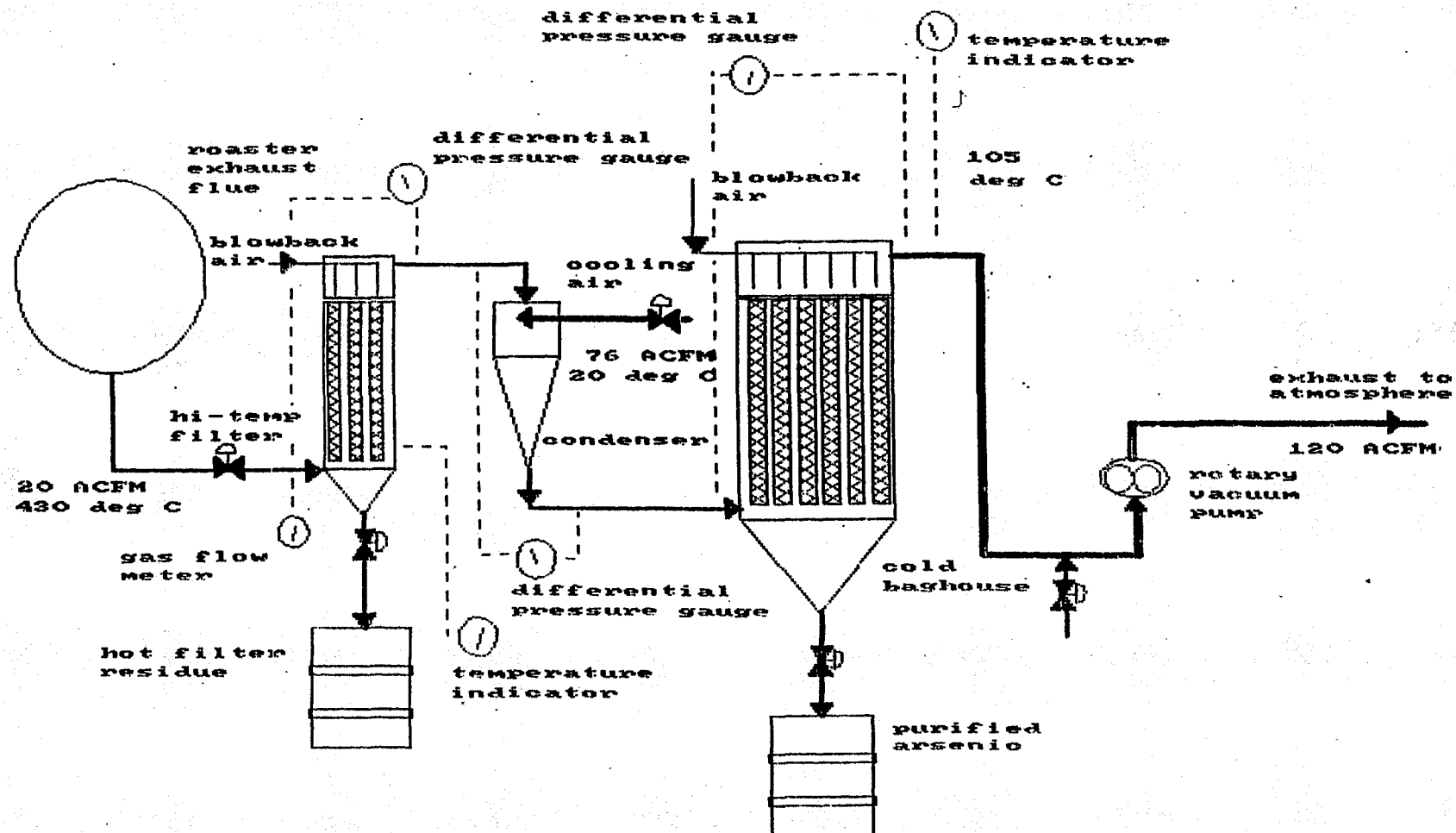
12.5 hr

СВН 42

Appendix B

Graphs

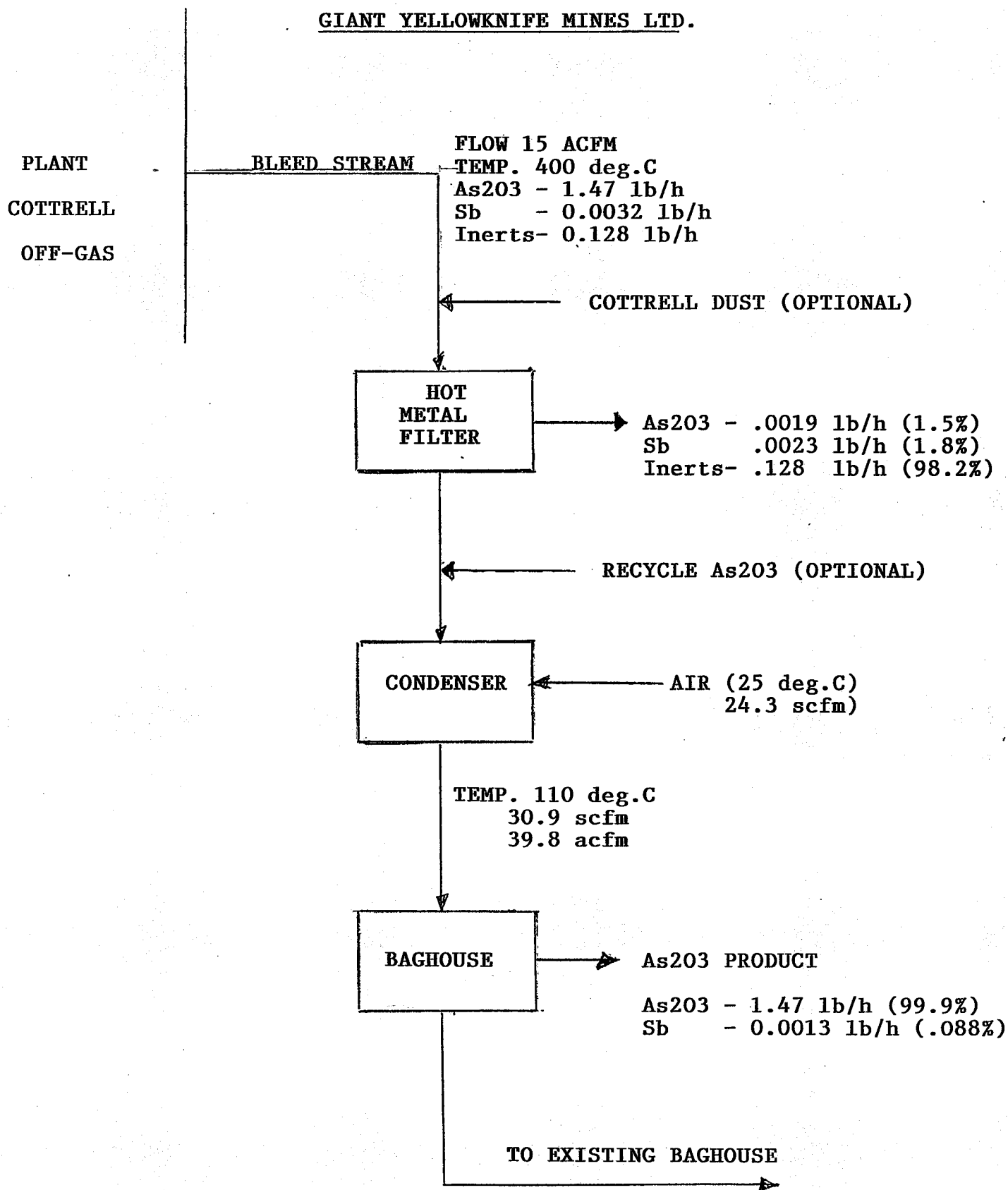
HI TEMP FILTER PILOT PLANT



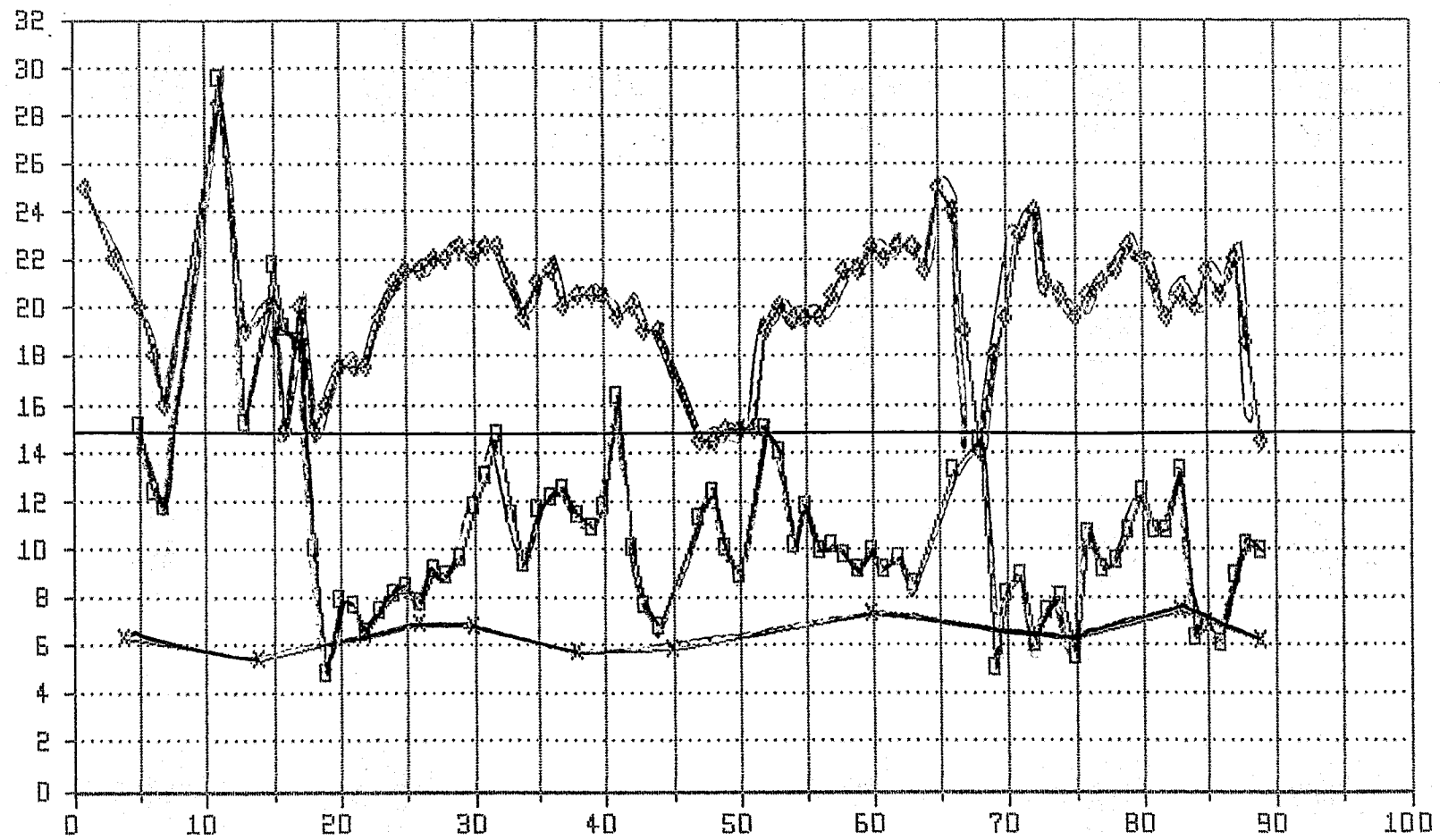
ARSENIC PURIFICATION PILOT PLANT

FIGURE 1

GIANT YELLOWKNIFE MINES LTD.



