THE LABORATORY IN 1945

THE LABORATORY IN 1945

In 1945, the element of time seemed to be the one most important factor in laboratory formulation. As one raw material crisis followed another, substitute formulas had to be developed rapidly in order to keep production moving. Every job was done against time and every day brought a new reformulation deadline. The jobs were done, the deadlines were met and our factories kept producing -- at least to the extent permitted by raw material restrictions.

Early in the war, when restrictions were still a novelty, one chemist remarked that paint could always be made from rosin and linseed oil -- no matter what happened. The year 1945 proved this prediction to be wrong for even rosin and linseed oil became formulating luxuries denied or restricted except for military use. By midyear, the raw material cupboard was bare. Each substitute had been examined, put into use and then discarded as it went on allocation. The European war ended just in time to prevent a complete breakdown in civilian paint quality.

Bad raw material news started January 1, 1945, with an oil quota reduction from 60% to 50%. On January 31, 1945, a 30-day inventory restriction was imposed on the purchase of linseed oil thus forcing us to discontinue certain special oils purchased in small quantities. In March, the oil quota was reduced again, this time to 40%. During the first quarter of 1945, a considerable amount of laboratory work was devoted to the replacement of reportable linseed oil with China wood oil. As a result, "61" Floor Varnish, "61" Floor & Porch Enamel, "61" Spar Varnish and several other listed items were materially improved but only at the expense of profit. The cost increase resulting from these changes averaged thirteen cents per gallon. In July, castor oil was placed under allocation and China wood oil was restricted. The restrictions on castor and China wood oils ended with V-J Day, and in October, the oil quota was raised to 75%.

The restrictions and complications affecting drying oils resulted in laboratory expenditures which amounted to $1040. Among the many relief measures which were investigated was the use of fish oil in house paint. Fish oil formulas were set up but were held in abeyance for a last stand in the event that oil conditions became worse. It never became necessary to adopt these formulas.

The restrictions on rosin and rosin derivatives had a more damaging effect on quality and profit than any wartime raw material restriction. Rumors of rosin restrictions were widespread before WPB Order M340 was issued on February 6, 1945. This order was merely the entering wedge and provided nothing more than a tool for honoring preferred orders. It was succeeded by WPB Order M387 on

February 28, 1945, which limited the consumption of rosin (as such and in its derivatives) to 30% of the usage in the corresponding period in 1944. Since all other widely used varnish resins had already become unobtainable, the rosin order was a heartbreaking blow. It immediately became necessary to revamp most of our industrial and trade sales finishes to reduce rosin consumption.

Our first step toward meeting this situation was the wholesale use of Piccolyte, a rosin-free terpene resin. Piccolyte cost us 20-1/2 cents per pound -- three times as much as rosin and twice as much as ester gum -- and cost increases in the order of ten cents per gallon immediately took place in our finished products. Hardly a month had passed before Piccolyte shortages developed and by the end of April, Piccolyte was so scarce that it had to be taken out of all products except "61" Enamel White Gloss and "61" Q. D. Enamel White. In July, Piccolyte went on allocation.

In the meantime, we had turned our attention to another rosin-free resin, Velsicol, a petroleum derivative. Under normal conditions, Velsicol would have been (and now is) a drug on the market for it was exorbitantly priced at 18-1/2 cents per pound and it was almost pitch black in color. In spite of these drawbacks, we were eager to buy carload quantities and soon had it in the bulk of our trade sales items. The best evidence of the fallacious value set on Velsicol is that it dropped 25% in cost as soon as rosin again became available.

During 1945, we consumed 30 tons of Piccolyte and 55 tons of Velsicol in the manufacture of 200,000 gallons of enamels, primers and undercoatings which we would not otherwise have made. No sales difficulties arose from the use of these two rosin substitutes.

One place in which we had consumed large quantities of rosin in the past was in the production of driers for our own as well as subsidiary company use. In 1944, approximately 42 tons of rosin and 10,000 gallons of oil went into these driers. The merits of purchased driers vs. driers of our own manufacture had been debated over a period of years but debating ended when the rosin situation forced us to take action. The changeover to purchased tall oil driers will save us about $8500 during the 12-month period following the move. When we adopt naphthenate driers, which are again available and which are superior to tall oil driers, the annual saving will shrink to about $7000. A part of these savings represents the freight charges on driers heretofore made at Buffalo and shipped to the subsidiaries. Under the present plan, the subsidiaries are making their own driers from locally purchased drier concentrates. The Buffalo factory has lost about 45,000 gallons of production as a result of this move, but the company as a whole has benefitted. The feeling of security fostered by 45,000 gallons of production may have been an expensive form of insurance.

