Monsanto

FROM (NAME & LOCATION): D. R. Cova - T3C

DATE : March 24, 1975

CC: R. H. Munch - T1B

SUBJECT : CAPACITOR AND TRANSFORMER FLUIDS BY VARIOUS ROUTES

REFERENCE :

TO : W. R. Richard
T3A

We have looked briefly at four possible routes to a form of MCS-1043. All four involve chlorination of biphenyl to Aroclor 1133 followed by fractionation in the 30-tray column in the Aroclor Department. MCS-1043 for capacitors is taken off as a forecut, followed by a 4,4'-DCBP fraction. The remaining residue is straight-takeover distilled in another still.

The four routes vary in the handling of the 4,4'-DCBP fraction and in the transformer product produced.

Route I

The 4,4'-DCBP fraction is chlorinated to reduce the 4-4'-DCBP level. This fraction is then recycled to the fractionator with the next batch. The transformer product here is similar to Aroclor 1016 in concentration of pentachlorobiphenyls.

Route II

The 4,4'-DCBP fraction is chlorinated further than in Route I. This further reduces the level of 4,4'-DCBP so that further fractionation is not required. Pentachlorobiphenyls however are too high to make Aroclor 1016 without fractionation. The chlorinated 4,4'-DCBP fraction is added to the column residue and this is all straight-takeover distilled in another still to make a form of Aroclor 1242 for transformer use.

Route III

The 4,4'-DCBP fraction is allowed to cool, crystallizing out most of the 4,4'-DCBP. The liquid is drawn off or filtered off and added to the MCS-1043 fraction to make additional capacitor fluid. The remaining solids are melted and chlorinated to lower the 4,4'-DCBP level. This chlorinated fraction is added to the column residue and this is straight-takeover distilled to make a form of Aroclor 1242 for transformer use.

(might sell 4,4'?)

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Route IV

The column is shut down after the MCS-1043 fraction has been distilled off. The residue (which now includes the 4,4'-DCBP fraction) is then straight-takeover distilled to make a form of Aroclor 1242 for transformers. This Aroclor 1242 would contain on the order of 16% 4,4'-DCBP. At room temperature (20°C) this mixture would contain 11% 4,4'-DCBP as a crystallized solid. The solubility point would be about 55°C. Conversations with Westinghouse have indicated that they may be willing to take such a fluid for their transformers at a lowered price.

It must be understood that none of these routes has been completely researched. They all required some estimation in order to carry out calculations to arrive at the capacities given below. Approximate material balances are given in Figures I, II, III and IV.

The capacity calculations were based on the assumption that the fractionation step was limiting. The following monthly capacities were calculated:

Route I

2.57$\overline{M}$ lb/mo capacitor fluid (MCS-1043 type)
1.70$\overline{M}$ lb/mo transformer fluid (Aroclor 1016 type)

Route II

3.05$\overline{M}$ lb/mo of capacitor fluid (MCS-1043 type)
2.01$\overline{M}$ lb/mo of transformer fluid (Aroclor 1242 type)

Route III

3.76$\overline{M}$ lb/mo of capacitor fluid (MCS-1043 type)
1.19$\overline{M}$ lb/mo of transformer fluid (Aroclor 1242 type)

Route IV

4.17$\overline{M}$ lb/mo of capacitor fluid (MCS-1043 type)
2.56$\overline{M}$ lb/mo of transformer fluid (Aroclor 1242 type)

From Ken Boucher, I obtained, for monochlorobiphenyl, the following capacities:

1.4$\overline{M}$ lb/mo monochlorobiphenyl
1.23$\overline{M}$ lb/mo of transformer fluid (Aroclor 1242')

I have assumed the following desired product mix for the Aroclor Department:

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21$\overline{M}$ lb/yr of capacitor fluids
19$\overline{M}$ lb/yr of transformer fluids (exclusive of trichlorobenzene)
8$\overline{M}$ lb/yr of monochlorobiphenyl (MCBP)

Going with Route I, we would require 8.2 months to make 21$\overline{M}$ lbs. of capacitor fluid. Concurrently, we would make 14.0$\overline{M}$ lbs. of Aroclor 1016 type transformer fluid. With the time remaining in the year, we could produce 5.3$\overline{M}$ lbs. of MCBP and 4.7$\overline{M}$ lbs. of Aroclor 1242' for transformers. Total transformer fluids would be 18.7$\overline{M}$ lbs., close to the desired quantity. We would not be able to make 8$\overline{M}$ lbs/yr of MCBP.