FLUID DYNAMICS #1 ELEMENTS



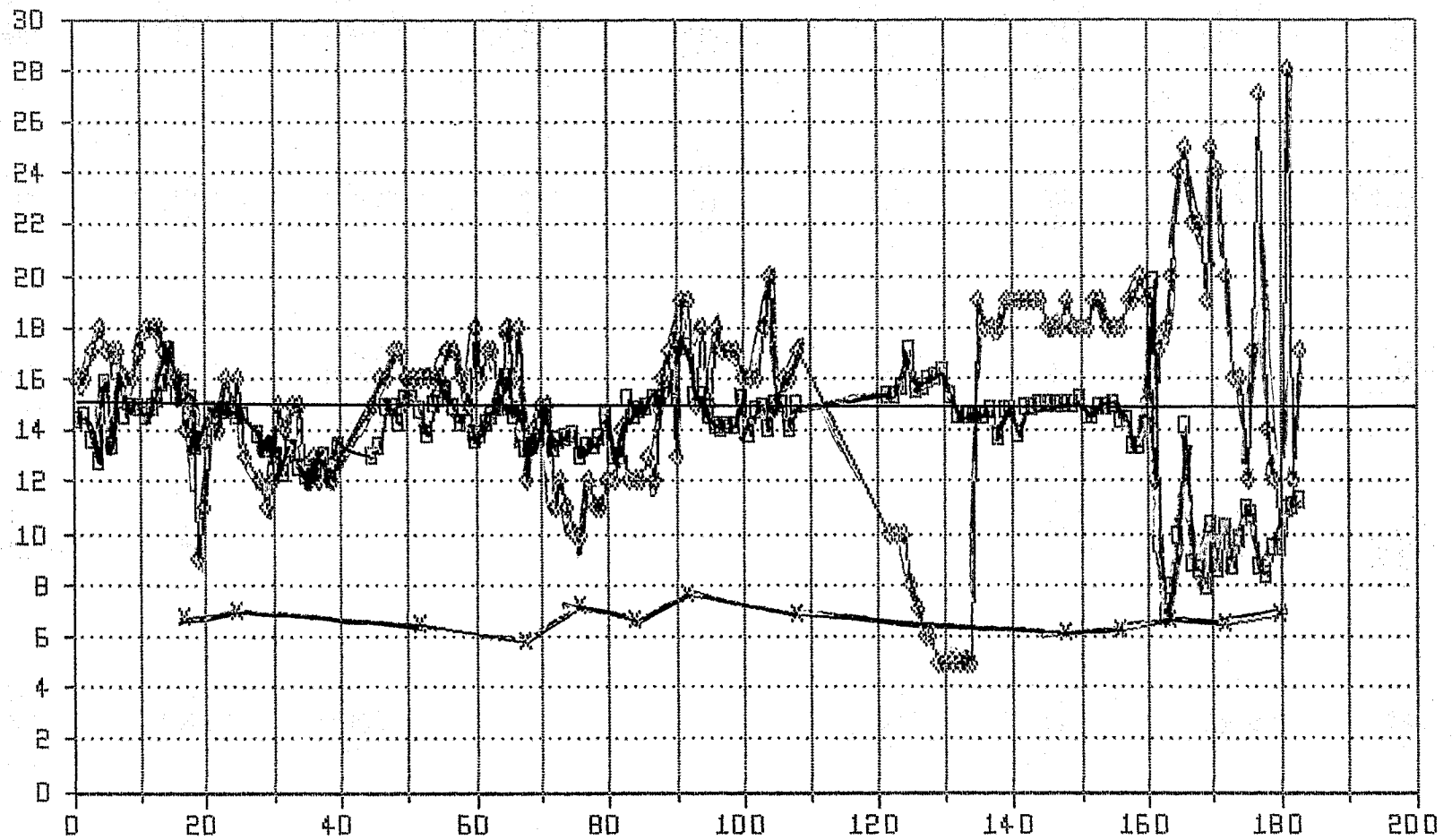
RECORD #

—◇— DELTA P

—□— F VELDC

—X— FILT EFFIC

fluid dynamics #2 filter elements



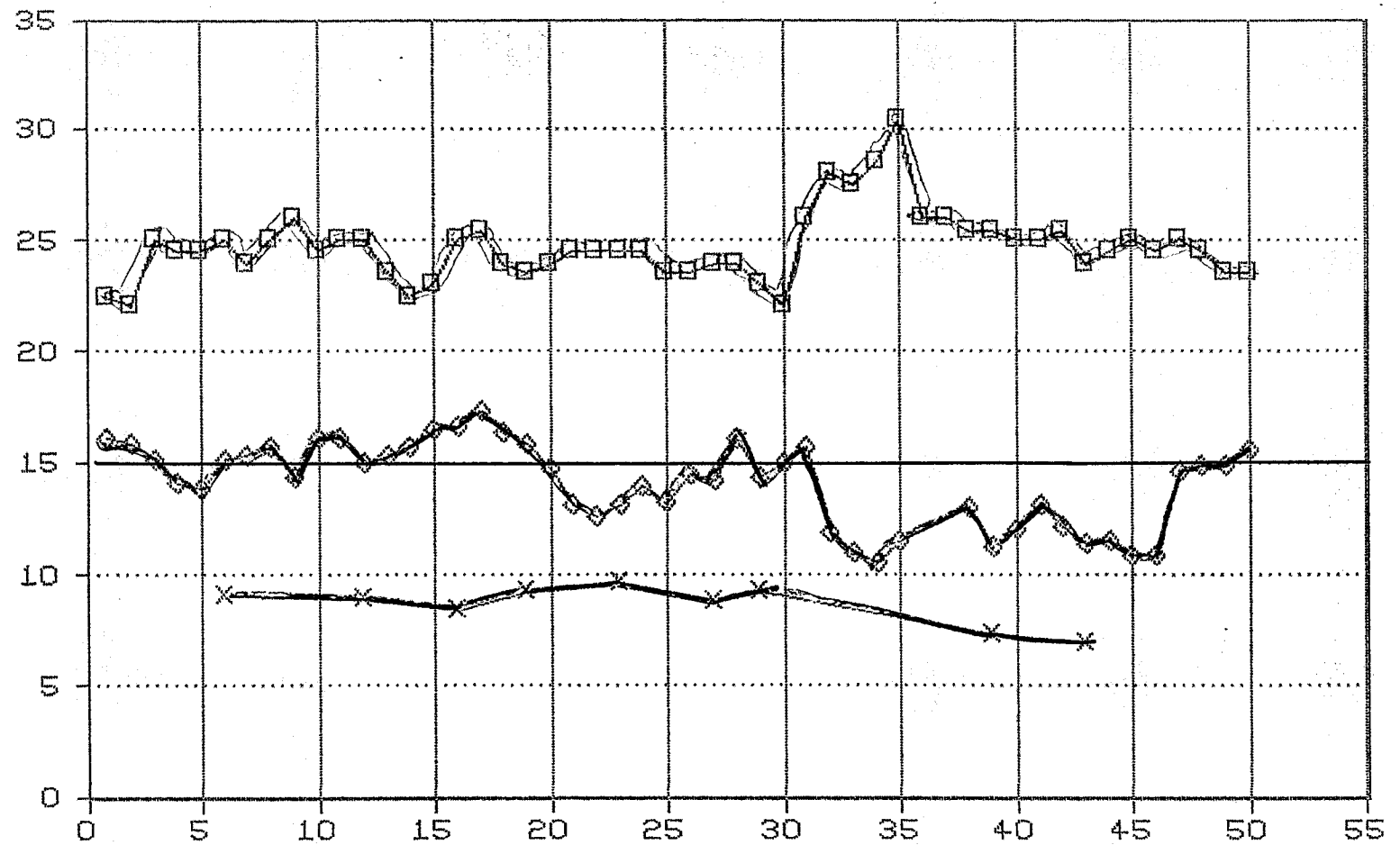
RECORD #

—◇— DELTA P

—□— F VELOC

—x— FILT EFFIC

MOTT ELEMENTS RUN #1



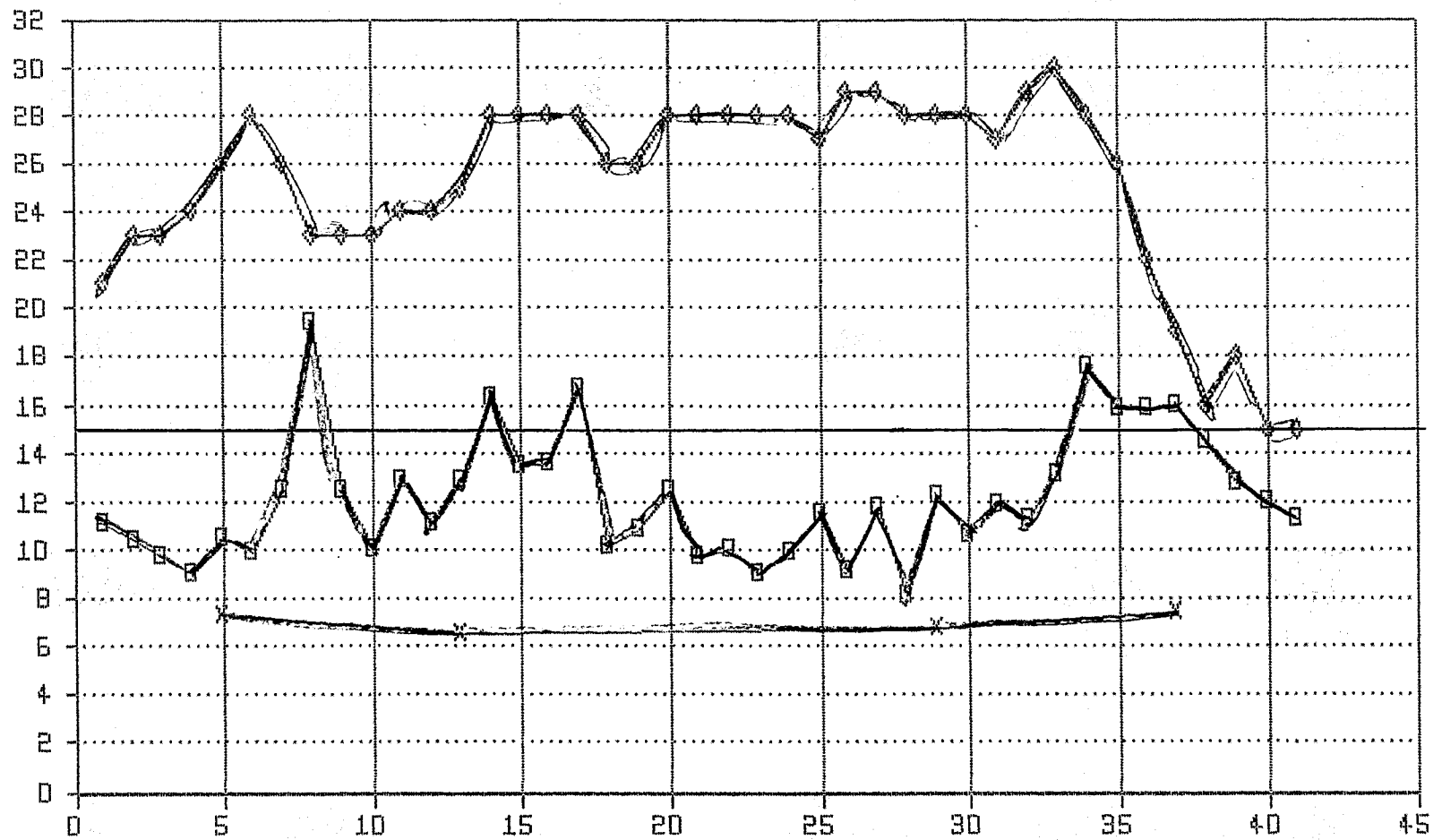
RECORD #

—♦— FACE VELOCITY