Rosin restrictions as a whole cost the company $5410 in laboratory work. What they cost in profits due to the use of more expensive resins is a matter of guess, but it is probable that another $5000 was spent in this way.

In addition to oil and rosin problems, 1945 ushered in WPB Order M384 on lead chemicals which limited our use of lead carbonate to about one-third of our prior usage. This order was a major blow to subsidiary company production but it had no effect on Buffalo production. Little laboratory work was involved, other than the development of a new house paint white (No. 5 Exterior White) which was produced until October when lead restrictions ended.

In the industrial field, one other raw material led to considerable reformulating work in 1945 and that was alkyd resin. In February, the phthalic anhydride content was reduced by government order in all types of alkyd finishes including even military coatings. This required some very rapid formula juggling in order to produce contracted materials on time and with the reduced volume of alkyd that was allocated each month. Out of this situation came a multitude of non-phthalic alkyd coatings, some of which won a permanent place in industrial finishes. We developed a not too successful non-phthalic alkyd from azelaic acid and used it in a limited way in wrinkle finishes. The limitations on phthalic anhydride served one useful purpose in that they proved conclusively that positive drying, durable production finishes could be made only with a fairly high phthalic anhydride content. Reformulating work involving alkyd finishes cost us $2610 in 1945.

A multitude of minor raw material problems demanded a great deal of laboratory time in 1945. The raw materials involved were iron oxide, magnesium silicate (Asbestine), diatomaceous earth (Celite), chrome pigments, organic colors and titanium dioxide.

In the aggregate, about $10,000 was spent in 1945 by the laboratory in raw material work, the sole purpose of which was to keep production moving. Most of this work was technically unprofitable for it added little permanently useful knowledge. The conditions necessitating this work were short-lived. In all, 339 formula changes (exclusive of changes due to driers) were made in the 187 items listed in Temporary Price Schedule No. 119-T. In 1944, 306 changes were made in the then active 204 item price list.

General Research

The most outstanding single laboratory development in 1945 was a process for making alkyd resins directly from oils. Heretofore, we have made alkyds from the fatty acids of oils, since vegetable oils (except tung oil) have not readily combined with glycerine and phthalic anhydride. A technique whereby alkyds can be made directly from oil by a method known as alcoholysis was successfully worked out and put into use in 1945. Future savings of at least $10,000 per year should result from the process and will reach a peak after our new alkyd equipment is in operation.

Trade Sales Developments

Formulas for virtually all of the proposed postwar finishes have now been established. These include the new Vitralite Enamels and Undercoating, Effecto, Lyt-all Flowing Flat and Stippling Eggshell, Verdura Trim & Shutter Finish, House Paint, and "61" Floor & Porch Enamel. The major effort is now being devoted to the transportation line.

Approximately $11,500 was spent on postwar development work in 1945.

Industrial Finishes

About half of the work done for the Industrial Sales Department in 1945 was confined to the following fields:

Industry, Type finish or Work	Total number problems	Dollar value of laboratory work
Government Specifications (mostly aircraft)	85	$ 5074
Cloth and Textile Coatings	67	2975
Wrinkle Finishes	133	2002
Army and Navy Inspection Testing	95	1298
Electrical Fixtures and Equipment	38	1220
Metal Decorating	62	1132
Collapsible Tube Coatings	33	975
Casket Finishes	19	528
Paper Coatings	8	410
Totals	540	$ 15,614

In past years, work on zinc chromate primer demanded a considerable part of the laboratory's time. Our troubles in this field were as numerous in 1945 as in preceding years, but the end of the war abruptly ended the demand for primer as well as for laboratory work. Only $832 was spent on zinc chromate primer work in 1945 whereas $8651 had been spent in the previous three years. Production likewise dropped. 29,500 gallons were produced in 1945 in comparison with a production of 47,150 gallons in 1944. During the entire war period, our company made 191,650 gallons of zinc chromate primer.

