

July 20, 1967 (Prep. 7/11)

FROM

Mr. F. G. Steward - Newark ✓

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SUBJECT

FILTRATION OF CHLORACNEGENS FROM 10% TCP

REPLY REQUESTED BY (Date)

SUMMARY

It is recommended that investigations to remove chloracnegens by filtration be discontinued for two primary reasons:

1. The studies of chloracnegen absorption on charcoal show more promise as a feasible method of chloracnegen removal and can probably be developed much sooner.
2. The maximum allowable porosity in a medium to filter the chloracnegens has not been established(*). This porosity is easily less than 10μ , and may be less than 1μ , but the exact value has not been satisfactorily determined.

If for any reason filtration investigations are renewed, then a multi-stage approach should be considered. For example, a coarse filter in series with a fine filter --- the coarse filter to remove heavy sediment, and the fine filter to remove the chloracnegens. Such two-stage filtration would probably give maximum filtration rates with minimum filter area.

Also, it is suggested that to establish the allowable porosity in the fine filter, non-absorbent type filter media be employed (such as those from the Millipore Corporation). Such tests usually apply only a small volume in filtration. When performed with thick cloth or filter-aid, ad or absorption may predominate and be erroneously regarded as true filtration.

(*). This statement encompasses the review of J. J. Lusardi's work also, and not only the tests described in this report.

DISCUSSION

Four filtration tests were made with three different batches of 10% TCP, all having a pH = 10. The filters with porosities ranging from 10 to 75μ were a cartridge type of woven cloth from the Commercial Filters Corporation. In each test, only one cartridge was used. The general test data is given in Exhibit I.

Exhibit 2 shows that removal of the chloracnegens was not satisfactory even with a 10μ filter. The desired 1 ppm for the most active chloracnegen (2) was not attained.

How the course of filtration developed is best shown in Exhibit 3, Parts A and B, which are plots of % removed vs. gallons filtered.

DS 00023266

The plots indicate the following:

1. The particle size distribution of the chloracnegens varies significantly with the TCP batches. For example, the 40 μ filter with Batch-B (Test ~~5~~⁴) effected greater removal of chloracnegens (2) (3) and ~~(4)~~⁽⁴⁾ than did the 20 μ filter with Batch-A (Test I).
2. For a given batch and filter, ad or absorption can develop or the particle size distribution can vary in situ during the course of filtration (*). This is illustrated in Test I with chloracnegen (2). With filtration of materials having a constant particle size distribution, the slopes should be zero or positive. Since the general slope with chloragne-gen (~~2~~³) is negative, then either ad or absorption, or a variation in particle size distribution must be suspected.

(*) In these studies, only Batch-A gave indications of this nature. However, J. J. Lusardi gives evidence of this occurring in his work. See: Interim Report of Experimental Work for TCP Purification, J. J. Lusardi, January 9, 1966, Page 3, 2nd Paragraph.

The nature of the sediment in the TCP solution does not present overwhelming obstacles in filtration. This is shown in Exhibit 4, with the plots of gallons filtered vs. time. The filtration rates diminish rapidly in the first half hour, but then the decrease in rate is much slower. Apparently the coating from the sediment is porous enough to permit satisfactorily steady rates for much longer periods than test length. The end-of-test filtration rates shown in Exhibit 1 (or Exhibit 5) were derived graphically from Exhibit 4. These rates could have been larger if greater pressures had been used, rather than the actual 8-17 psi employed.

The purpose of Exhibit 5 is for loose extrapolation of a predictive nature. Assuming that it is found that a filter of approximately 1 μ porosity can satisfactorily remove all of the chloranegens, then this data shows that a feasible filtration system may be possible, having the following characteristics:

1. Two-stage filtration:
2. Pressures of 50 psi.
3. Filter porosities - 1st stage-20-75 μ ; 2nd stage- 1 μ .
4. Filter areas - 1st stage-1-5 sq. ft.; 2nd stage-2-5 sq. ft.