—□— DELTA P

—x— FILT EFFIC

MOTT ELEMENTS RUN #2



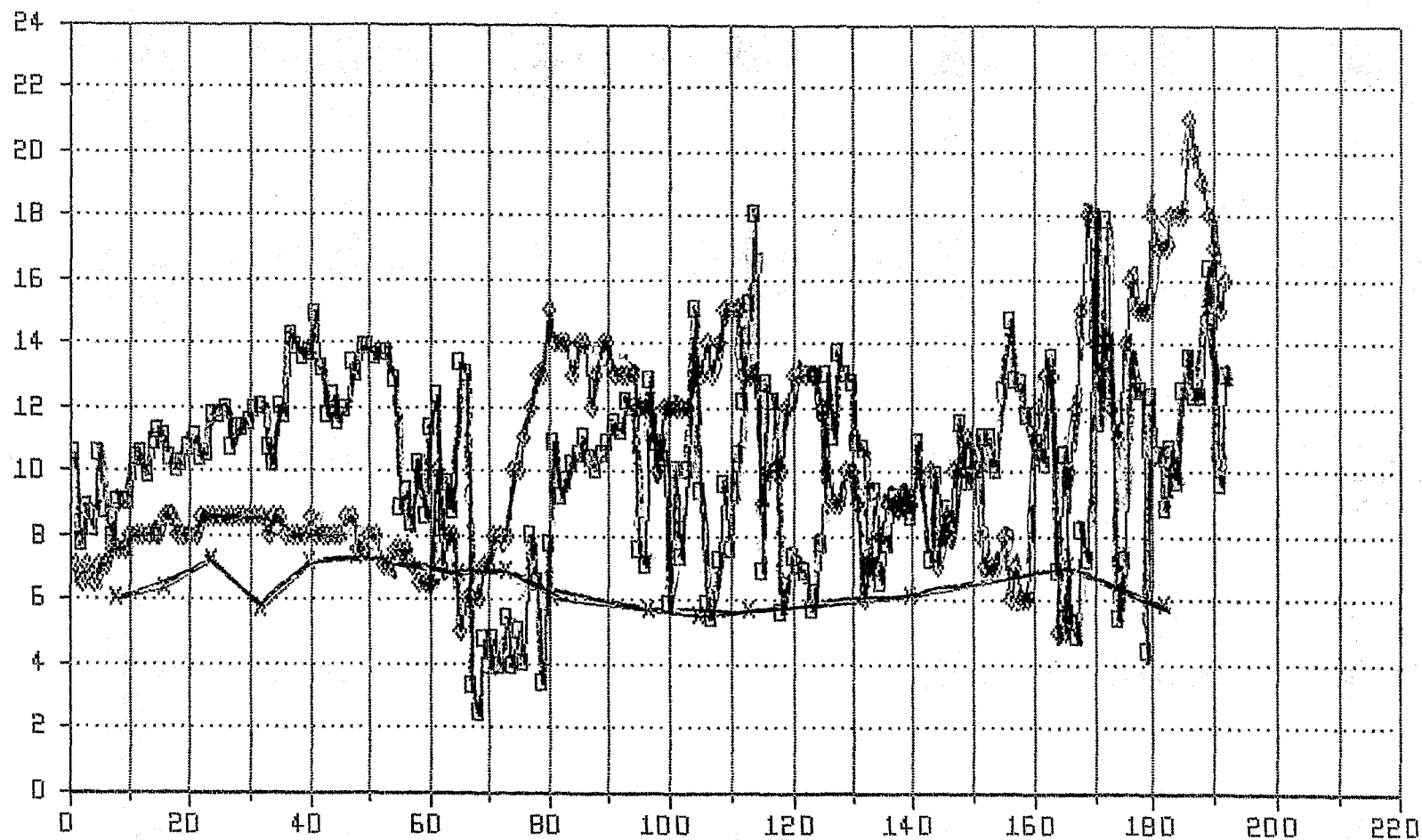
RECORD #

—◇— DELTA P

—□— F VELDC

—X— FILTER RATING

PALL ELEMENTS RUN #1



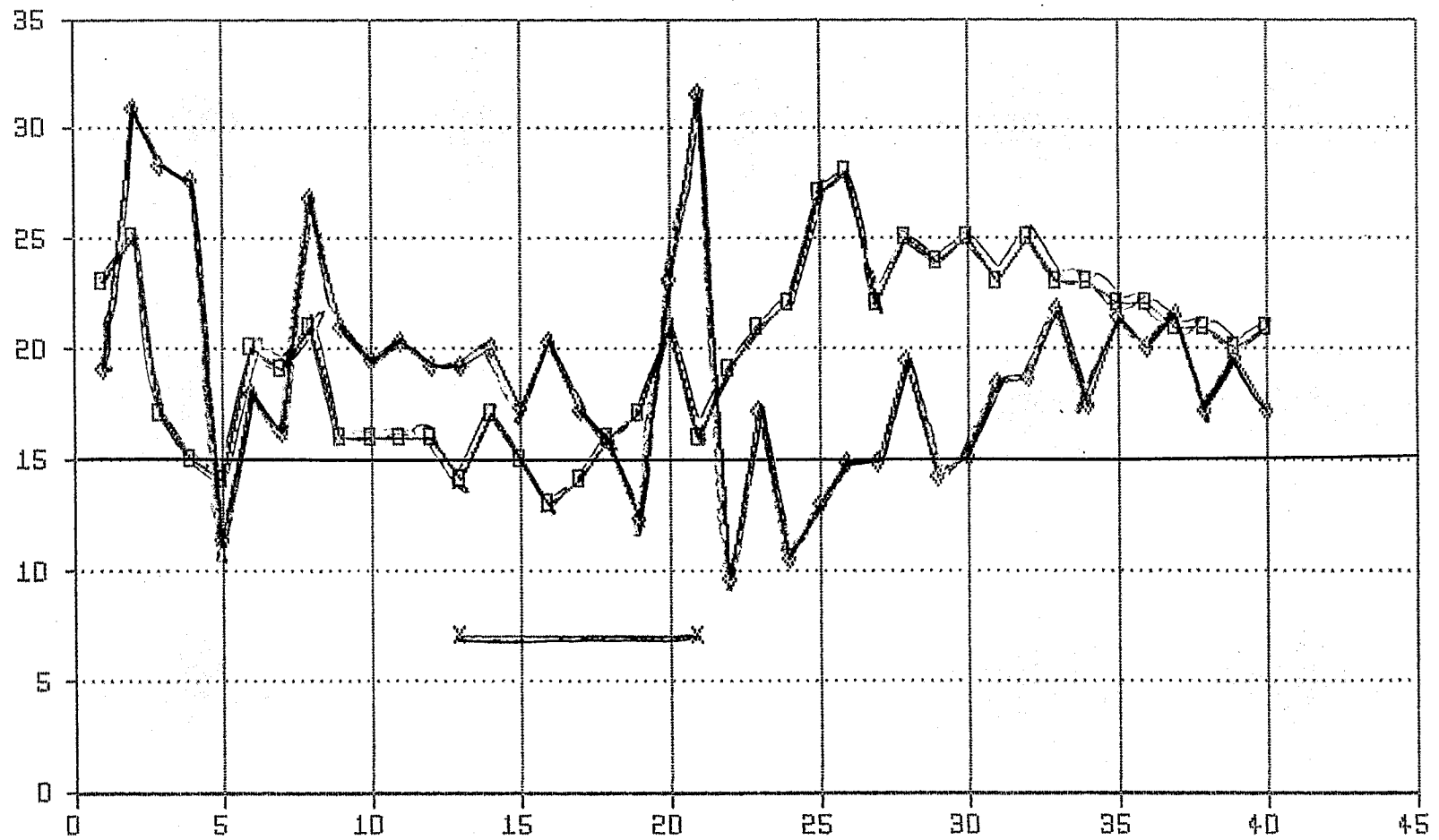
RECORD #

—◇— DELTA P

—□— F VELDC

—×— FILT EFFIC

PALL ELEMENTS RUN #2



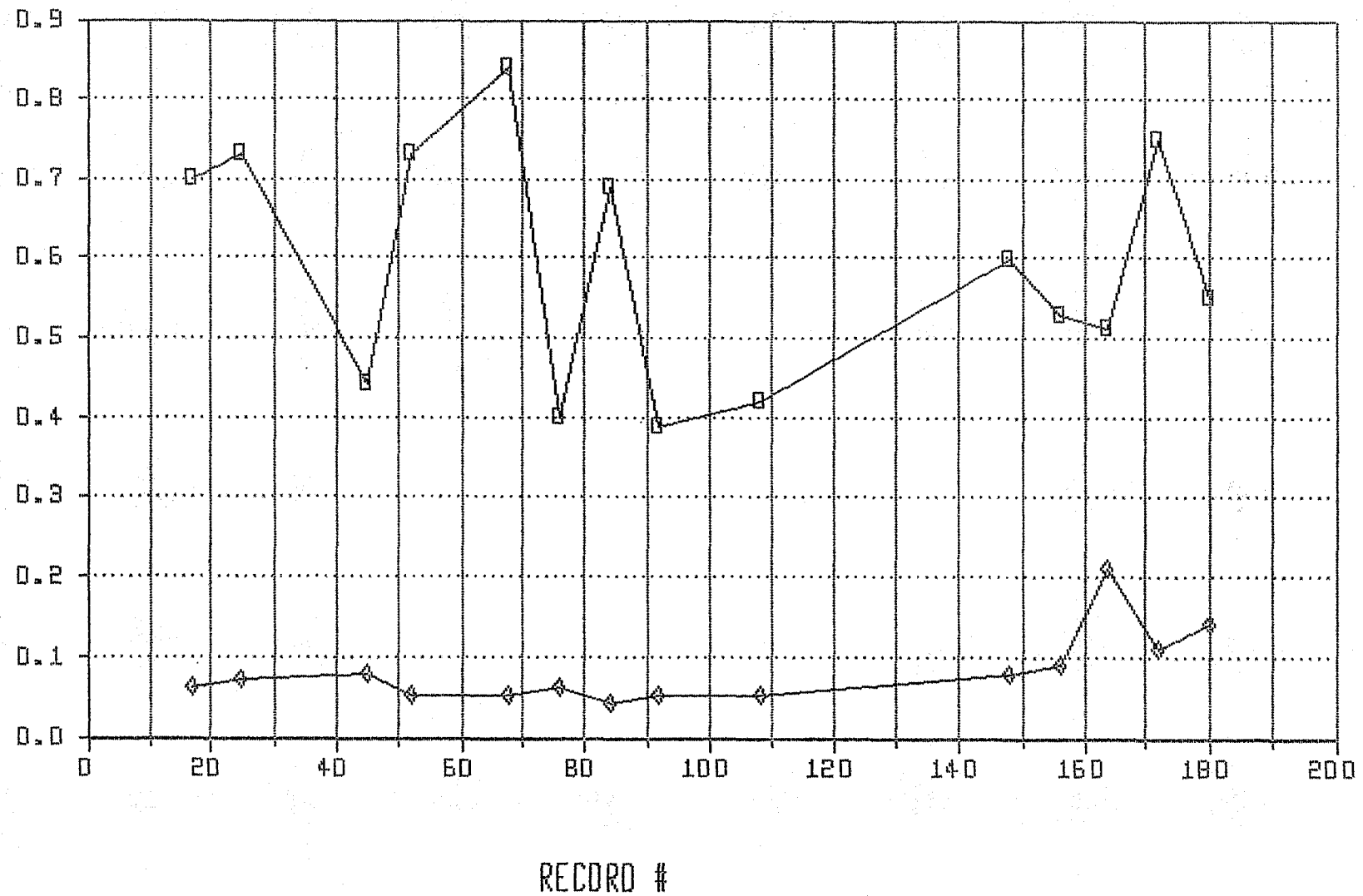
RECORD#

—♦— F VELDC

