REPORT #D.S.C. 67-1

MAY 1967

"CONFIDENTIAL DU PONT TECHNICAL INFORMATION"

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Marshall Laboratory
May 15, 1967

E. I. Du PONT DE NEMOURS & COMPANY
FABRICS AND FINISHES DEPARTMENT
DIVISIONAL PLANTS CHEMICAL GROUP

DISPERSION STABILIZATION CONCEPT 330-LINE COMPUTERIZED REFORMULATION PROGRAM DIVISIONAL

PREPARED BY: M. H. SCHAFFER
DATE ISSUED: MAY 15, 1967
PROJECT: P-63, DISPERSION STABILIZATION CONCEPT
PREVIOUS REPORTS: D.S.C. #66-5

ABSTRACT:

330-Line Computerized Reformulation Program (330-CRP) was developed and successfully applied to commercialize 2,500 formulas. Objectives of economy, speed and accuracy in "en masse" revisions, not feasible up to now with manual formula conversion, are achieved by this program. Program capability to accept the formula tab card deck as input and produce the revised formula tab card deck as output represents a major technological breakthrough. Use of the 330-CRP instead of manual revision yielded a $0.50 per formula savings on the 2,500 formula revision. This savings is expected to increase to $6.00 per formula on the next 330-Line "en masse" revision through further program refinement and dissipation of development costs. Built-in flexibility is allowing application of this program to many different reformulation and formulation objectives.

DSC #67-1

330-LINE COMPUTERIZED REFORMULATION PROGRAM

TABLE OF CONTENTS

REASON FOR REPORT:

This report is being written to:

(1) Review program capabilities.

(2) Delineate recommendations for increasing program potential.

(3) Provide information on a program which may have application to the objectives of other groups in order to maximize benefits to F. & F.

(4) Provide the basis for future planning by describing the overall coordination found to be necessary for a successful large-scale reformulation effort.

(5) Summarize economic benefits.

OBJECTIVE:

The objective of this work is to develop an automated method for reformulating large numbers of formulas with:

(1) Speed.

(2) Economy.

(3) Accuracy.

(4) Versatility to handle numerous product qualities.

(5) Compatibility with present divisional systems.

COORDINATION:

Our experience indicates that during a mass revision it is essential that all formulas scheduled for reformulation remain under the control of the group handling the reformulation. This control will prohibit other locations from revising any of these formulas while they are already in the process of being computer reformulated. If steps are not taken to maintain this control, reformulation of obsolete formulas takes place. Actually, mass formula revisions involve many different operating groups and therefore require maximum cooperation, effective communication and close overall coordination in order to be successful. This was especially true in the recent 2,500 formula 330-Line conversion, since it was the initial application of the high speed, large-volume processing, 330-CRP. Exhibits I, I-A and I-B show the flow of materials and paper during this recent "en-masse" revision and indicate the sequential actions required of the various Groups involved.

CAPABILITIES:

The present capabilities of the program include:

(1) Use of Formula Tab Card Deck as Input.

(2) Production of revised Formula Tab Card Deck as output.

(3) Mathematical Conversion from 42-Line to 330-Line.

(4) Gallon Weight Adjustments.

(5) Changes to Title Cards as programmed.

(6) Standardizing Orders of Addition.

(7) Standardizing mixing cycles and manufacturing directions.

(8) Inserting footnotes, and filtering, filling, labelling and cleaning instructions.

(9) Producing Divisional Ingredients Index up-date cards.

(10) Calculating raw material replacement cost changes.

(11) Generating C.O.S. data.

FUTURE ACTION AND RECOMMENDATIONS:

Several steps are now underway, or planned, to generalize, and expand the versatility of the 330-CRP. All of these items are being built into the program before our next 330-Line "en masse" reformulation (8,000 formulas) scheduled for late 1967. They are as follows:

(1) "S" Code classification capabilities.

(2) Increased recognition and insertion of special formula instructions and/or footnotes based on specific ingredients, combinations of ingredients and product types, e.g., bleeding notations, zinc reactivity cautions, etc.

(3) Expansion of gallon weight calculations as well as all other formula physical constants, e.g., weight solids, volume solids, pigment volume, etc.

(4) Handling alternate composition type formulas.

(5) Improved method for inserting gloss notations on formulas requiring same.

(6) Use of magnetic tape, containing the formula composition, as input to the UNIVAC 1108 instead of the Tab Cards themselves.

(7) Modifications to the output processing operation to increase formula issuance capacity.

In order to attain its full potential as a tool for both formulation and reformulation, additional work in the following areas should be undertaken:

(1) Expansion of standardization of orders of addition, mixing cycles and manufacturing directions to systems other than alkyd and nitrogen alkyd, i.e., "Lucite®" Acrylic, T.A.E., Acrylic Lacquer, etc.

(2) Formulating capabilities from mill base composition through programming of Formulating Tables.

(3) Color Classification Data Form Generation.