The above is not meant as argument for continued filtration studies --- the recommendations in the Summary are still stressed. The above serves as rough guidelines should, for any reasons, it becomes necessary to renew filtration studies.

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DS 00023267

GENERAL TEST DATA - FILTRATION OF CHLORINATEDS
FROM 10% TCP TEMP RANGE 20-30°C

TEST No.	TEST DURATION HOURS	TCP			FILTER (1)		FILTRATION		REMARKS
		BATCH	PH	TEMP °C	POROSITY H	IDENT. NO.	g/hr/ft ²	ΔP PSI	
I	4.41	A	10.1	24	20	E15R10	26	14-17	
II	1.85	B	10.1	30	75	E10R10	250	8-11	
III	2.58	B	10.1	22	40	E12R10-26V	18	10-14	
IV	3.25	C	10.0	20	10	E19R10	16	15	FILTER COATED WITH SUPERCCEL FILTER AID

- (1) EACH TEST HAD 1-10" CARTRIDGE FROM COMMERCIAL FILTERS CORPORATION WITH SURFACE AREA = 0.55 ft²
- (2) END OF TEST RATES.

LEGEND

- ⊙ , 1 = 2, 3, 7, 9 - TETRACHLORO-DI-BENZO-PARA-DIOXIN
- , 2 = 2, 3, 7, 8 - " " " "
- , 3 = 2, 2', 4, 4', 5 - PENTACHLORO-5'-METHOXY DI PHENYL OXIDE
- + , 2, 3, 7 - TRICHLORO-8-METHOXY-DIBENZO-PARA-DIOXIN
- , 4 = DIOXIN RELATED UNKNOWN
- △ , 5 = TRICHLORO ANISOLE
- , 6 = ANISOLE RELATED UNKNOWN
- x , 7 = 1, 5 DIMETHOXY 2, 4 DICHLORO BENZENE

CHLOROPNEGEN CONCENTRATION VS GALLONS FILTERED
 (CONCENTRATION IS AS % FRACTION OF CONTAINED TSP)

TEST I
 20µ FILTER
 BATCH - A

COMPONENT	1	2	3	4	5	6	7
STARTING CONC. PPM	<1	56	18	3	800	900	2400
GAL FLTRD	C, PPM, FOR INDICATED COMPONENT						
	1	2	3	4	5	6	7
31	<1	28	7	2	700	1000	1400
60	4	37	13	2	700	900	1800
85	<1	41	10	2	600	800	1800

TEST II
 75µ FILTER
 BATCH - B

COMPONENT	1	2	3	4	5	6	7
STARTING CONC. PPM	TR	92	28	5	600	700	1600
GAL FLTRD	C, PPM, FOR INDICATED COMPONENT						
	1	2	3	4	5	6	7
10	TR	73	18	3	800	800	1600
126	TR	73	18	3	800	800	1600
286	TR	73	18	3	800	800	1600
412	TR	73	18	3	800	800	1600

TEST III
 40µ FILTER
 BATCH - B

COMPONENT	1	2	3	4	5	6	7
STARTING CONC. PPM	TR	92	28	5	600	700	1600
GAL FLTRD	C, PPM, FOR INDICATED COMPONENT						
	1	2	3	4	5	6	7
10	TR	48	15	TR	600	700	1500
42	TR	34	11	TR	600	700	1300
59	TR	23	10	TR	500	600	1100