—□— DELTA P

—x— FILTER RATING

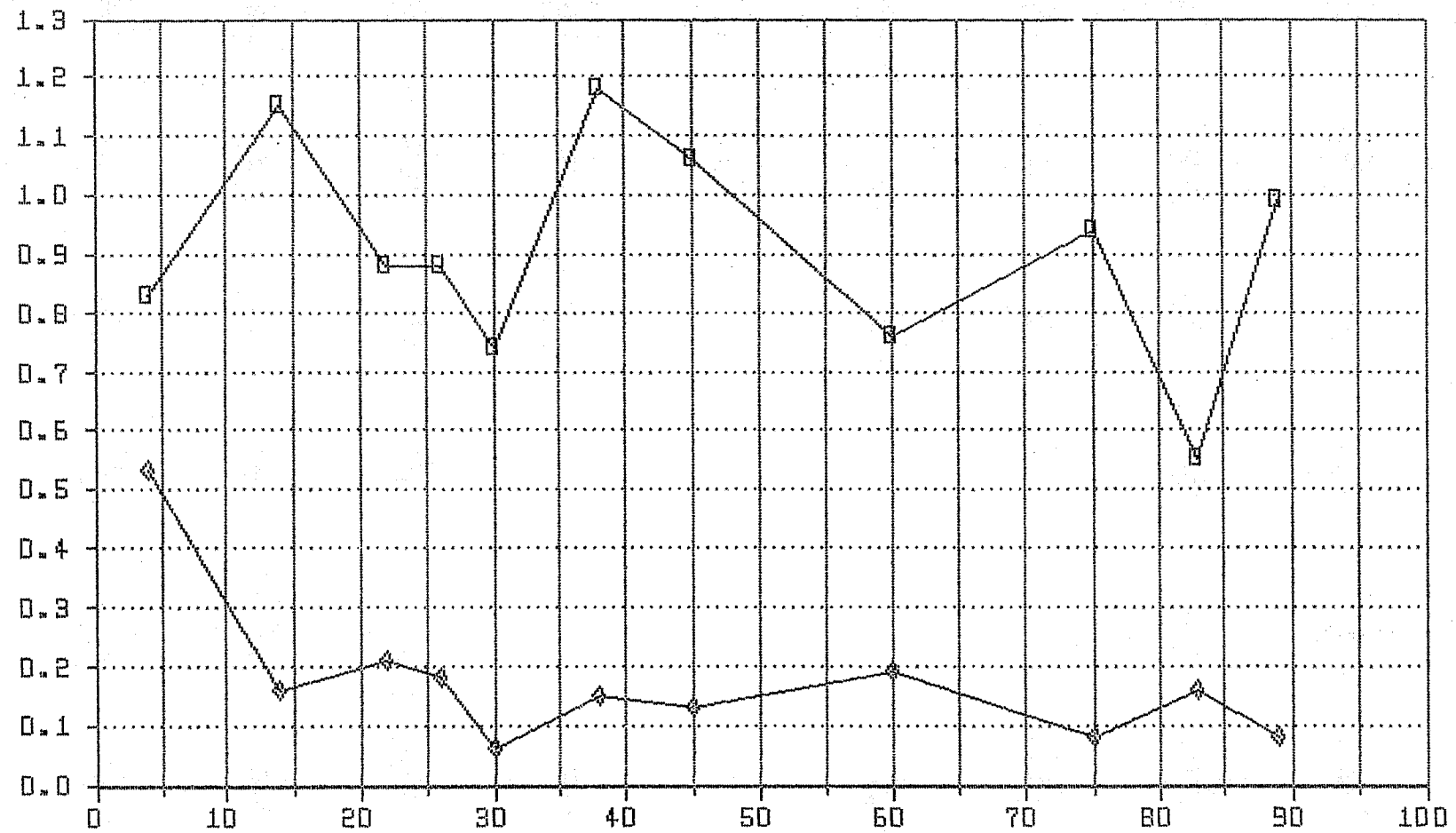
fluid dynamics #2 filter elements



◆ CBH FE

□ CBH SB

Fluid Dynamics Run #1

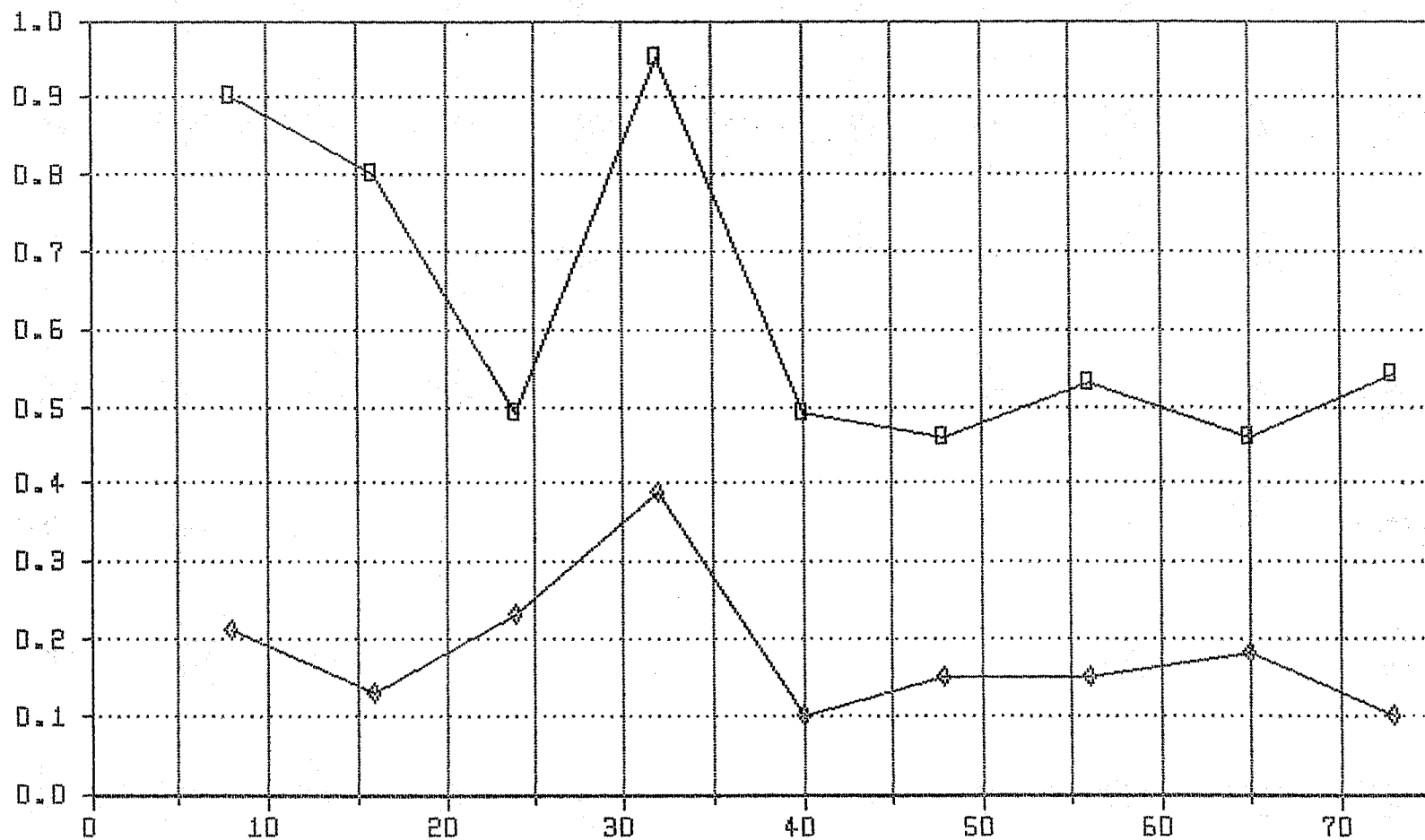


RECORD #

—◆— CBH FE

—□— CBH SB

PALL ELEMENTS RUN #1

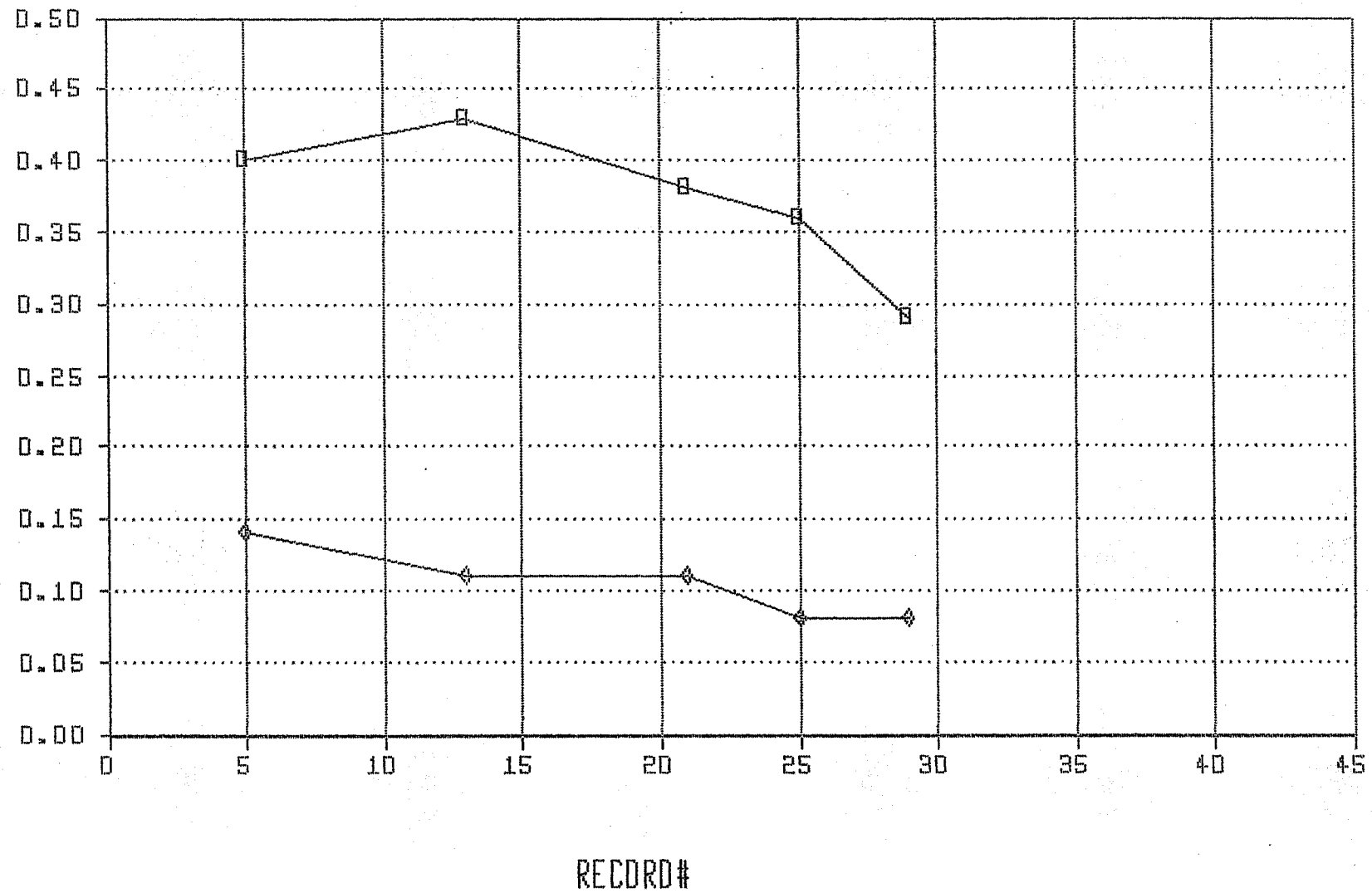


RECORD #

—◆— CBH FE

—□— CBH SB

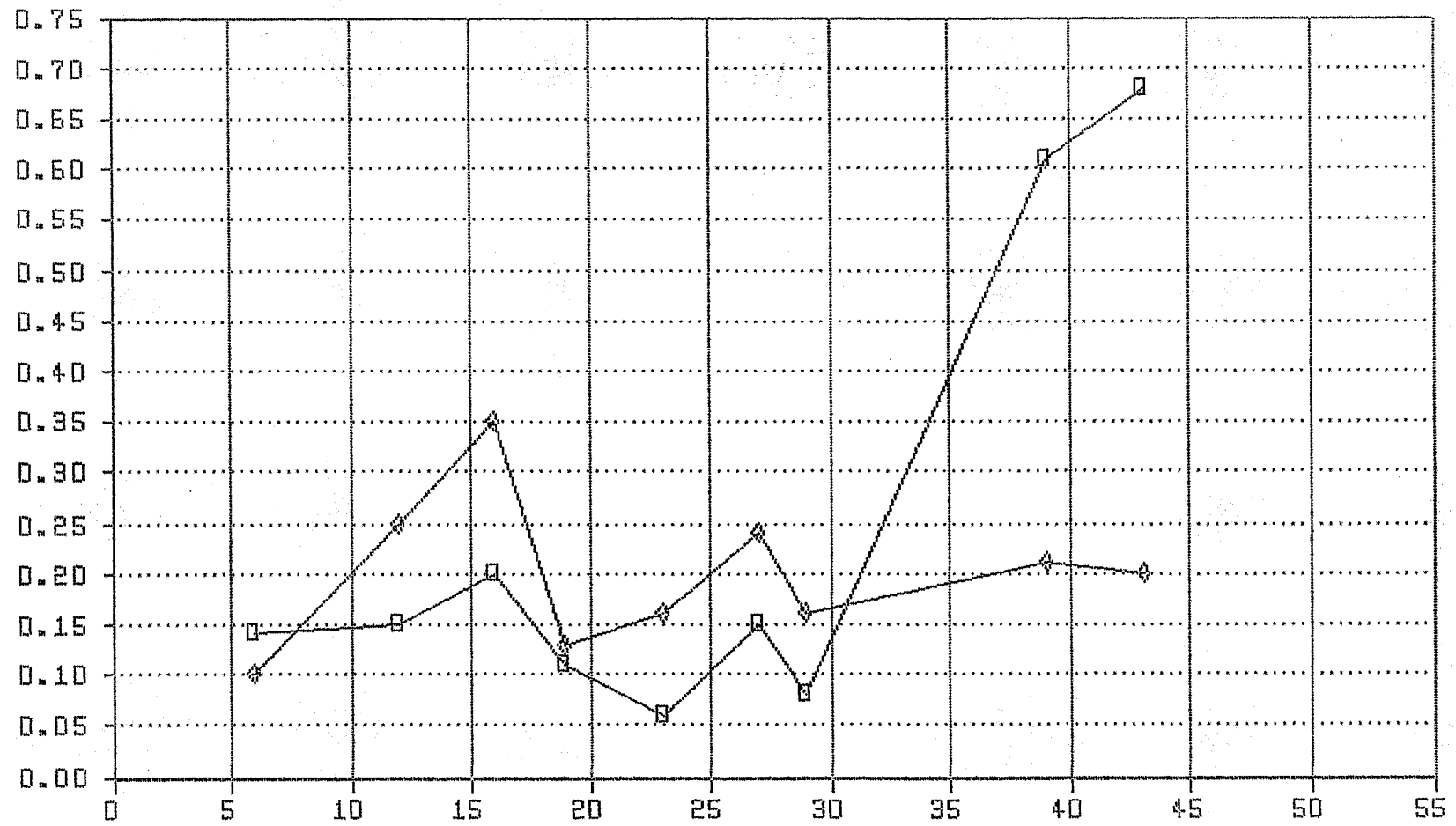