Going with Route II, we would require 6.9 months of operation to produce 21$\overline{M}$ lbs. of capacitor fluid. Concurrently, we would make 13.8$\overline{M}$ lbs. of Aroclor 1242 type transformer fluid. We would be able to make 7.1$\overline{M}$ lbs/yr of MCBP and, concurrently, 6.3$\overline{M}$ lbs. of Aroclor 1242' for transformers. Total transformer fluids production would be 20.1$\overline{M}$ lbs. (about 1$\overline{M}$ lbs. more than desired).

Going with Route III, we would require 5.6 months to make 21$\overline{M}$ lbs. of capacitor fluid. Concurrently, we would make 6.7$\overline{M}$ lbs. of Aroclor 1242 type transformer fluid. In another 5.7 months we could make 8$\overline{M}$ lbs. of MCBP and, concurrently, 7.0$\overline{M}$ lbs. of Aroclor 1242'. Total transformer fluids production would be 13.7$\overline{M}$ lbs. If we desired to make 19$\overline{M}$ lbs. of transformer fluids per year, the remaining 5.3$\overline{M}$ lbs. could be made by the normal Aroclor 1242 route which does not require fractionation.

Going with Route IV, we would require 5.0 months to make 21$\overline{M}$ lbs. of capacitor fluid. Concurrently, we would make 13.0$\overline{M}$ lbs. of Aroclor 1242 (with a high level of 4,4'-DCBP). In another 5.7 months we could make 8$\overline{M}$ lbs. of MCBP and, concurrently, 7.0$\overline{M}$ lbs. of Aroclor 1242'. Total transformer fluids production would be 20.0$\overline{M}$ lbs., about 1$\overline{M}$ lbs. higher than the desired product mix.

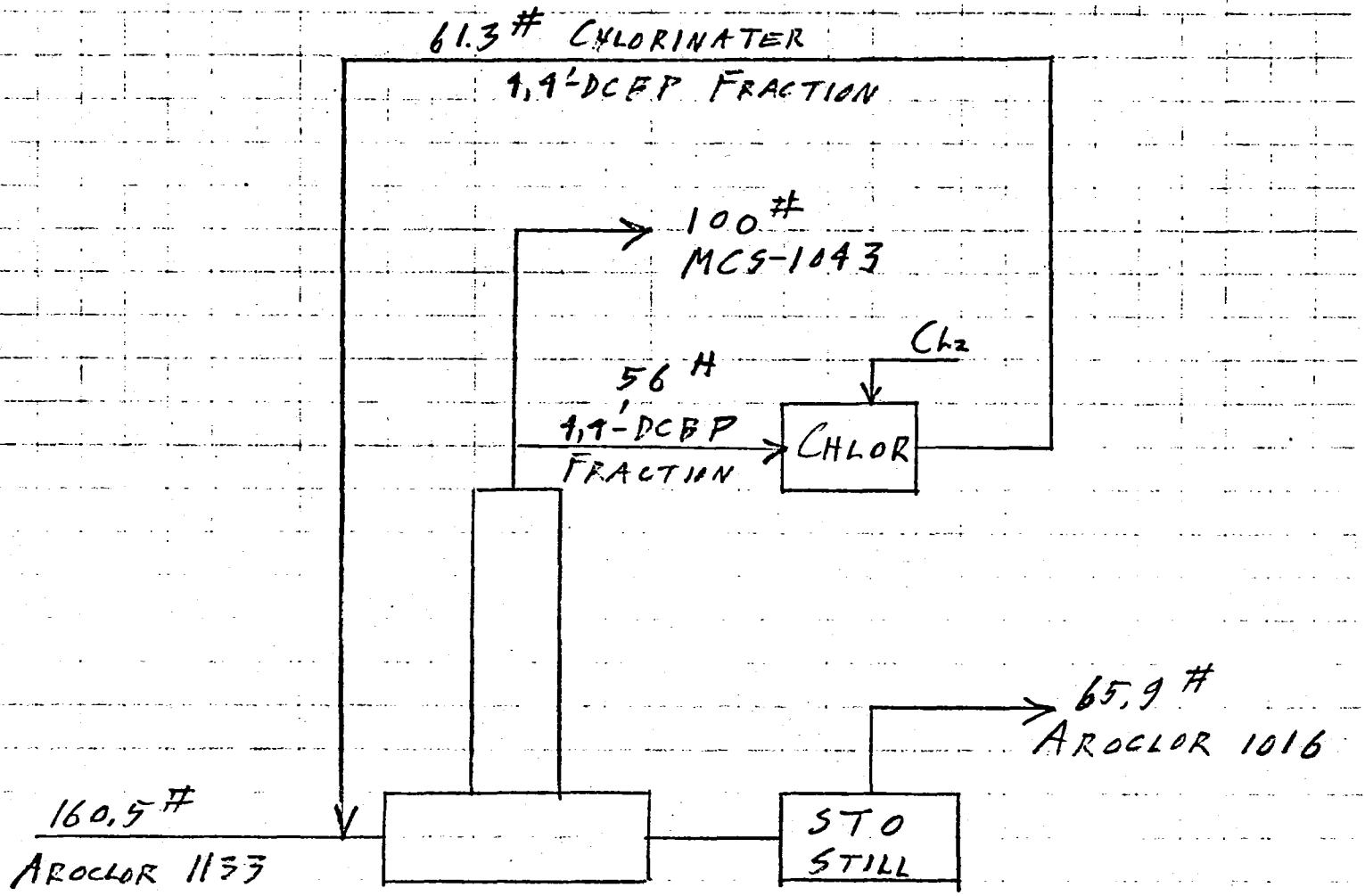
Route III gives us the greatest flexibility on product mix. It would probably be the most costly since more manipulation of the 4,4'-DCBP fraction is required. Route IV should give the lowest cost products as it has a minimum of processing steps.