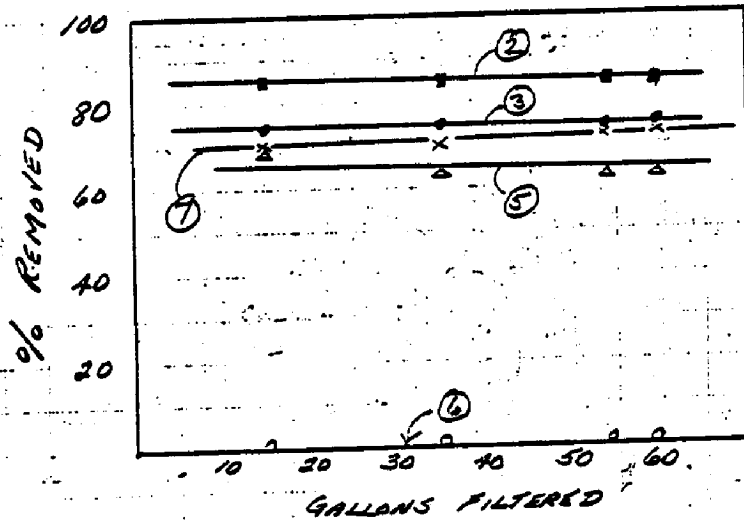
TEST IV
 10µ FILTER
 COATED WITH
 SUPER GEL
 FILTER AID.
 BATCH - C

COMPONENT	1	2	3	4	5	6	7
STARTING CONC. PPM	TR	95	20	TR	1600	1400	3000
GAL FLTRD	C, PPM, FOR INDICATED COMPONENT						
	1	2	3	4	5	6	7
15	TR	13	5	TR	500	1400	900
36	TR	13	5	TR	600	1400	900
53	TR	13	5	TR	600	1400	800
59	TR	13	5	TR	600	1400	800

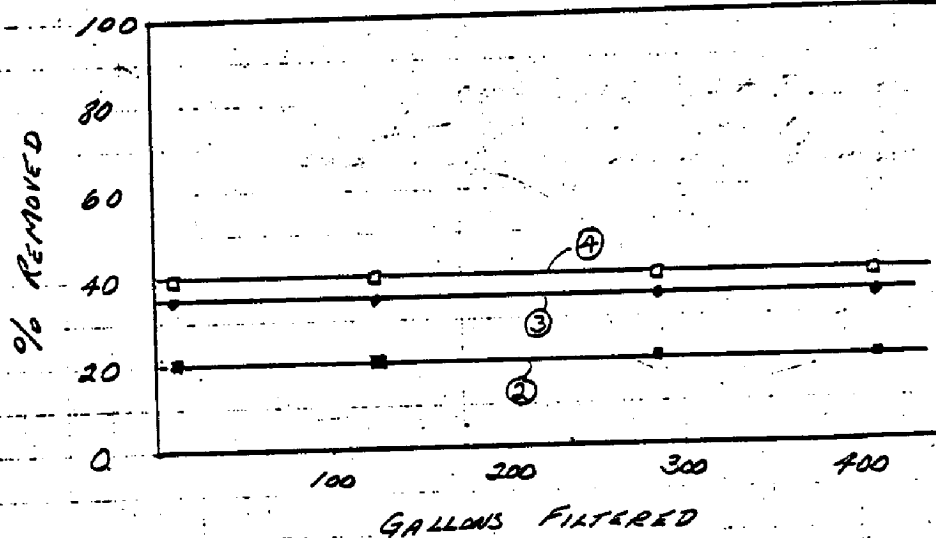
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% REMOVAL OF CHLORACNEGENS VS GALLONS OF TCP FILTERED