(4) Label Analysis.

(5) Flash Point Classification.

(6) Other programs or routines as required by individual Plants, Laboratories or personnel for special formulation or reformulation projects, e.g., "Rule 66" Breakdown, Resin Composition Breakdown, etc.

CONFIDENTIAL INFORMATION:

The information contained herein is strictly Company Confidential. Details on specific sections of the 330-CRP have been kept to a minimum in accordance with the confidential nature of the material and the security procedures now in effect.

ACKNOWLEDGEMENTS:

J. I. Ralph, E.S.D., and M. E. Barton, Divisional Plants Chemical Groups, who did the programming. G. C. Fox who formulated much of the initial logic. W. S. Armstrong, C.O.S. Group, for programming much of the C.O.S. section of this program. C. A. Carpenter whose ideas and cooperation in data processing and preparation of cost calculations for manual formula revisions were so important to the success of the program. H. A. Wray for providing information on conventional formula format and guidelines. W. B. Callahan who coordinates 330-Line objectives. W. B. Schaner for diligently carrying out the experimental work and proofreading computer output.

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MHS:jp

DISCUSSION:

Background:

The immediate objective of the DSC Program, P-63, is to replace 42, 732 and 743-Line dispersions with 330-Line counterparts. When setting up this objective, it was recognized that several thousand formulas would eventually have to be revised to complete the program. Normal manual procedures for handling revisions are impractical since; (1) speed in mass reformulation is necessary to orderly changeover, (2) the cost to manually handle 10,000 revisions is prohibitive, (3) standardization requirements and technical considerations of the revision require exhaustive training of personnel, and (4) accuracy in conversion is difficult to control.

Accordingly, objectives were set up to develop a computerized reformulation program. Engineering Services Department was contracted to write a computer program specifically designed to handle the conversion of formulas containing 42, 732 and 743-Line dispersions to a 330-Line basis. Midway through this program it was decided to develop it not only specifically for the 330-Line conversion, but also to build it in a manner which would permit application to many other formulation and reformulation programs. The evolved program possesses this flexibility and is already being adapted to handle Toledo's objective to convert 1,400 15-Line formulas to 16-Line quality.

Input:

The present formula issuance and distribution procedures in F. & F. are compatible with data processing systems and equipment. All divisional formulas have tabulating card decks. These tab card decks contain all the information found on the formula and are used to make the printed hard copy formula card and, at many locations, the production batch card.

The input to the UNIVAC 1108 is the tab card deck of the formula being revised. This may be the actual cards themselves, as was the case for the 2,500 formula revision, or it may be magnetic tape on which the tab card data have been recorded.

The logistics of tab card handling make the latter type input more desirable and tape will therefore be used on future mass revisions. Tab card decks will be read on to discs at Philadelphia via the IBM 1401. This recorded data will then be transferred from the disc to tape, and the tape used for input to the 1108. This operation of tab card to disc to tape has already been programmed and validated by M. E. Barton (Statistical Engineer, Divisional Plants Chemical Group) and is now operable.

Output:

There are three types of output from the UNIVAC 1108:

(1) Comment Print-Out Sheet - This is a computer print-out detailing the entire revision and is used to proof-read the revision since it also shows:

(a) Line skipping sequence to conform to formula format.

(b) Gallon weight reallocation figures.

(c) Raw material replacement cost changes.

(d) C.O.S. data.

(e) Any pertinent information such as missing cards in the original formula, wrong totals, etc.

Exhibit II shows the printout sheet of a formula processed through the 1108.

(2) Tab Card Deck - The revised tab card deck for the formula being processed is produced by the 1108. This new tab card deck is used, as is, to print the revised formula and/or batch card as required.

(3) Tape - Tape output contains COS data.

It should be noted that tab card output is somewhat cumbersome on the 1108 and on future revisions it is planned to record the formula output on tape. The tape output will then be used to punch the tab card decks on hardware more efficient than the 1108 in this operation. This change from tab card to magnetic tape output on the 1108 will lead to faster processing, easier handling and unlimited processing lot size.

Processing:

The UNIVAC 1108 accepts the formula tab card input, goes through the manipulations listed below to convert it to a 330-Line basis, and produces the revised formula in tab card form. Exhibit III shows a typical input formula and Exhibit III-A the output from the 1108. These Exhibits illustrate many of the items enumerated below.

(1) Title Card Changes - These include cards 101 through 307, 529, 230 and 231.

(a) 101 and 529 Cards - These cards are changed to show the date the formula is processed.

(b) 203 Card - "Perm" or "Temp" is inserted in the middle block of the 203 card, determined by the formula being permanent or temporary.

(c) 205 Card - The "Reviser" on the 205 card is changed to show UNIVAC. The Plant or Laboratory responsible for the revision is inserted in the Plant responsibility block.

(d) 206 Card - The date on the 101 card of the input is transferred to the previous formula date block on the 206 card. The approval block is changed as required.