D. R. Cova

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attachments

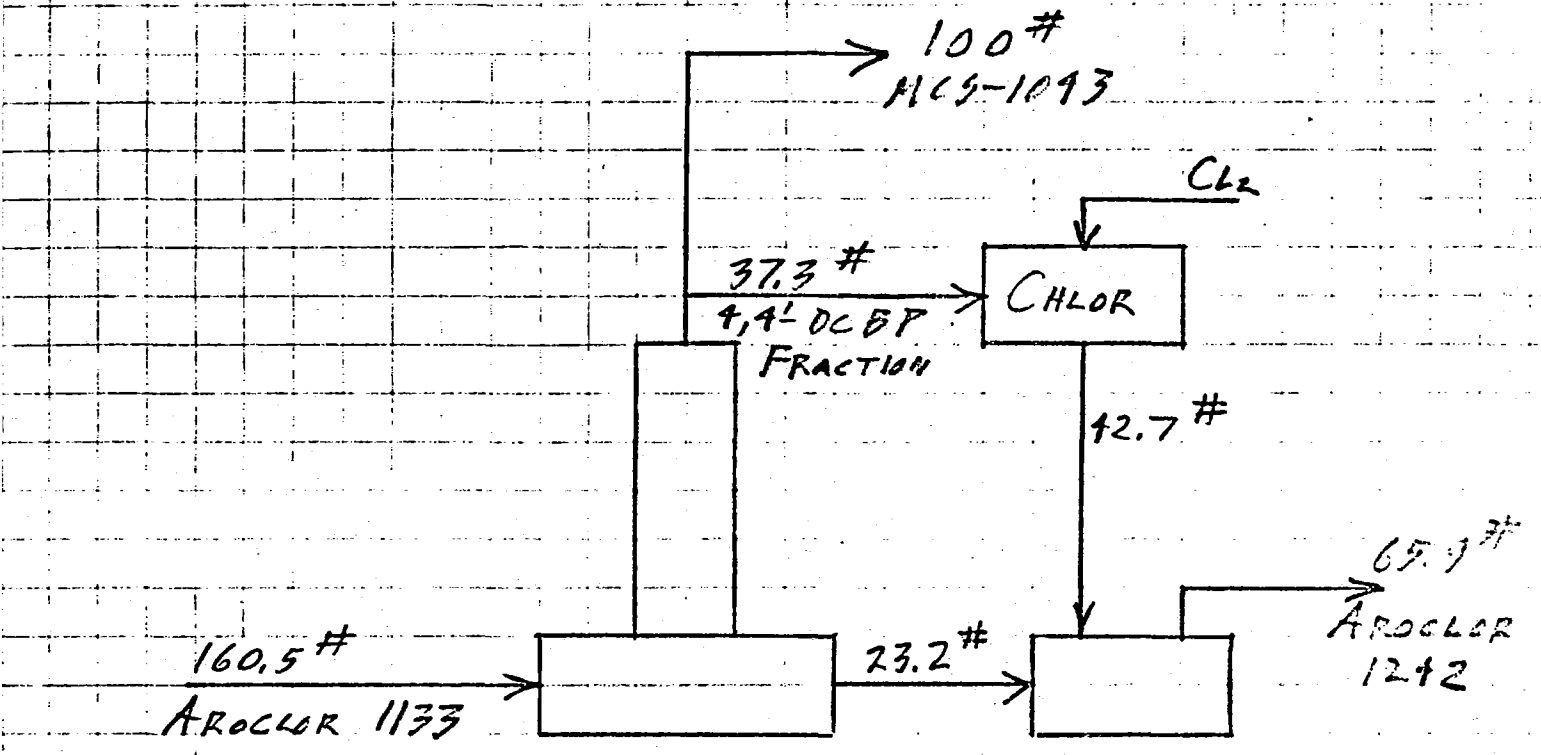
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ROUTE I