TEST II
 10 μ FILTER
 WITH FILTER
 AID
 BATCH - C



TEST II
 75 μ FILTER
 BATCH - B



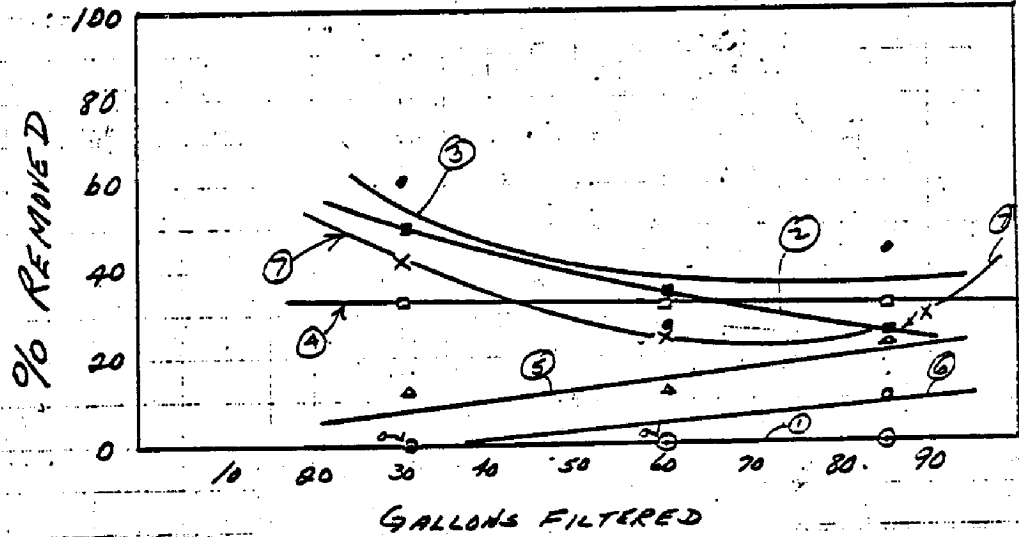
NOTES: 1) TEST II
 COULD NOT DETERMINE WITH 1 & 4,
 SINCE CONCENTRATION WAS IN TRACE AMOUNTS.

2) TEST II
 NO REMOVAL OF 5, 6 & 7.
 COULD NOT DETERMINE WITH 1, SINCE
 CONCENTRATION WAS IN TRACE AMOUNTS.

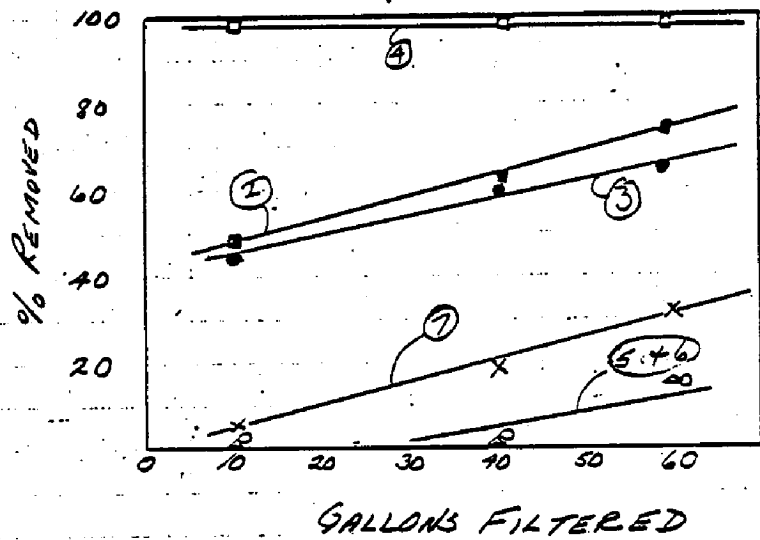
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% REMOVAL OF CHLORACNEGENS VS GALLONS OF TCF FILTERED

TEST I
20μ FILTER
BATCH - A



TEST III
10μ FILTER
BATCH - B



NOTE: COULD NOT DETERMINE % REMOVED FOR COMPONENT (1) IN TEST III, SINCE IT WAS IN TRACE AMOUNTS.