A very considerable amount of time and money was spent on other aircraft specification items, most of which involved lacquer or synthetic enamel coatings. On one specification job (AN-L 29, Lacquer Cellulose Nitrate) nineteen different colors were developed and submitted for test. Insofar as can be determined, little, if any, business resulted from most of this work.

One unusual aircraft coating developed in 1945 was a finish for the inside of aircraft engines (goods K920). This coating had to withstand the exceedingly high operating temperatures inside engines as well as salt water, hot oil, etc.

In the cloth and textile field, a large amount of work continued to come into the laboratory even though Mr. Avallone's association with the company ended early in 1945. Probably the most interesting new development in 1945 was a solventless coating capable of application at greater film thickness than any previously available solution type coating. Samples submitted to cloth coaters have been very favorably received but no business has so far resulted.

The very fast baking postwar wrinkle finishes developed in 1944 are now being regularly supplied to several accounts. A novelty type wrinkle was created in 1945 under the name Ripplescent Finish. Ripplescent Finishes are clear wrinkles containing traces of color. When applied on polished metal, effects simulating gold, copper, brass and silver are obtained. In 1945, 40,290 gallons of all types of wrinkle finishes were produced. This gallonage represents a considerable shrinkage from the previous year's production of 60,000 gallons.

In the electrical field, several new products met with considerable success. A baking aluminum finish for flourescent lighting fixtures (K7443) resulted in sales of 5500 gallons during the last six months of 1945. Two gray baking enamels (K7467 and K7474) were adopted by Western Electric Co. in 1945 and led to orders totaling 7500 gallons. A wide variety of finishes were developed for the Markel Electric Co. ranging from a parchment finish for paper lamp shades to a plastic sealing compound for cases containing radar equipment. Much time and effort was spent on fungus resistant coatings for electrical equipment used in the tropics but the sudden termination of war ended interest in these coatings.

In the metal decorating field, we have been engaged in improving the sanitary lacquers used on the interior of caps and cans in order to make them more resistant to chemical agents and to forming. Better adhering sizes for tin and terne plate are being developed. Expanded use of vinyls and alkyds is being investigated.

Delivery of a roller coating machine which was ordered in 1944 for testing metal decorating finishes has been delayed for a multitude of reasons but is being promised monthly. The punch press and knurling and threading equipment also ordered in 1944 have been recently installed and the press is now in use. The knurling equipment lacks a special die which has not yet been received.

Three unusual tube coatings were developed in 1945. One was a quick bake enamel (GX117) curing in one minute at 350°F. Conventional enamels require from 30 minutes to one hour at 150° - 180°F to bake. A lacquer (79-555) was also produced. Both of these developments were aimed at faster production which means lower production costs for the tube manufacturer. The third development was an extremely

resistant white tube coating (G28681). Tube manufacturers state that this is the most alkali resistant coating they have ever examined and that it will eliminate the need for a final coating of clear lacquer which has heretofore been used to obtain maximum resistance.

A washing machine enamel (K1296) was developed in 1945 and has met the production tests of one manufacturer.

New faster baking enamels were developed for Talon fasteners in place of prewar enamels which required a two-hour bake.

4300 gallons of a black primer (K0215) was sold to Royal Typewriter in November and December 1945 for use on typewriter bases. This product was similar to an enamel developed for aircraft engine baffles and is one wartime development that has been utilized for peacetime purposes. The primer bakes in one minute at 400°F.

A new and unique white enamel containing silicone resin has been developed for household electric heaters. This enamel (K1292) will withstand indefinite exposure to temperatures of 250°- 400°F without discoloration. All previously available finishes have yellowed.

In the wood furniture field, modifications of our proposed postwar "38" Trim Varnish have been received with great interest. One account, Sikes Chair, has just placed an initial order for 300 gallons.

The Carborundum Co. again became active late in 1945 and ordered approximately 44,000 gallons of adhesives. Laboratory work has been resumed on "repaint" and industrial sandpapers. The most important problem is a non-curling paper for mechanical sanding machines that will be adopted by the automobile industry. A really sensational new sandpaper adhesive (M4965) has been approved by the Carborundum Co. but the use of this adhesive is being delayed until suitable ovens can be installed. This adhesive bakes in 4-8 minutes at 250°F whereas previous adhesives required 8-12 hours at 170°F. Manufacturer's tests indicate that paper made from this adhesive has three times the sanding efficiency of previous papers coupled with indefinite "cut" retention.