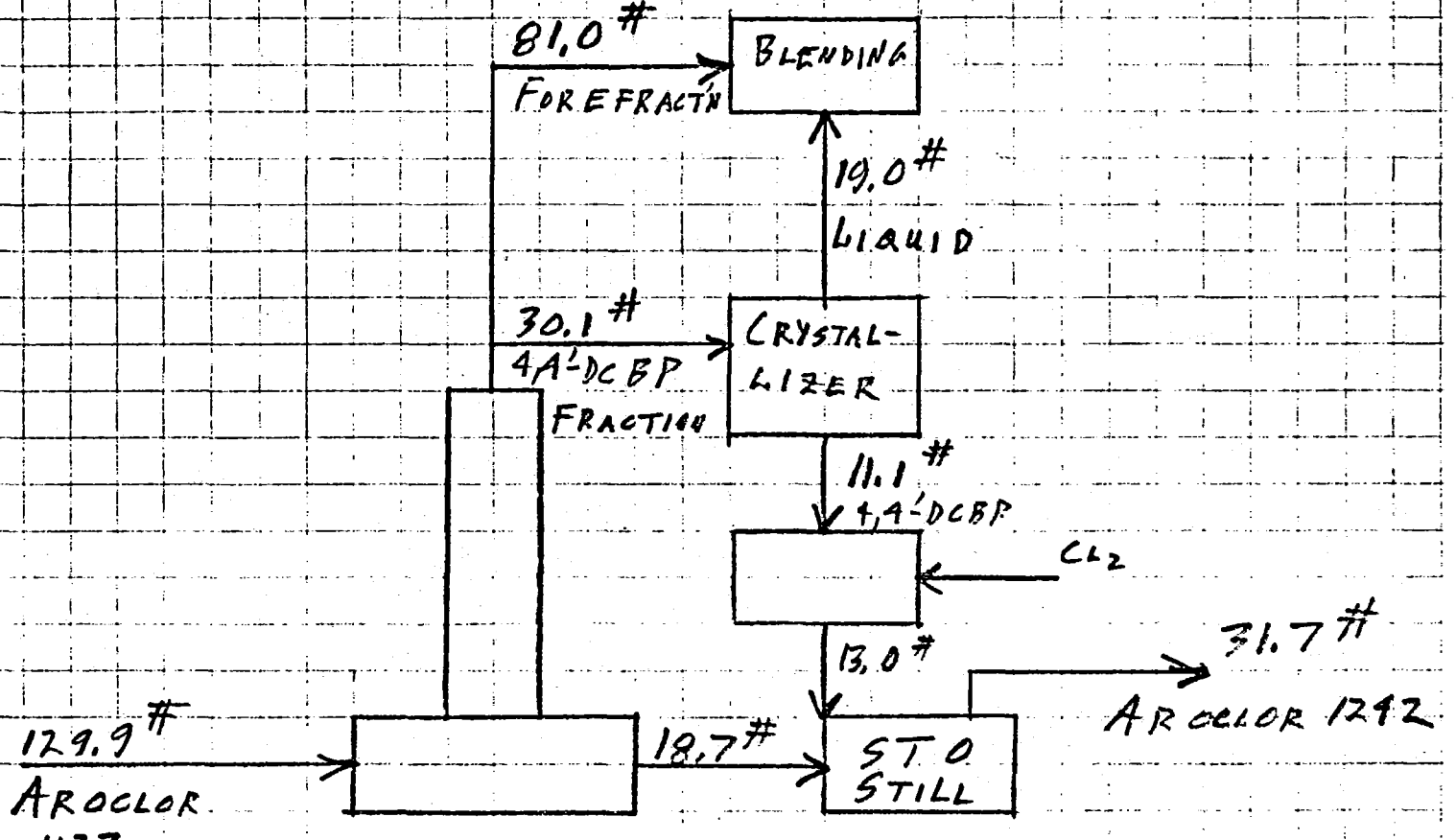
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Route II