(e) 307 Card - The reason for issue is inserted here as desired.

(f) 230 Card - COS is inserted in the Patent Marking block.

(g) 231 Card - The gallon weight of the revised product is inserted in the gallon weight block.

(2) Mathematical Conversion - The computer identifies any ingredients which must be converted and uses a replacement table, similar to a formulating table, to effect the change.

(3) Order of Addition - The computer identifies all ingredients in the formula and sorts them into pre-established groupings. These groups of materials are then placed in a standardized order according to the type product, alkyd or nitrogen-alkyd, which is being processed.

(4) Standard Manufacturing Directions and Mixing Cycles - Manufacturing and mixing cycles are inserted based on the quality of the product formula, alkyd or nitrogen-alkyd.

(5) Special Instructions and Footnotes - The computer is programmed to insert special instructions upon recognition of single ingredients, series of ingredients, product lines, or combinations thereof. These instructions include:

(a) Labelling Instructions.

(b) Special Manufacturing Directions.

(c) Filtering Instructions.

(d) Equipment Cleaning Instructions.

(e) Filling Instructions.

(f) Some Bleeding Notations.

(g) Special Loading Instructions.

(h) Doping Instructions.

All instructions and footnotes are in accordance with FP-08, Divisional Formula Writing Guide.

(6) Gallon Weight Adjustment Calculation - The gallons of material removed from the formula vs. the gallons of material added to the formula are determined. Small differences in the gallon weight between the old and new formula are compensated for by increasing or decreasing the amount of thinning solvent to give a 100 gallon formula.

(7) Raw Material Replacement Cost Calculation - The difference in the raw material cost of the new and the old formulas is calculated and printed on the comment sheet. A negative amount indicates a cost decrease.

(8) Divisional Ingredient Index Up-Date Cards - These cards are punched to indicate any deletions or additions to the ingredient composition of the new vs. the old formula. The cards are used directly by Division Planning to up-date the Divisional Ingredient Index.

(9) C.O.S. Data - C.O.S. data is generated for all formulas which have the required characterization data.

(10) Formula Format - The computer is programmed to place all data on the tab cards in the proper spaces and to skip lines or blocks of lines, as necessary, so that the output is in the exact conventional formula format currently in use.

Performance.

The performance of the 330-CRP is rated on the number of formulas processed which require no manual changes vs. the number of formulas processed which do require some key punching effort to either correct or augment information. Although it is feasible to reduce keypunching to zero through extended programming, the effort required to reach this goal is impractical in both time and cost. A particular piece of logic was included only where the amount of time required to do the actual programming was substantially less than the time which would be required to manually revise the formulas directly involved with the note. For example, a note which would eliminate the requirement of key punching for 100 formulas would be programmed, whereas one involving only three formulas would not.

The actual performance of the 330-CRP on the 2,500 formula revision in terms of keypunching requirements was as follows:

Perfect Formulas		
(a) Required No Keypunching		89.4%
Imperfect Formulas		
(a) Keypunching of 3 tab cards per formula or less	- 9.8%	
(b) Keypunching of more than 3 tab cards per formula	- 0.8%	
		10.6%

The total keypunch time which was required for the entire revision is estimated at 16 hours.

Speed:

Average volumes on the 330-Line revision recently completed were 200 formulas per computer run. This volume gave a median processing average of 3½ seconds per formula or approximately 12 minutes for 200 formulas. Per formula processing time through the computer is dependent on volume. The larger the volume the less the per formula processing time. Runs were kept at 200 formulas on the 2,500 formula revision because of handling time restrictions imposed by use of tab cards as input. With the planned replacement of tab card input with tape, the formula volume per run will be greatly increased and a corresponding decrease in processing time to two seconds per formula is expected.

Application:

The first application of the computer program was in the 2,500 formula, 42-Line to 330-Line conversion. M. E. Barton is currently up-dating the 330-CRP to handle Toledo's objective of converting 15-Line Mixing Machine Enamel formulas to a 16-Line basis. Immediate planning also includes work to add additional notes, expand capabilities and further refine the 330-CRP in preparation for the revision of approximately 8,000 formulas in the next 330-Line commercialization scheduled for late 1967. Other reformulation and formulation objectives currently being considered for application include:

(1) "Rule 66" conversions.

(2) Sulfate to Chloride processed TiO_2 conversions.

(3) Formulating Table capabilities.

M. E. Barton will be handling the programming requirements for all future application of the 330-CRP.

In addition to these applications, the C.O.S. portion of the reformulation program can be used independently of the main body of the program to generate C.O.S. data. The C.O.S. section of the 330-CRP was developed by W. S. Armstrong (C.O.S. Group, Philadelphia.

Economics:

Use of the 330-CRP in-lieu of manual revision resulted in a savings of $1,450 or about $0.50 per formula, on the recent 2,500 formula revision. This savings is expected to increase to $48,000 or $6.00 per formula on the anticipated 8,000 formula 330-Line revision. This increase in savings will be accomplished through further program refinement and dissipation of program development costs.