PALL ELEMENTS RUN #2



—◇— CBH FE

—□— CBH SB

MOTT ELEMENTS RUN #1

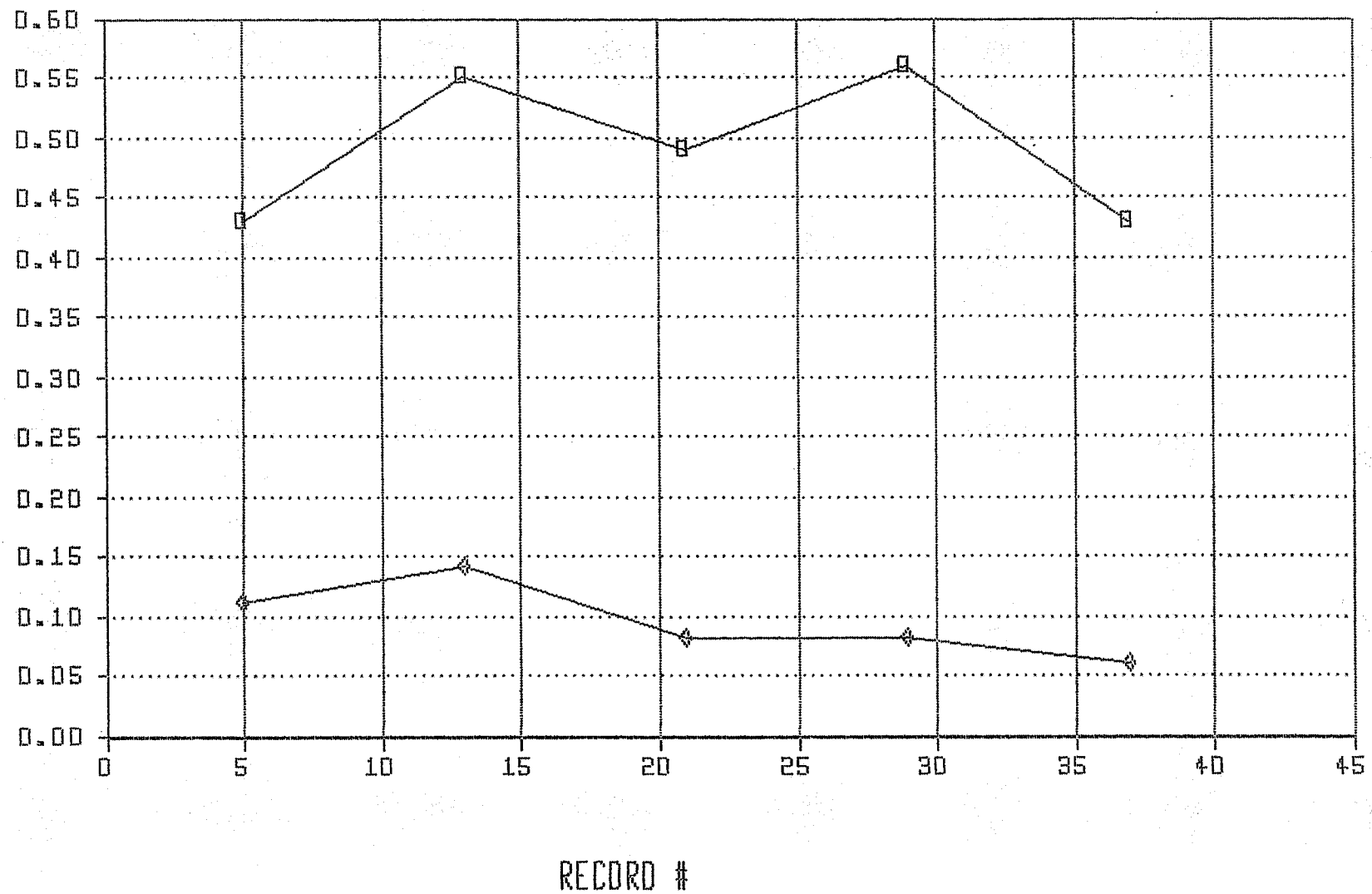


RECORD #

—◆— CBH FE

—□— CBH SB

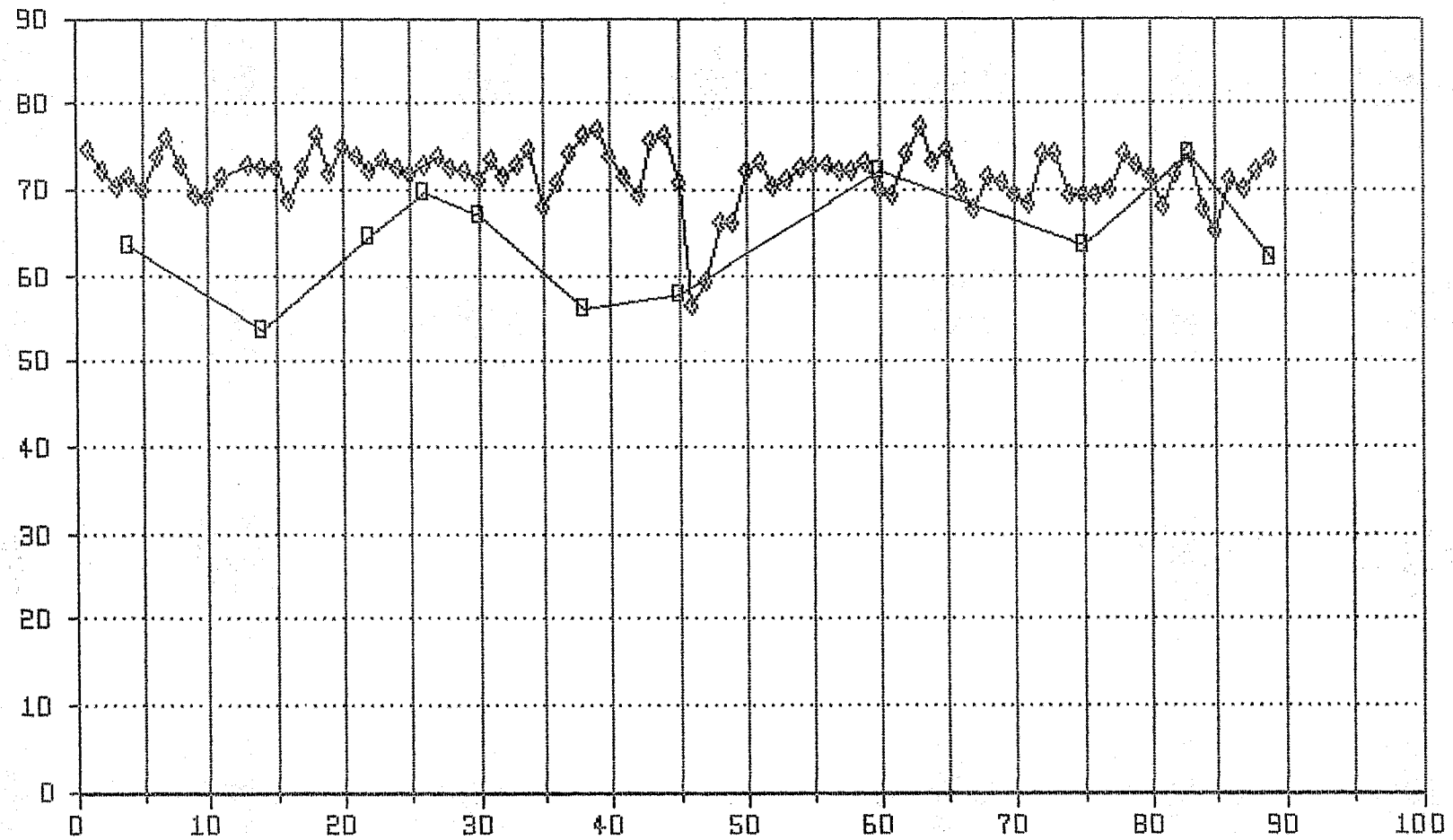
Mott Elements Run #2



—◆— CBH FE

—□— CBH SB

FLUID DYNAMICS #1

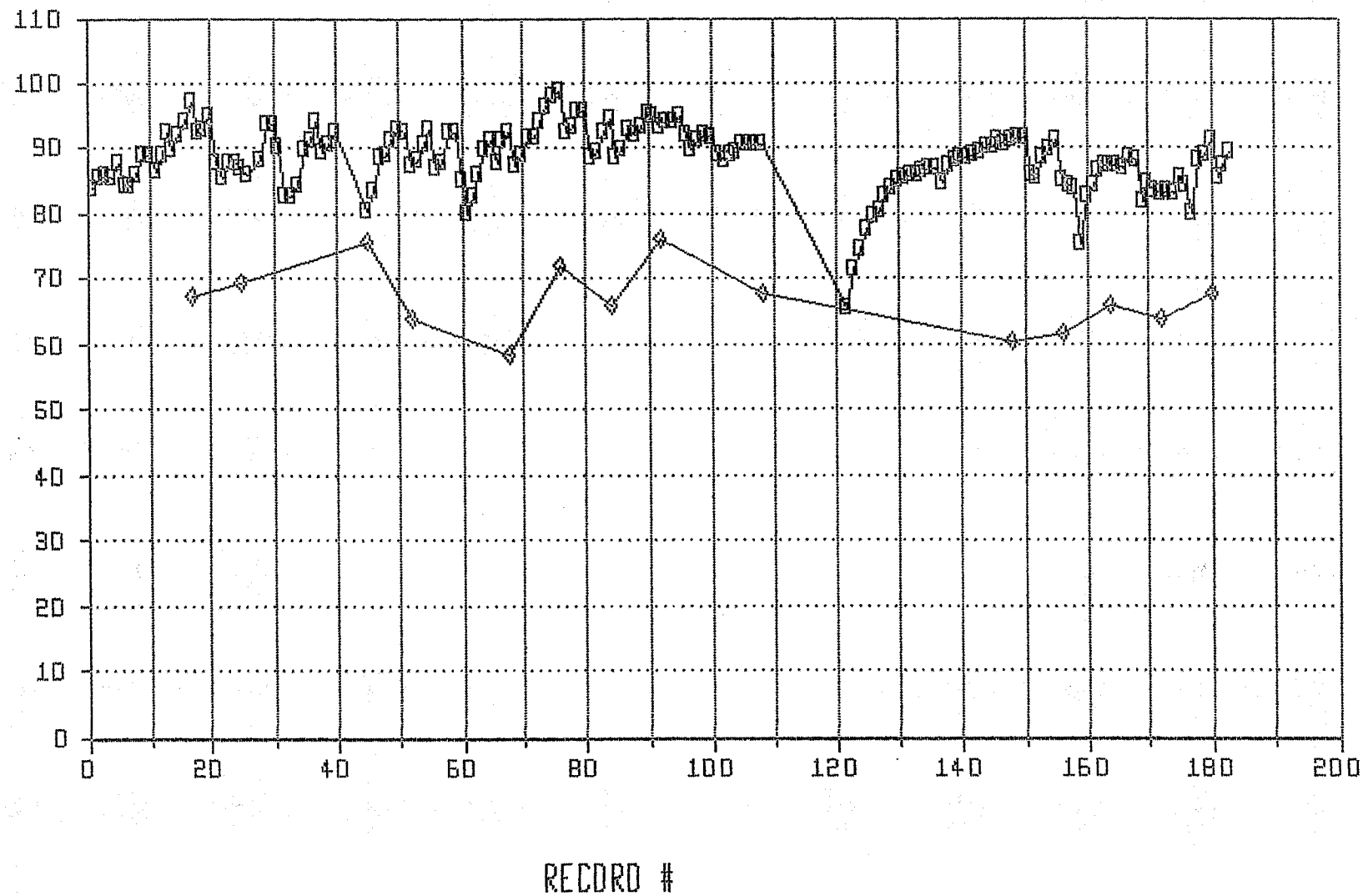


RECORD #

◆ TEMP FACTOR
(DEG F/10)