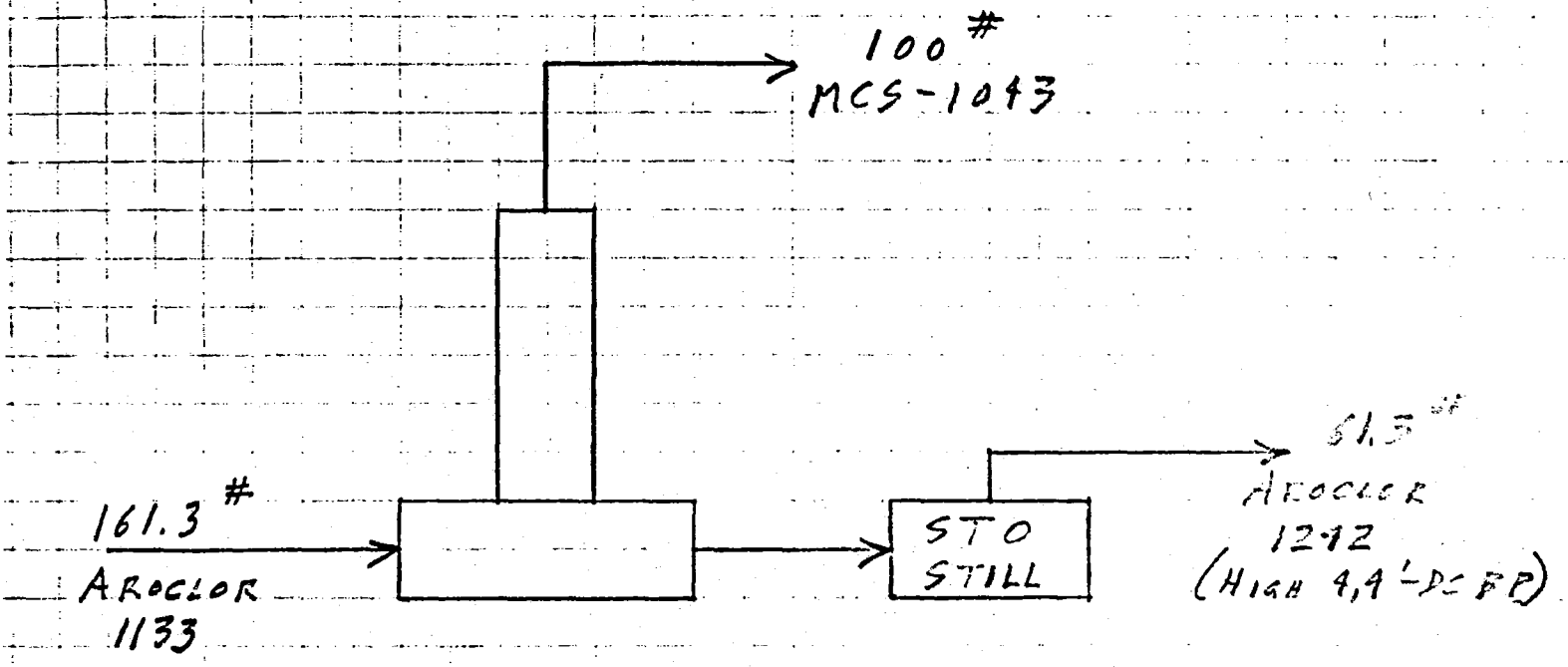
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ROUTE III



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ROUTE IV



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