A direct comparison of the cost between manual and computerized reformulation is presented in Exhibit IV. These costs are not official and are intended to reflect the relative cost difference between only those operations common to the 330-CRP and manual revision procedures. Cost of formula issuance and distribution are not included in the comparisons since the costs of these operations are currently equivalent for both revision procedures. Cost data for most of the manual revision operations were provided by Division Planning and for COS data generation by the COS Group.

Exhibit V details the operations involved with formula revision up to and including generation of the revised formula tab card deck and delineates per-operation costs, equipment and manpower requirements.

EXHIBIT I

330-LINE COMPUTERIZED REFORMULATION

OPERATIONS FLOW DIAGRAM

INPUT

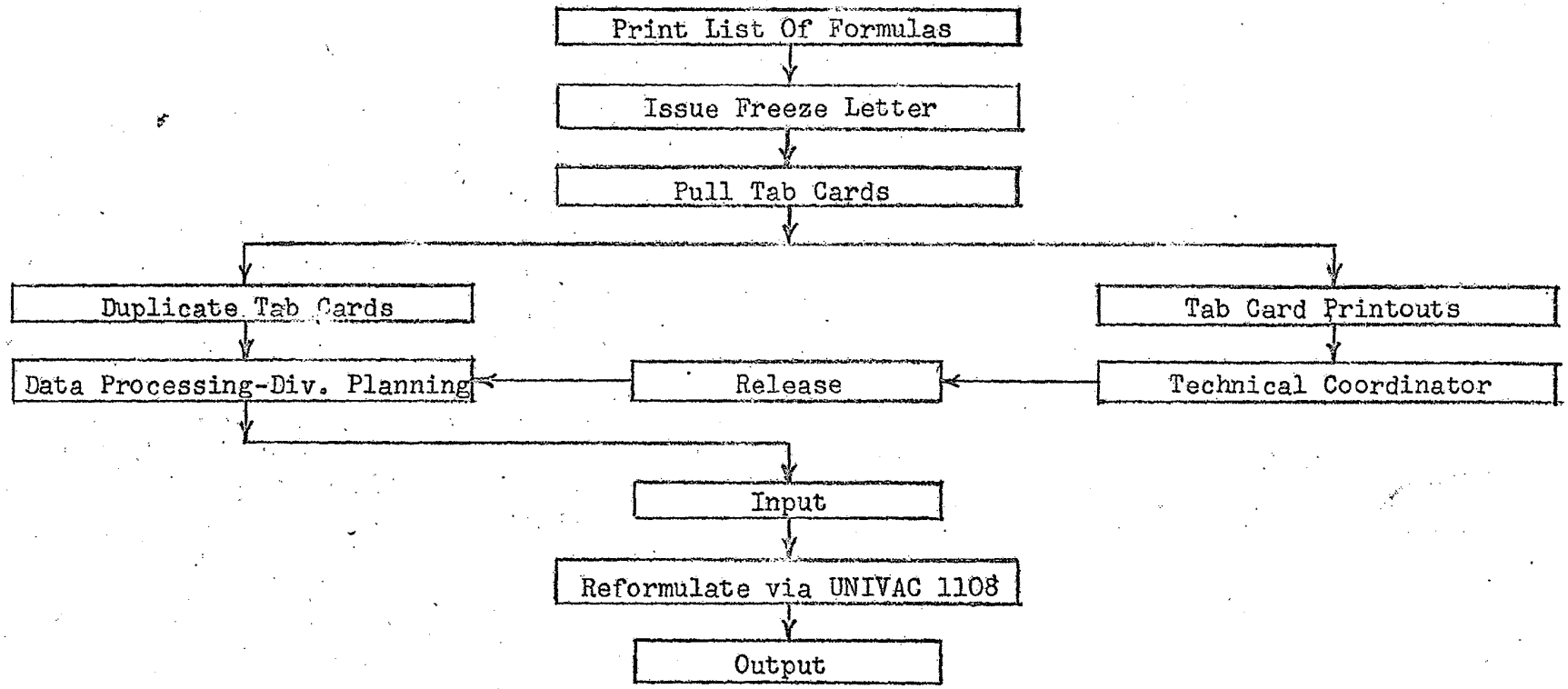


EXHIBIT I-A

330-LINE COMPUTERIZED REFORMULATION

OPERATIONS FLOW DIAGRAM

OUTPUT

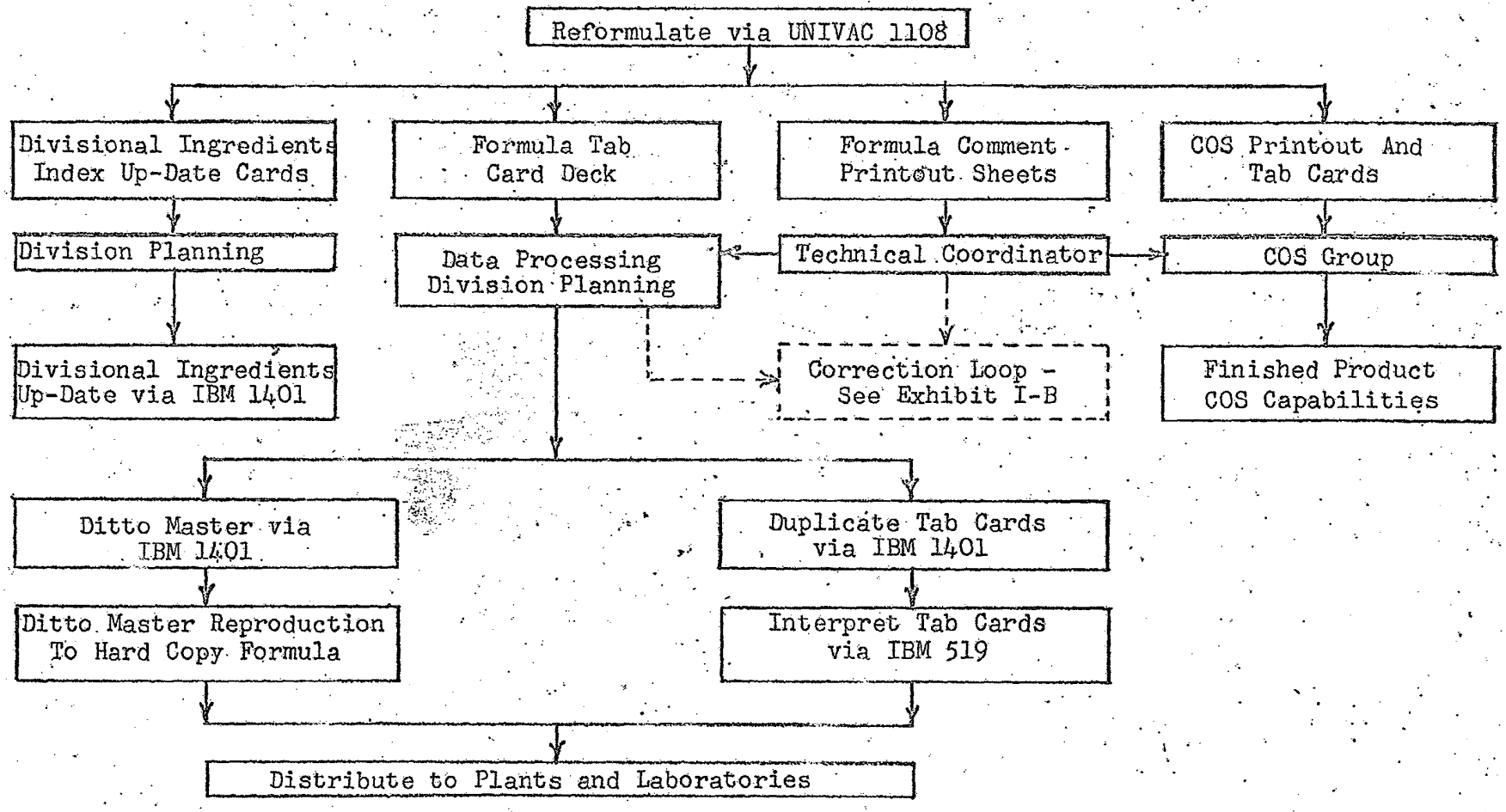
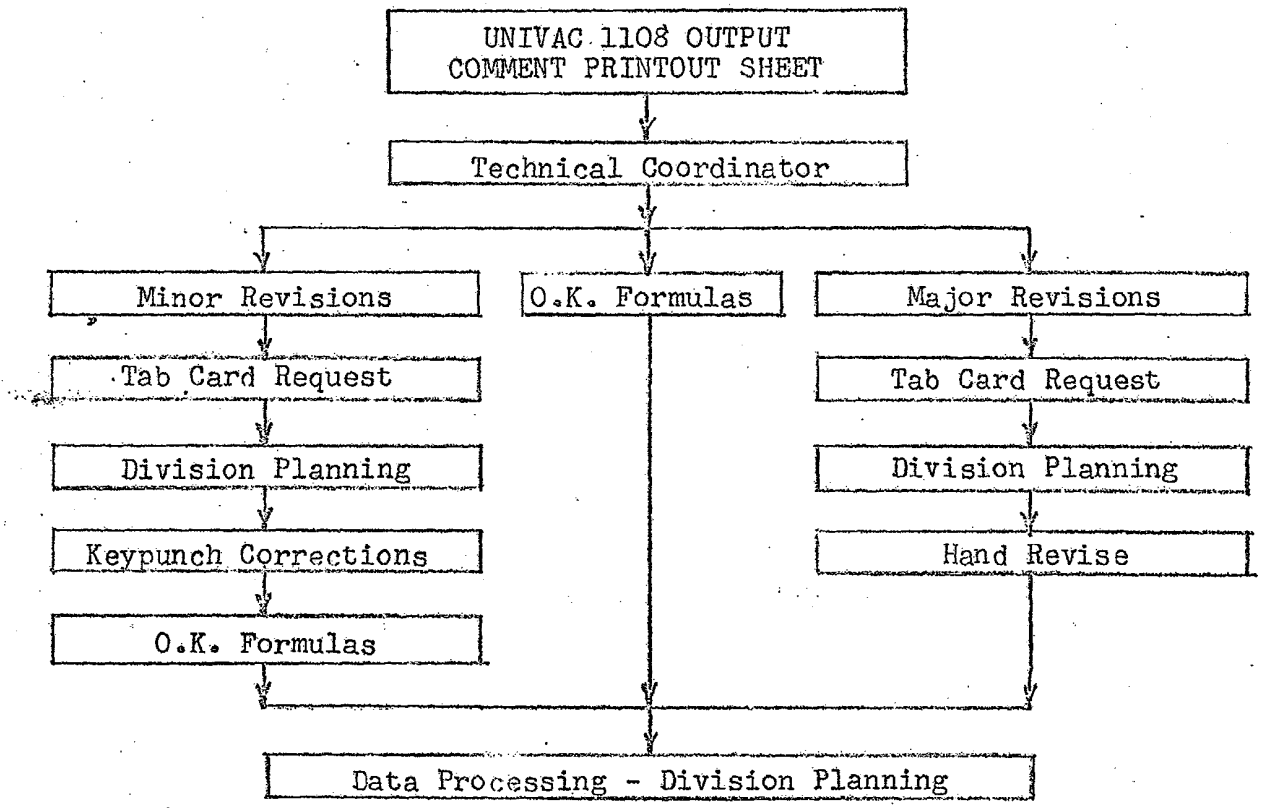