□ SB REMOVAL EFFICIENCY

fluid dynamics #2 filter elements



◆ SB REMDVAL PERCENTAGE — TEMP FACTOR

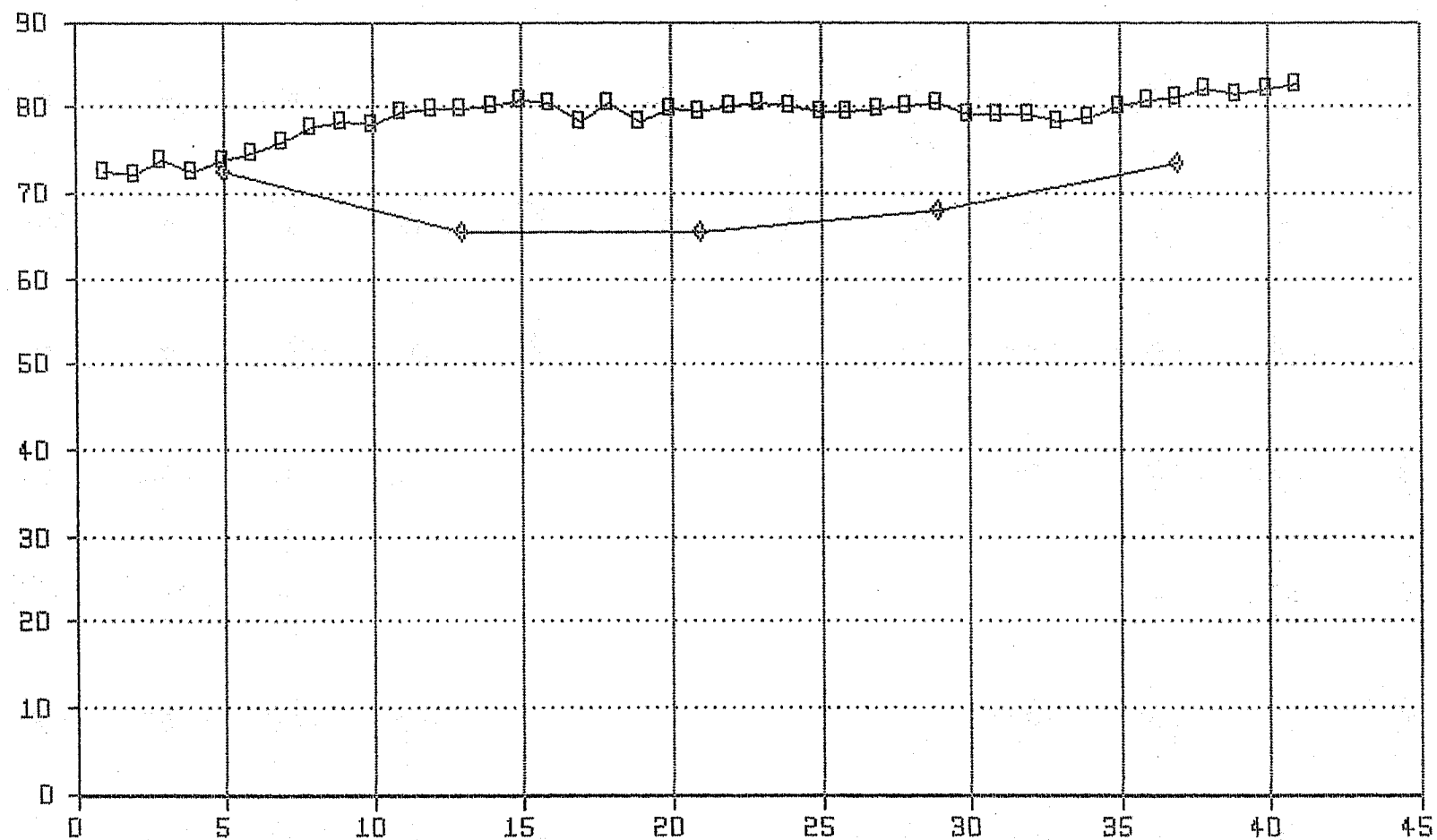
MOTT ELEMENTS RUN #1



RECORD #

◆ SB REMOVAL EFFICIENCY □ TEMP FACTOR

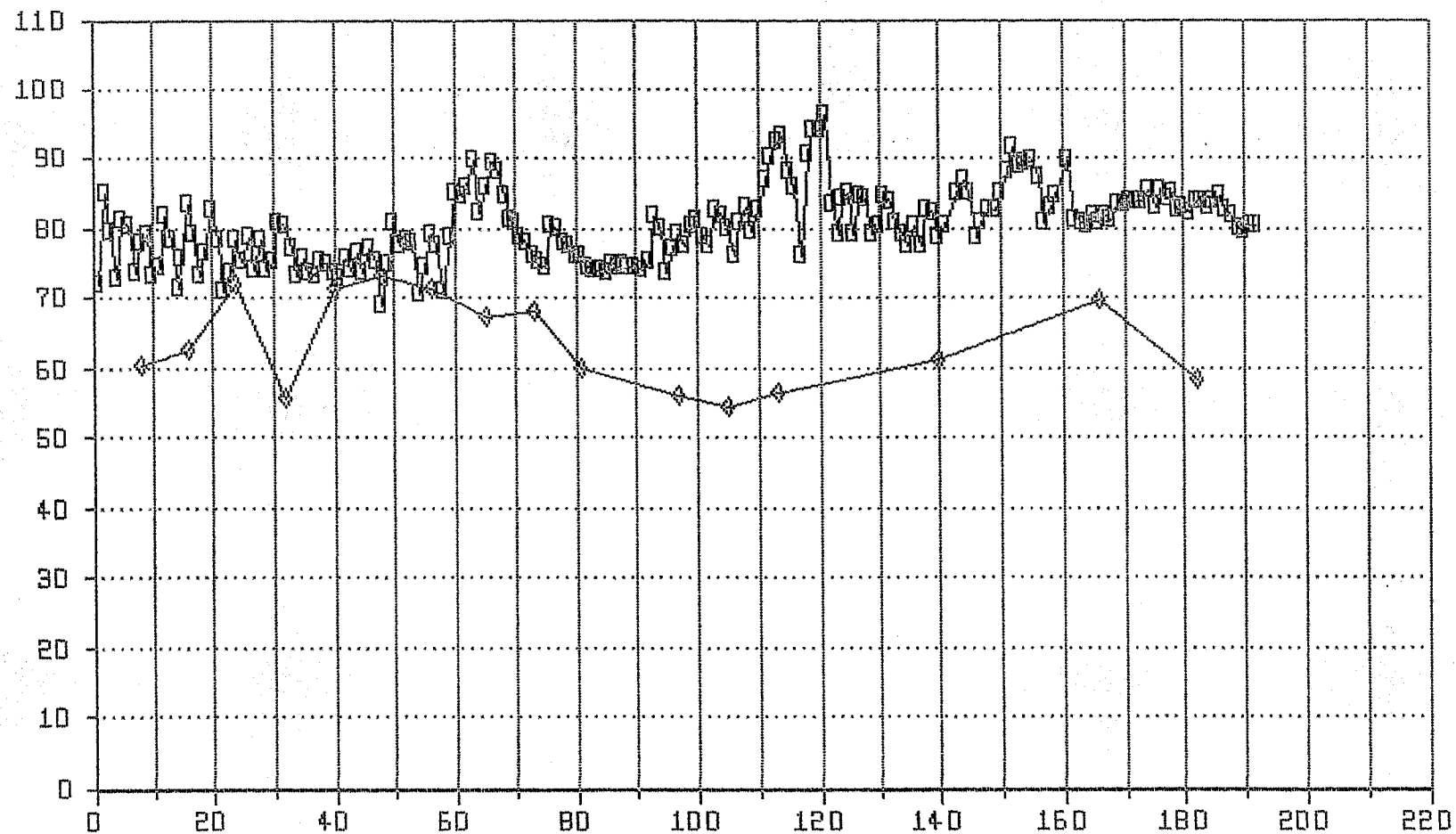
MOTT RUN #2



RECORD #

◆ SB REMOVAL PERCENTAGE — TEMP FACTOR

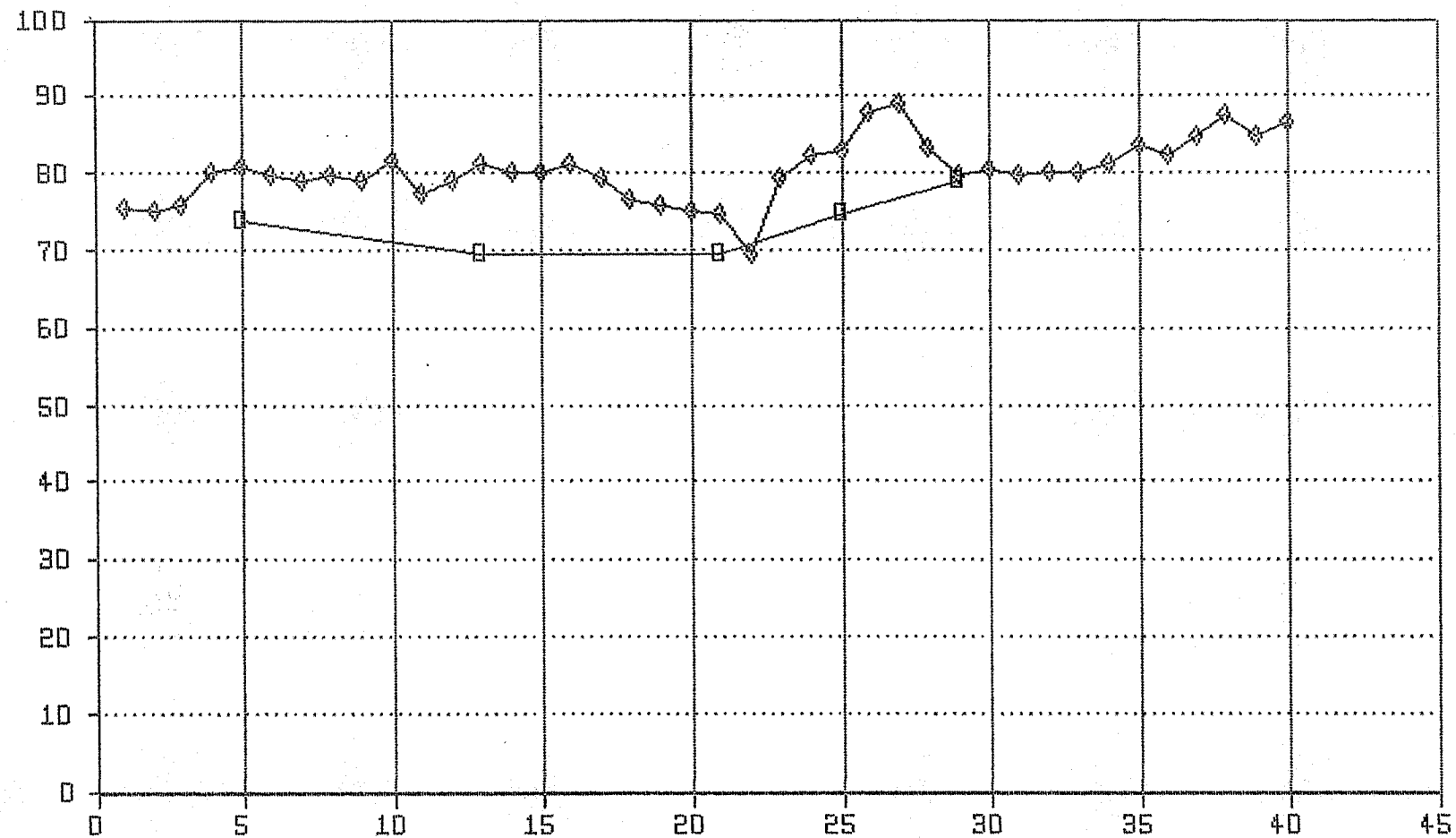
PALL ELEMENTS RUN #1



RECORD #

◆ SB REMOVAL PERCENTAGE □ TEMP FACTOR

PALL ELEMENTS RUN #2



RECORD#

◆ TEMP FACTOR

□ SB REMOVAL PERCENTAGE

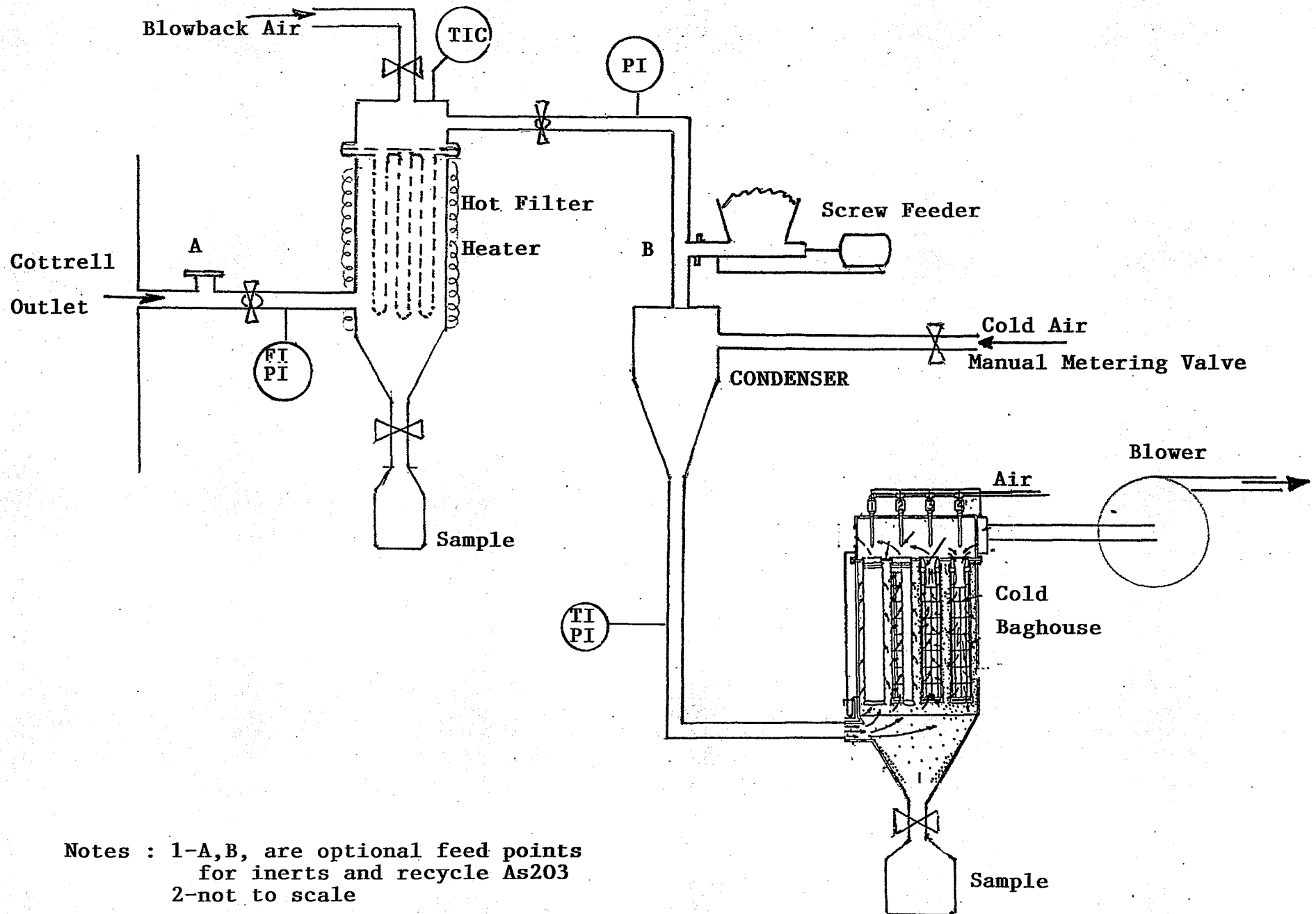
Appendix C

Pilot Plant Flowsheet

GIANT YELLOWKNIFE ARSENIC PURIFICATION PLANT

FIGURE 2

MECHANICAL DIAGRAM



Notes : 1-A,B, are optional feed points
for inerts and recycle As₂O₃
2-not to scale

Appendix D

Full Scale Application

GIANT YELLOWKNIFE MINES LIMITED
WAROX PROJECT
SIMPLIFIED ECONOMIC ANALYSIS

[illegible]

Appendix E

Pilot Plant Cost Summary

Giant Yellowknife Mines Ltd.
NTAP Hi-Temp Gas Filtration Project

Actual Charges =====	Complete Phase I	To Date Phase II, III, IV	Total
M0990-9371 NTAP -Engineering/Supervision	5,311.84	13,322.09	18,633.93
9372 NTAP -Consultants	4,558.76	10,059.99	14,618.75
9373 NTAP -Met Testing/Assaying	0.00	7,739.09	7,739.09
9374 NTAP -Pollution Control	0.00	204.62	204.62
9375 NTAP -Operaring Labour	0.00	2,416.76	2,416.76
9376 NTAP -Equipment Purchase	19,997.90	5,849.30	25,847.20
9377 NTAP -Fabrication/Installation	1,001.10	22,820.13	23,821.23
9378 NTAP -Administrative Overhead	0.00	0.00	0.00
	30,869.60	62,411.98	93,281.58
NTAP Share	23,152.20	42,440.15	69,961.19
Giant Share	7,717.40	19,971.83	23,320.40

PHASE I

Expenditures to March 31, 1990

	Actual	NTAP	Adjusted
M0990-9371 NTAP -Engineering/Supervision	5,311.84	2,315.22	2,996.62