Personnel

Labor turnover increased slightly in 1945 and resulted in the third highest separation rate in seventeen years. Data on separations follow:

	1945	1944	1943
Resigned	17	15	7
Transferred to other departments or to subsidiaries	3	3	2
Discharged	3	1	-
Laid off	-	1	-
Drafted or enlisted	-	-	3
Total separations	23	20	12
Average number employees	51	48	47
Separation rate	45%	42%	26%

Over 80% of the labor turnover occurred after V-E Day and a third of the 80% took place in the month following V-J Day. Half of all 1945 separations were related in some way to the end of the war. Four women resigned to join husbands returning from the army or at some army post, four others found educational opportunity not previously available and a small number left their jobs following the removal of job controls.

The laboratory lost the services of its oldest (in service) employee, Mr. Johnston, in 1945. Mr. Johnston had been associated with the laboratory organization for 28 years. Another veteran employee, Mr. A. Wolf, was transferred to the Dibble Color Co.

For the first time since war began, it has been possible to select employees rather than accept the only applicant that might offer himself or herself. The laboratory organization has been expanded slightly due to the return of four veterans, all of whom were former employees. Two other veterans are expected back shortly. Unskilled chemists are still difficult to obtain and will continue to be scarce for another four years. The laboratory is now stronger, better coordinated and composed of higher caliber employees than it has been since war began. The average age of the laboratory staff has dropped considerably since 1941. In April of that year, only two employees were under 21 years of age; today 15 employees are under 21.

In analyzing laboratory labor turnover, one fact deserves special emphasis. Over a period of years, the two or three laboratory employees who are transferred every year to some other department of the company now constitute a good sized group of men. In the last ten years, 25 employees have been trained for other departments and many now occupy positions of considerable responsibility in our sales offices, subsidiary companies and factory. In most cases, the best employees have been transferred and not employees of lesser abilities. While the laboratory affords a fine place for men to obtain basic training, the gradual elimination of older and well trained men is a weakening process. The problem created within the laboratory can be solved only by overstaffing.

In addition to training men for our own company, the laboratory has also trained large numbers of men for competitors and raw material suppliers. In seventeen years, 25 laboratory employees have left our employ to go with other firms in the industry.

In 1945, the laboratory underwent a major reorganization. From 1924, when the laboratory was set up under Mr. Fuller's supervision, until September 1945, formulating activities had been departmentalized along product lines, i.e. paint, varnish, lacquer, etc. This arrangement was quite satisfactory when we made only varnish and enamel but with each succeeding year, new product types, such as Vinylites and ureas have come on the scene to complicate the set-up. For quite some time it has been evident that a subdivision of formulating work by problem types -- i.e. industrial, architectural, etc. -- would provide greater efficiency and less overlapping of work.

When Mr. Johnston was transferred to the General Sales Department, an opportunity was presented to consider a reallignment of personnel and departments. The resulting reorganization represents a long step toward the ultimate goal. The names of the old and new laboratory departments are indicated below:

Department Names Before Change	Present Department Names
Oil Base Enamel (originally Pigment Products)	Architectural Enamel and Paint
Paint	Industrial Enamel and Lacquer
Lacquer	Varnish and Wax
Synthetic Enamel	General Research
Varnish	Testing
General Research	
Analytical and Raw Materials	
Physical and Weather Testing	

In addition to the advantages already mentioned, the new set-up represents a consolidation of departments. Five departments now take the place of eight, thus minimizing overhead. Larger laboratory groups also offer greater operating flexibility when peak loads develop. Overspecialization in the former set-up frequently blinded the groups to the possibilities of other types of coatings. This has been minimized in the new set-up.

Complaints

The complaint record during 1945 continued the trend which started in 1940. Data are as follows:

Year	Total Complaints Reviewed	Per Cent Justified	Complaint Index*
1945	87	37	35
1944	98	36	30
1942	119	34	52
1940	248	22	134

*No. of complaints per million gallons manufactured goods

While the total number of complaints dropped below the 1945 level, the per cent of justified complaints continued to rise. Both figures are probably related to the wartime economic situation which has eliminated the superficial complainer.