EXHIBIT I-B

330-LINE COMPUTERIZED REFORMULATION

OPERATIONS FLOW DIAGRAM

OUTPUT - CORRECTION LOOP



F + F PAINT FORMULAE PRODUCTION GROUP IX + 500 LINE. DATE

```
START  0 793  17529      77
SOLVENT CHANGE(LBS) NEEDED BY 100 GAL REALLOCATION IS    -.01
COST INCREASE     -.01
1010 793  17529BLEEDING GREEN METALLIC 'DULUX' ENAMEL      11667
2020 793  17529CHEVROLET                                  DETROIT-AUTO
2030 793  17529AUTO                        PERM           GREEN
2040 793  17529R A HAUBERT
2050 793  17529DSC/UNIVAC  120256          * CEFLMPST     TOLEDO/P
2060 793  17529    1- 9-64-TOLEDO-         FPST           CNS/CAC
2070 793  17529REVISE TO USE 330-LINE DISPERSIONS.  R.L. 180.
2080 793  1752957                                        7-0015-3          $
4200 793  17529
3210 793  17529P/B)4.3/100//
3220 793  17529ALKYD)75(//MELAMINE)15(//UF RESINS)10(//
3230 793  17529COVERS AT ABOUT 1.8 MILS//                                  $
5290 793  17529BLEEDING GREEN METALLIC 'DULUX' ENAMEL      11667
2300 793  17529                                 10C/28-32'
2310 793  17529REGULAR                         903          - 60L          ,1
6320 793  17529//REACTIVE WITH ZINC//THIS FORMULA BLEEDS//
6330 793  17529AGITATE ALL DISPERSIONS BEFORE USING AND ADD SLOWLY.         ,1
7350 793  17529RL       3141     20627
7360 793  17529RL       3144      2590
7370 793  17529RL        495      7580
7380 793  17529  793     121      6250
7390 793  17529   42     612      4130
6400 793  17529----------------------ADD IN ORDER WITH MIXING.
6410 793  17529MIX 15 MIN.                                                 ,1
7430 793  17529RC        751      9250
7440 793  17529RC        710      5730
7450 793  17529H          41 S2   2500
7460 793  17529H         540 S2   2400
7470 793  17529VH       5379*      100
6480 793  17529----------------------ADD IN ORDER WITH MIXING.
6490 793  17529MIX 15 MIN.
6500 793  17529*WEIGH ACCURATELY.                                           ,1
7520 793  17529   42     482        80
7530 793  17529  330    1755        23
7540 793  17529H          601      3200
7550 793  17529H          257      9810                                    $
6560 793  17529----------------------SHADE TO STD. + THIN TO VISC.
6570 793  17529DO NOT USE MORE THAN 3.9% OF H-41 METHANOL ON TOTAL BATCH WT.
6580 793  17529----------
7590 793  17529          TOTAL     50300                                   ,1
5610 793  17529FORMULA CONTAINS VH-5379.  FLUSH EQUIPMENT THOROUGHLY BEFORE
6620 793  17529USING FOR BATCH OF ANOTHER CODE.                            $
```