9372 NTAP -Consultants	4,558.76	2,315.22	2,243.54
9373 NTAP -Met Testing/Assaying	0.00		0.00
9374 NTAP -Pollution Control	0.00		0.00
9375 NTAP -Operaring Labour	0.00		0.00
9376 NTAP -Equipment Purchase	19,997.90	18,521.76	1,476.14
9377 NTAP -Fabrication/Installation	1,001.10		1,001.10
9378 NTAP -Administrative Overhead	0.00		0.00
	30,869.60	23,152.20	7,717.40

PHASE II, III, IV To Date

Expenditures from April 01 to July 31, 1990

	Actual
M0990-9371 NTAP -Engineering/Supervision	13,322.09
9372 NTAP -Consultants	10,059.99
9373 NTAP -Met Testing/Assaying	7,739.09
9374 NTAP -Pollution Control	204.62
9375 NTAP -Operaring Labour	2,416.76
9376 NTAP -Equipment Purchase	5,849.30
9377 NTAP -Fabrication/Installation	22,820.13
9378 NTAP -Administrative Overhead	0.00
	62,411.98

NTAP Share @68% 42,440.15

Appendix F

Gold Extraction Testwork

GIANT YELLOWKNIFE MINES LTD
CYANIDATION TESTS

Date: JULY 31/90

Sample: WAROX - #6 & #7 COMPOSITE

Test #: W1

Initial						
Size =100 g	Reagents	1 hr Roll	After hrs	After 48 hrs	After 72 hrs	
pH =	CaO = g	pH = 6.8	pH =	pH = 8.4	pH = 8.3	
%-200=	NaCN = g	CN ⁻ = 1b/t	CN ⁻ = 1b/t	CN ⁻ = 1b/t	CN ⁻ = 1.0 lb/t	
H2O =150 ml	pH to	Tit = ml	Tit = ml	Tit = ml	Tit = ml	
Other=	Other=	Other=	Other=	Other=	Other=	
	AMINE-.81b/t					
	NaOH- 1 lb/t	NaCN- 18 lb/t				
	Na2CO3- 5 lb/t					

Calculations

	Units	Assay	GOLD		ARSENIC	
			Distrib	Recovery	Assay	Distrib Recovery
Preg	0.138 l	22.83 mg/l	3.15 mg	58.1 %	547 mg/l	75 mg 3.5 %
Wash	0.515 l	3.87 mg/l	2.00 mg	36.8 %	192 mg/l	99 mg 4.6 %
Total	0.653 l	7.88 mg/l	5.15 mg	94.9 %	267 mg/l	174 mg 8.1 %
Residue	100 g	2.74 g/t	0.27 mg	5.1 %	1.97 %	1970 mg 91.9 %
Calc Head	100 g	54.21 g/t	5.42 mg	100.0 %	2.14 %	2144 mg 100.0 %
Assay Head	100 g	55.89 g/t	5.59 mg	%	2.13 %	2130 mg %