The four commonest criticisms in 1945, as in previous years, were drying, consistency, color and gloss. Complaints on drying showed an increase, but less than a fifth of these complaints were justified. Color complaints increased numerically as well as in the percentage which were justified. In 1945, slightly more than half of the color complaints were justified. In previous years, about 40% of the color complaints were justified. Wartime manufacturing conditions probably explain the increase in both the drying and color complaints.

Expense

The overall cost of all laboratory operation was $150,109 in 1945. This compares with $141,782 in 1944. Of the $8,327 increase, $7,745 or 93% represents added labor costs. For the first time since the laboratory was organized, operating costs exceeded the 1929 figure of $142,728.

The following table provides a comparison between 1945 and 1944 laboratory costs in terms of production and sales.

	Cost of Laboratory			
	Per Gallon of Production (Buffalo and Ft. Erie)		Per Sales Dollar	
	1945	1944	1945	1944
Research and Formulating	3.6 cents	2.6 cents	1.2 cents	0.9 cents
Manufacturing Serv.	2.5	1.8	0.8	0.6
Total	6.1	4.4	2.0	1.5

While 1945 operating costs exceeded 1944 costs on both a per gallon and per sales dollar basis, the operating costs in 1945 compared favorably with 1940 figures (6.2 cents per gallon and 2.8 cents per sales dollar). Operating costs in 1944 represented an all time low for the seventeen year period that data have been accumulated.

It should be remembered that manufacturing services (product control, raw material testing, small batch manufacture for the factory, factory problems and complaint investigations) account for 40% of all money expended in laboratory work. This portion of the laboratory's operating expense is primarily related to production and has nothing to do with research or sales developments.

Of the $89,000 spent on development in 1945, about $30,000 was devoted to general research and the remaining $59,000 was spent on specific sales problems (laboratory requisitions). In 1944, $33,000 and $50,000 were spent, respectively on general research and specific sales problems.

In discussing 1945 laboratory operating costs, the following figures provide an interesting picture:

	Production at Buffalo and Ft. Erie	Cost of Research and Development	Cost of Research and Development per gal. produced
Industrial Finishes	945,040 gals.	$ 55,200	5.8 cents
Architectural Finishes (excluding paint)	1,528,863	20,800	1.4
Paint	-	13,000	-
	2,473,903 " tot.	$ 89,000, tot.	3.6 cents, avg.

From these figures, it will be noted that the development of industrial finishes costs about four times as much per gallon produced as did trade sales finishes. This is quite understandable for industrial products are custom made for one specific account whereas trade sales developments are applicable to a large number of customers. Over 80% of the cost of industrial development work is paid by the Industrial Sales Dept. in the form of laboratory charges ($44,842 in 1945) but less than half of trade sales developmental costs are paid by the interested sales departments (combined laboratory charges $9,859 in 1945). What this means is that the Industrial Sales Department pays most of the technical expense involved in its operations, whereas the trade sales divisions pay for no major developments but only for the smaller specific problems arising in individual offices. In other words, our research activities largely benefit the trade sales divisions of the company.

Interesting comparisons can be made with 1929, if certain liberties are taken with the 1929 figures. The juggling of these early figures is necessary because of changes in laboratory and factory accounting practices since 1929. Assuming that the reworked figures are correct, 385,000 gallons of industrial goods were produced at Buffalo and Ft. Erie in 1929 with a laboratory expenditure of $46,000. In other words, each gallon of industrial production cost 12.1 cents per gallon. This is over double the 1945 figure. In the trade sales field, 2,160,000 gallons of paint were produced in 1929 with a laboratory expenditure of $26,000 or at a cost of 1.2 cents per gallon. This figure does not differ appreciably from the 1945 figure. There has apparently been a tremendous increase in laboratory efficiency in the industrial field since 1929, probably as a result of increased familiarity with its problems. We are now selling about three times the volume of industrial goods that we did in 1929 with only 15% more laboratory effort. The amount of money spent in 1945 on trade sales developments, excluding paint, was 20% less than it was in 1929.

Statistical Summary of Laboratory Work

	1945	1944
New products developed	1,594	1,321
Sales problems submitted to laboratory	1,965	1,898
New research problems assigned	96	114
Research problems completed	93	121
Raw material shipments tested	2,106	2,142
Batches tested by control laboratories	15,140	16,209
Service calls made by Lab. employees	112	97