EXHIBIT II

330-LINE COMPUTERIZED REFORMULATION

COMPUTER PRINTOUT SHEET

DSC #67-1

101	CODE	0 793 | 17529	NAME	BLEEDING GREEN METALLIC "DULUX" ENAMEL		DATE	1 1 954
202	CUST.	CHEVROLET	LOC.		REG. & D.		DETROIT-AUTO
203	END USE	AUTO	CLASS.		COLOR		GREEN
204	FORM.	W A HAUBERT	R. L. - I.		N. B. & P.		
205	REVISER	K F KOELLA/SF	R. DIST.	CEFLMPST	PLANT		TOLEDO
206	PREV. R	T-9-6-62-T+P-7-23-62-T	T. C. DIST.	FPST	APPR.		KFK
307	R.F.I.	REVISED TO CURRENT QUALITY//					
208	S.T.P.	57	QUAL. STD.		COL. STD.		T-0015-3

TESTING INFORMATION

EXHIBIT III

330-LINE COMPUTERIZED REFORMULATION

INPUT - TYPICAL FORMULA

420	VOL. SOL.	%	PIG. VOL.	%	WT. SOL.	%	

OTHER INFO.

321 P/B=4.3/100//
322 ALKYD=75%//MELAMINE=15%//UF RESINS=10%//
323 COVERS AT ABOUT 1.8 MILS//

529	CODE	0 793 | 17529	NAME	BLEEDING GREEN METALLIC "DULUX" ENAMEL		DATE	1 1 954
230	PAT. MAR.	NONE	VISC.	100/28-32"	FINE.		
231	CONT.	REGULAR	GAL. WT.	803 ±0	ICC. INFO.		80L

MANUFACTURING INGREDIENTS AMOUNTS AND DIRECTIONS

	INGREDIENT		✱	SC	ALT. #1	ALT. #2	
632	//REACTIVE WITH ZINC//THIS FORMULA BLEEDS//						
734	743	121			62 5		
735	42	612			41 3		
736	RL	495			75 8		
737	RL	3141			206 1		
738	RL	3144			85 9		
639	----------	----------			----------	LOAD AND	MIX 15 MINS//
740	RC	731			92 8		
741	RC	718			57 3		
742	H	540		S2	24 0		
743	VH	5379			1 0		
744	H	41		S2	25 0		
745	H	601			32 0		
646	----------	----------			----------	ADD AND	MIX 15 MINS//
747	H	257			98 1		
748	42	482			0 8		
749	42	785			0 4		
650	----------	----------			----------	ADJUST TO	VISC. AND SHADE//
751		TOTAL			803 0		

201	CODE	0 793 | 17529	NAME	BLEEDING GREEN METALLIC "DULUX" ENAMEL		DATE	11667
202	CUST.	CHEVROLET		LOC.		REG. & D.	DETROIT-AUTO
203	END USE	AUTO		CLASS.	PERM	COLOR	GREEN
204	FORM.	W A HAUBERT		R. L.-I.		N. B. & P.	
205	REVISER	DSC/UNIVAC 120266		R DIST.	CEFLMPST	PLANT	TOLEDO/P 1
206	PREV. R.	1- 9-64-TOLEDO		T. C. DIST	FPST	APPR.	CNS/CAC
307	R. F. I.	REVISE TO USE 330-LINE DISPERSIONS.					
208	S. T. P.	57		QUAL. STD.		COL. STD.	7-0015-3

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EXHIBIT III-A

330-LINE COMPUTERIZED REFORMULATION.

OUTPUT

TESTING INFORMATION

420	VOL. SOL.	%		PIG. VOL.	%	WT. SOL.	%

321 P/B=4.3/100//
322 OTHER ALKYD=75%//MELAMINE=15%//UF RESINS=10%//
323 COVERS AT ABOUT 1.8 MILS//

529	CODE	0 793 | 17529	NAME	BLEEDING GREEN METALLIC "DULUX" ENAMEL		DATE	11667
230	PAT. MAR.			VISC.	10C/28-32"	FINE.	
231	CONT.	REGULAR		GAL. WT.	803 ±0	ICC. INFO.	- 80L