GALLONS FILTERED VS TIME

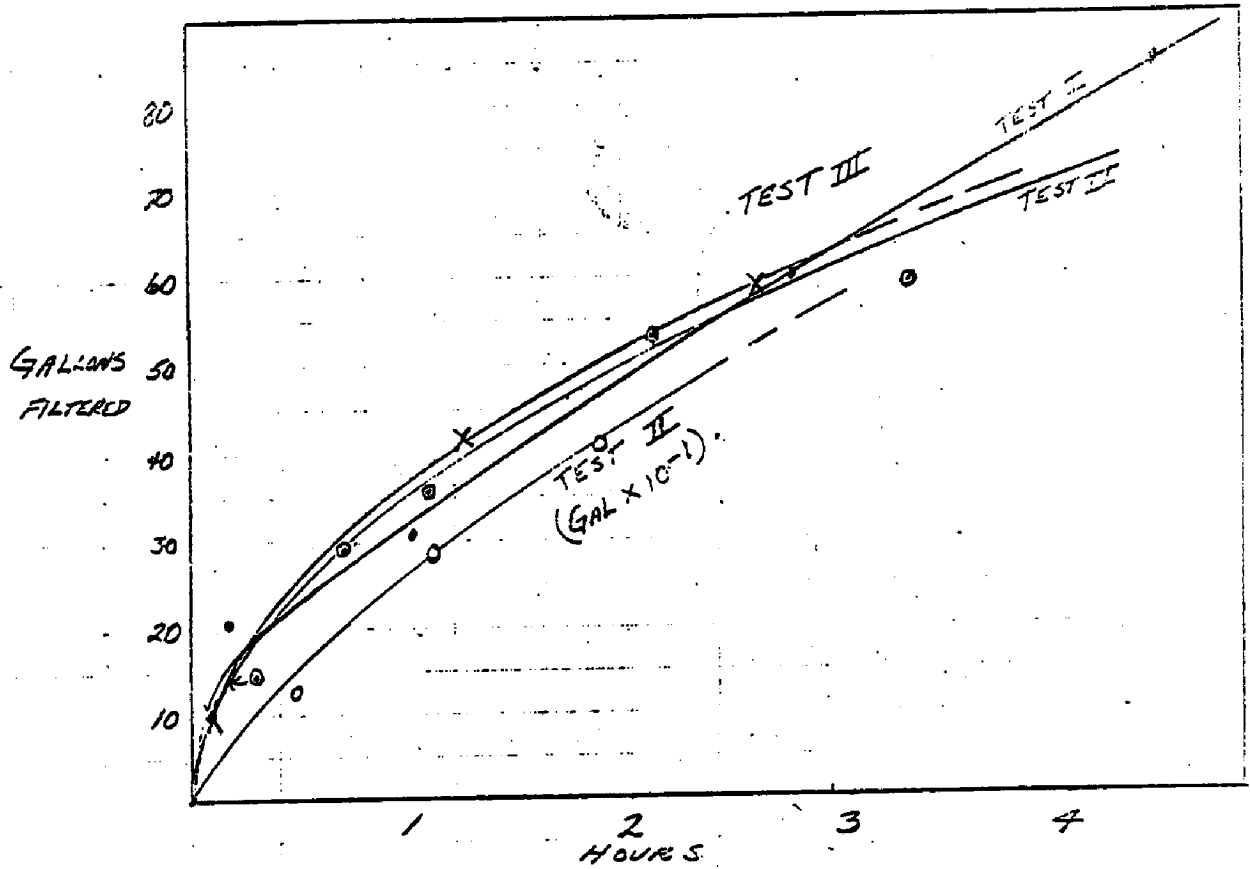


EXHIBIT 5

DATA FOR EXTRAPOLATION PURPOSES —
REQUIRED FILTER AREA TO FILTER 10% TCP WITH PRODUCTION RATE OF 416.16 TCP/HF.

TEST No.	FILTER PRESSURE, ΔP - PSI	FILTER RESISTIVITY μ	FILTRATION RATE - END OF TEST g/hr/ft ²	REQUIRED AREA, ft ²	NO. OF ELEMENTS, 0.55 ft ² /EACH
I	14-17	20	26	18	32
II	8-11	75	250	1.8	3
III	10-14	40	18	25	46
IV	15	10*	16	29	52

* PRECOATED WITH FILTER AID