+ 7.55%

87.35

GIANT YELLOWKNIFE MINES LTD
CYANIDATION TESTS

Date: JULY 31/90

Sample: WAROX - #6 & #7 COMPOSITE

Test #: W2

Initial						
Size =100 g	Reagents	1 hr Roll	After hrs	After 48 hrs	After 72 hrs	
pH =	CaO = g	pH = 6.2	pH =	pH = 8.1	pH = 8.0	
%-200=	NaCN = g	CN ⁻ = lb/t	CN ⁻ = lb/t	CN ⁻ = lb/t	CN ⁻ = 0.8 lb/t	
H2O =150 ml	pH to	Tit = ml	Tit = ml	Tit = ml	Tit = ml	
Other=	Other=	Other=	Other=	Other=	Other=	
	AMINE-.8lb/t					
	NaOH- 1 lb/t	NaCN- 18 lb/t				
	Na2CO3- 5 lb/t					

Calculations

	Units	GOLD			ARSENIC		
		Assay	Distrib	Recovery	Assay	Distrib	Recovery
Preg	0.170 l	18.93 mg/l	3.22 mg	61.2 %	547 mg/l	93 mg	4.4 %
Wash	0.500 l	3.53 mg/l	1.77 mg	33.6 %	149 mg/l	75 mg	3.5 %
Total	0.670 l	7.44 mg/l	4.98 mg	94.8 %	250 mg/l	167 mg	7.8 %
Residue	100 g	2.74 g/t	0.27 mg	5.2 %	1.97 %	1970 mg	92.2 %
Calc Head	100 g	52.57 g/t	5.26 mg	100.0 %	2.14 %	2137 mg	100.0 %
Assay Head	100 g	55.89 g/t	5.59 mg	%	2.13 %	2130 mg	%

87.35

+ 7.45

GIANT YELLOWKNIFE MINES LTD
CYANIDATION TESTS

Date: JULY 31/90

Sample: WAROX - JULY 20 & 21 COMPOSITE

Test #: W3

Initial						
Size =100 g	Reagents	1 hr Roll	After hrs	After 48 hrs	After 72 hrs	
pH =	CaO = g	pH = 6.9	pH =	pH = 8.2	pH = 8.0	
%-200=	NaCN = g	CN ⁻ = lb/t	CN ⁻ = lb/t	CN ⁻ = lb/t	CN ⁻ = lb/t	
H2O =150 m	pH to	Tit = ml	Tit = ml	Tit = ml	Tit = ml	
Other=	Other=	Other=	Other=	Other=	Other=	
	AMINE-.8lb/t					
	NaOH- 1 lb/t	NaCN- 18 lb/t				
	Na2CO3- 5 lb/t					

Calculations

	Units	GOLD			ARSENIC		
		Assay	Distrib	Recovery	Assay	Distrib	Recovery
Preg	0.175 l	20.37 mg/l	3.56 mg	59.4 %	468 mg/l	82 mg	2.7 %
Wash	0.500 l	3.36 mg/l	1.68 mg	28.0 %	122 mg/l	61 mg	2.0 %
Total	0.675 l	7.77 mg/l	5.24 mg	87.4 %	212 mg/l	143 mg	4.7 %
Residue	100 g	7.54 g/t	0.75 mg	12.6 %	2.89 %	2890 mg	95.3 %
Calc Head	100 g	59.98 g/t	6.00 mg	100.0 %	3.03 %	3033 mg	100.0 %
Assay Head	100 g	65.83 g/t	6.58 mg	%	2.74 %	2740 mg	%

83.6

3.8%

**GIANT YELLOWKNIFE MINES LTD
CYANIDATION TESTS**

Date: JULY 31/90

Sample: WAROX - JULY 20 & 21 COMPOSITE

Test #: W4

Initial						
Size =100 g	Reagents	1 hr Roll	After hrs	After 48 hrs	After 72 hrs	
pH =	CaO = g	pH = 6.8	pH =	pH = 8.1	pH = 8.1	
%-200=	NaCN = g	CN ⁻ = lb/t	CN ⁻ = lb/t	CN ⁻ = lb/t	CN ⁻ = lb/t	
H2O =150 m	pH to	Tit = ml	Tit = ml	Tit = ml	Tit = ml	
Other=	Other=	Other=	Other=	Other=	Other=	
	AMINE-.8lb/t					
	NaOH- 1 lb/t	NaCN- 18 lb/t				
	Na2CO3- 5 lb/t					

Calculations

		GOLD			ARSENIC		
	Units	Assay	Distrib	Recovery	Assay	Distrib	Recovery
Preg	0.180 l	19.95 mg/l	3.59 mg	60.6 %	492 mg/l	89 mg	3.4 %
Wash	0.500 l	3.43 mg/l	1.71 mg	28.9 %	128 mg/l	64 mg	2.5 %
Total	0.680 l	7.80 mg/l	5.31 mg	89.6 %	224 mg/l	153 mg	5.9 %
Residue	100 g	6.17 g/t	0.62 mg	10.4 %	2.43 %	2430 mg	94.1 %
Calc Head	100 g	59.23 g/t	5.92 mg	100.0 %	2.58 %	2583 mg	100.0 %
Assay Head	100 g	65.83 g/t	6.58 mg	%	2.74 %	2740 mg	%

83.6

+ 6.0 %

GIANT YELLOWKNIFE MINES LTD
CYANIDATION TESTS

Date: JULY 31/90
Sample: WAROX - JULY 22 COMPOSITE
Test #: W5

Initial						
Size =100 g	Reagents	1 hr Roll	After hrs	After 48 hrs	After 72 hrs	
pH =	CaO = g	pH = 7.0	pH =	pH = 8.6	pH = 8.4	
%-200=	NaCN = g	CN ⁻ = lb/t	CN ⁻ = lb/t	CN ⁻ = lb/t	CN ⁻ = lb/t	
H2O =150 m	pH to	Tit = ml	Tit = ml	Tit = ml	Tit = ml	
Other=	Other=	Other=	Other=	Other=	Other=	
	AMINE-.8lb/t					
	NaOH- 1 lb/t	NaCN- 18 lb/t				
	Na2CO3- 5 lb/t					

Calculations

	Units	GOLD			ARSENIC		
		Assay	Distrib	Recovery	Assay	Distrib	Recovery
Preg	0.135 l	18.51 mg/l	2.50 mg	53.1 %	1830 mg/l	247 mg	6.9 %
Wash	0.500 l	3.19 mg/l	1.59 mg	33.8 %	404 mg/l	202 mg	5.7 %
Total	0.635 l	6.45 mg/l	4.09 mg	86.9 %	707 mg/l	449 mg	12.6 %
Residue	90 g	6.86 g/t	0.62 mg	13.1 %	3.47 %	3123 mg	87.4 %
Calc Head	90 g	52.34 g/t	4.71 mg	100.0 %	3.97 %	3572 mg	100.0 %
Assay Head	90 g	59.66 g/t	5.37 mg	%	4.03 %	3627 mg	%

GIANT YELLOWKNIFE MINES LTD
CYANIDATION TESTS

Date: JULY 31/90

Sample: WAROX - JULY 22 COMPOSITE

Test #: W6

Initial						
Size = 90 g	Reagents	1 hr Roll	After hrs	After 48 hrs	After 72 hrs	
pH =	CaO = g	pH = 6.8	pH =	pH = 8.2	pH = 8.0	
%-200=	NaCN = g	CN ⁻ = lb/t	CN ⁻ = lb/t	CN ⁻ = lb/t	CN ⁻ = lb/t	
H2O =150 m	pH to	Tit = ml	Tit = ml	Tit = ml	Tit = ml	
Other=	Other=	Other=	Other=	Other=	Other=	
	AMINE-.8lb/t					
	NaOH- 1 lb/t	NaCN- 18 lb/t				
	Na2CO3- 5 lb/t					

Calculations

		GOLD			ARSENIC		
	Units	Assay	Distrib	Recovery	Assay	Distrib	Recovery
Preg	0.165 l	19.95 mg/l	3.29 mg	62.7 %	1976 mg/l	326 mg	9.0 %
Wash	0.500 l	2.81 mg/l	1.41 mg	26.8 %	474 mg/l	237 mg	6.6 %
Total	0.665 l	7.06 mg/l	4.70 mg	89.5 %	847 mg/l	563 mg	15.6 %
Residue	89 g	6.17 g/t	0.55 mg	10.5 %	3.43 %	3053 mg	84.4 %
Calc Head	89 g	58.96 g/t	5.25 mg	100.0 %	4.06 %	3616 mg	100.0 %
Assay Head	89 g	59.66 g/t	5.31 mg	%	4.03 %	3587 mg	%

GIANT YELLOWKNIFE MINES LTD
CYANIDATION TESTS

Date: JULY 31/90

Sample: WAROX - JULY 19 COMPOSITE

Test #: W7

Initial						
Size = 90 g	Reagents	1 hr Roll	After hrs	After 48 hrs	After 72 hrs	
pH =	CaO = g	pH = 6.8	pH =	pH = 8.2	pH = 8.0	
%-200=	NaCN = g	CN ⁻ = lb/t	CN ⁻ = lb/t	CN ⁻ = lb/t	CN ⁻ = lb/t	
H2O =150 m	pH to	Tit = ml	Tit = ml	Tit = ml	Tit = ml	
Other=	Other=	Other=	Other=	Other=	Other=	
	AMINE-.8lb/t					
	NaOH- 1 lb/t	NaCN- 18 lb/t				
	Na2CO3- 5 lb/t					

Calculations

	Units	GOLD			ARSENIC		
		Assay	Distrib	Recovery	Assay	Distrib	Recovery
Preg	0.145 l	18.51 mg/l	2.68 mg	60.2 %	444 mg/l	64 mg	2.4 %
Wash	0.500 l	2.43 mg/l	1.22 mg	27.3 %	116 mg/l	58 mg	2.2 %
Total	0.645 l	6.05 mg/l	3.90 mg	87.5 %	190 mg/l	122 mg	4.6 %
Residue	90 g	6.17 g/t	0.56 mg	12.5 %	2.81 %	2529 mg	95.4 %
Calc Head	90 g	49.52 g/t	4.46 mg	100.0 %	2.95 %	2651 mg	100.0 %
Assay Head	90 g	54.17 g/t	4.88 mg	%	3.31 %	2979 mg	%

87.6

- 0.1 %

GIANT YELLOWKNIFE MINES LTD
CYANIDATION TESTS

Date: JULY 31/90
Sample: WAROX - JULY 19 COMPOSITE
Test #: W8

Initial						
Size = 90 g	Reagents	1 hr Roll	After hrs	After 48 hrs	After 72 hrs	
pH =	CaO = g	pH = 6.8	pH =	pH = 8.2	pH = 8.0	
%-200=	NaCN = g	CN ⁻ = lb/t	CN ⁻ = lb/t	CN ⁻ = lb/t	CN ⁻ = lb/t	
H2O =150 ml	pH to	Tit = ml	Tit = ml	Tit = ml	Tit = ml	
Other=	Other=	Other=	Other=	Other=	Other=	
	AMINE-.8lb/t					
	NaOH- 1 lb/t	NaCN- 18 lb/t				
	Na2CO3- 5 lb/t					

Calculations

	Units	GOLD			ARSENIC		
		Assay	Distrib	Recovery	Assay	Distrib	Recovery
Preg	0.200 l	14.40 mg/l	2.88 mg	56.9 %	310 mg/l	62 mg	2.1 %
Wash	0.500 l	3.12 mg/l	1.56 mg	30.8 %	109 mg/l	55 mg	1.9 %
Total	0.700 l	6.34 mg/l	4.44 mg	87.8 %	166 mg/l	117 mg	4.0 %
Residue	90 g	6.86 g/t	0.62 mg	12.2 %	3.13 %	2817 mg	96.0 %
Calc Head	90 g	56.19 g/t	5.06 mg	100.0 %	3.26 %	2934 mg	100.0 %
Assay Head	90 g	54.17 g/t	4.88 mg	%	3.31 %	2979 mg	%

87.6

+ 0.2%