		INGREDIENT	*	SC	ALT. #1	ALT. #2	
1							
632		//REACTIVE WITH ZINC//THIS FORMULA BLEEDS//					
633		AGITATE ALL DISPERSIONS BEFORE USING AND ADD SLOWLY.					
1							
735		RL 3141			206	27	
736		RL 3144			85	90	
737		RL 495			75	80	
738		743 121			62	50	
739		42 612			41	30	
640		----------					-ADD IN ORDER WITH MIXING.
641		MIX 15 MIN.					
1							
743		RC 731			92	80	
744		RC 718			57	30	
745		H 41		S2	25	00	
746		H 540		S2	24	00	
747		VH 5379	*		1	00	
548		----------					-ADD IN ORDER WITH MIXING.
549		MIX 15 MIN.					
550		*WEIGH ACCURATELY.					
1							
752		42 482				80	
753		330 1785				23	
754		H 601			32	00	
755		H 257			98	10	
556		----------					-SHADE TO STD. + THIN TO VISC.
557		DO NOT USE MORE THAN 3.9% OF H-41 METHANOL ON TOTAL BATCH WT.					
558		----------					
759		TOTAL			803	00	
561		FORMULA CONTAINS VH-5379. FLUSH EQUIPMENT THOROUGHLY BEFORE					

DUP030001675

EXHIBIT IV

330-LINE COMPUTERIZED REFORMULATION

COST COMPARISON*

MANUAL VS. COMPUTERIZED TECHNIQUES

PAST COST SAVINGS - 2,500 RX REVISION

(1) Cost for manual revision - 1,250 Formulas with COS @ $6.70/Rx.	=	$ 8,375
- 1,250 Formulas without COS @ $5.82/Rx.	=	$ 7,275
MANUAL TOTAL COST	=	$15,650
(2) Cost for computerized revision - 1,250 Formulas with COS @ $0.58/Rx.	=	$ 725
- 1,250 Formulas without COS @ $0.38/Rx.	=	$ 475
- 330-CRP Development Cost	=	$13,000
330-CRP TOTAL COST	=	$14,200
TOTAL COST SAVINGS	=	$ 1,450

ANTICIPATED COST SAVINGS - 8,000 RX REVISION

(1) Cost for manual revision - 8,000 Formulas (with COS) @ $6.70 Rx.		
MANUAL TOTAL COST	=	$53,600
(2) Cost for computerized revision - 8,000 Formulas (with COS) @ $0.20/Rx.	=	$ 1,600
Additional 330-CRP Development Cost	=	$ 4,000
330-CRP TOTAL COST	=	$ 5,600
TOTAL COST SAVINGS	=	$48,000

*Cost comparisons take into consideration the operations detailed in Exhibit V.

DSC #67-1

EXHIBIT V

330-LINE COMPUTERIZED REFORMULATION
OPERATIONS - COST - EQUIPMENT - MANPOWER
MANUAL VS. COMPUTERIZED TECHNIQUES

MANUAL

OPERATION #	DESCRIPTION	REQUIREMENTS	COST/RX.
1	Process Old Formula and Write Green Sheet	Chemists Assistant	$4.13
	(a) Develop Data		
	(1) Mathematical Conversion		
	(2) Reallocation to 100 gallons		
	(b) Green Sheet Write-Up		
	(1) Title Card Changes.		
	(2) Standardize Order-Of-Addition.		
	(3) Standardize Manufacturing Directions		
	(4) Insert Standard and Special Notes		
2	Keypunch		$0.72
	(a) Tab Card Deck from Green Sheet	Keypunch Operator	
	(b) Proofread	Clerk	
3	Divisional Ingredients Index Up-Date Cards		$0.97
	(a) Determination of New or Deleted Ingredients	Clerk	
	(b) Keypunch Up-Date Cards	Keypunch Operator	
	(c) Verify Up-Date Cards	Clerk	
4	C.O.S. Data Generation	Bendix G-15; C.O.S. Operator	$0.88
		TOTAL (with COS)	$6.70
		TOTAL (without COS)	$5.82

EXHIBIT V (CONT'D)

PAST 330-CRP (2,500 RX REVISION)

DSC #67-1

OPERATION #	DESCRIPTION	REQUIREMENTS	COST/RX.
1	Preparation of Formula for Revision		$ .19
	(a) Pull Tab Cards	Clerk	
	(b) Reproduce Tab Cards	IBM 519 + Operator	
	(c) Printout Tab Cards	IBM 1401 + Operator	
	(d) Interpret Tab Cards	IBM 519 + Operator	
	(e) Transport to UNIVAC 1108	Clerk	
2	UNIVAC 1108 Processing	UNIVAC 1108	$ .19
	(a) Generates "Manual Operations" #1, 2 & 3		
	(b) Generates G-15 requirements of "Manual Operation" #4		
3	C.O.S. Work-up to final data	C.O.S. Operator	$0.20
		TOTAL (with COS)	$0.58
		TOTAL (without COS)	$0.38

ANTICIPATED 330-CRP (8,000 RX REVISION)

1	Preparation of Formula For Revision		
	(a) Pull Tab Cards	Clerk	
	(b) Record Tab Cards onto disc and tape	IBM 1401 & 1460	$0.09
2	UNIVAC 1108 Processing	UNIVAC 1108	$0.11
	(a) Same as "Past 330-CRP Operations" #2 (a) and #2(b) but with increased processing rate.		
	(b) Improved C.O.S. work-up (requires no operator time)		
	TOTAL (with or without COS)		$0.20