QUALITY CONTROL IN THE BREWING INDUSTRY[1]

DONALD G. BERGER

Jos. Schlitz Brewing Company
205 West Galena Street
Milwaukee, Wisconsin 53201

ABSTRACT

The history of brewing and of brewing quality control technology is reviewed. Emphasis is placed on progress made in microbiological control, cereal development, technical knowledge of brewing chemistry, and packaging improvements. The current industry trend toward lighter brewing is related to flavor technology and product stability. Modern processing equipment and increased knowledge in the field of sanitation microbiology has resulted in sensitive quality control parameters. Included in sanitation consideration is the impact of the good manufacturing practices section of the food and drug regulations. The quality control of brewing is a dynamic, well-organized technology.

HISTORY OF BREWING QUALITY CONTROL

Brewing has interested civilized man for early 7000 years. Historians and archaeologists agree that people living in the Mediterranean area about 5000 B.C. used barley to prepare a fermented beverage. The predominant cereal grain, among others, in England of 3000 B.C., is reported to have been barley *(29)*. The Government of China in 1116 B.C. published a book that discussed fermented beverages *(1)*. The Magna Carta, signed by Charlemagne in 1267 A.D. set forth price regulations for ale and provided penalties for watering the product *(29)*. In Bavaria, 1516, King Wilhelm IV specified that beer will be brewed of barley, hops, yeast, water, and nothing else. This *Reinheits-gebot* is still in effect for beer to be consumed in West Germany *(21)*. Our American history books tell us the Pilgrims landed at Plymouth Rock instead of Jamestown because they ran short of provisions, especially their beer.

This chronology serves as a reminder that beer and ale have been with us for many years, and we should add that no scientific control of brewing was successfully practiced until the late nineteenth century. Louis Pasteur, in the 1870's, brought research and industry together in an exhibition of international cooperation when he visited and worked with several London breweries. He proposed that "every alteration in the quality of the beer coincides with the development of the microorganisms foreign to the nature of the true beer yeast" *(35)*. At this same time, Emil Christian Hansen was working at the Carlsberg Laboratory in Copenhagen, Denmark. He developed a single-cell culture method for brewers' yeast to eliminate "wild yeasts" *(25)*. In 1881, Alfred Jorgensen established his laboratory of fermentology in Copenhagen and using Hansen's technique, in 1884 he introduced pure culture yeast into the Tuborg breweries.

Beer, at this time, was unlike the beer we know today. These historic beers and ales were fermented without refrigeration, contained less carbon dioxide and were consumed fresh—before they spoiled. The alcoholic content was considerably higher and the drink we now call the beverage of moderation, was not so moderate. Monks and inn keepers in Western Europe made beer during the cool months of the year and stored it in caves and hillsides. While in storage, the beer clarified itself by sedimentation. Addition of hops in the brewing process served a dual purpose. It imparted a pleasant bitter flavor and provided a natural germicidal barrier to some spoilage microorganisms. We now refer to this type of beverage as lager beer. Yeast from lager beer fermentation settles to the bottom of the fermenting vat and is harvested for reuse after decantation of the beer. Ale yeast rises to the surface after fermentation and is skimmed for reuse. This provides a very distinct and practical classification of brewers yeast —bottom or lager yeast (*Saccharomyces carlsbergensis*), and top or ale yeast (*Saccharomyces cerevisiae*).

During the early twentieth century, the industrial revolution had begun, breweries in Europe prospered, and almost every sizable city in the northern and central portion of the United States had its own brewery, or two. As the malting barley fields moved west from New England to the Great Lakes, through the Dakotas and finally to California, so did the brewer *(34)*. Immigrants from Germany were numerous during this period. The many brewers who were among these people brought their knowledge and skill to the areas, among others, of New York, Philadelphia, Cincinnati, Cleveland, Chicago, Milwaukee, Detroit, St. Louis, Denver, San Antonio, San Francisco—an industry was formed. Centers of technology were founded, including brewers schools and independent laboratories such as Wallerstein Laboratories, the Siebel Institute, Wahl-Henius Institute,

[1]Presented at the 59th Annual Meeting of the International Association of Milk, Food, and Environmental Sanitarians, Milwaukee, Wisconsin, August 21-24, 1972.

and the United States Brewery Academy. The Master Brewers Association of America held its first meeting in 1888. The science of brewing in America was dormant from 1917 through 1933 as the result of the "noble experiment"—prohibition. But beer came back and the dormancy was broken. The American Society of Brewing Chemists was organized in 1934; the Malting Barley Improvement Association began its work 10 years later. In 1952, five industry groups participated in founding the Brewing Industries Research Institute to engage in cooperative scientific research for the general benefit of the industry. This work was carried on until 1969 when the Institute was dissolved *(27)*.

Brewing laboratories today, as well as in the past, have significantly contributed to the world of science. Is there need to remind you that, in addition to Pasteur, Lavoisier, Priestly, Scheele, Sorensen, Kjeldahl and Büchner had direct contact with breweries or worked in brewing laboratories *(3)*? Brewing science and research is being conducted in a very formidable manner by industrial laboratories and institutes in the United Kingdom, Belgium, Germany, Ireland, Japan, Mexico, Canada, France, and Spain and is reported in their literature *(22)*. Breweries in the United States and their supporting industries constantly contribute to the growth of brewing technology and control.

Significant Areas of Quality Control

Let us define beer. It is the resultant liquid from a fermentation, by yeast, of a boiled and cooled solution containing the sugars from malted barley plus cereal adjuncts, flavored with hops. Quality control of brewing necessarily begins with knowledge and specifications of its primary ingredient.

Malting barley has been the subject of industry research for many years. Farmers wanted disease resistance, firm straw, plump kernels, and a high yield per acre. Maltsters and brewers sought good germination, thin, firm husk, modifiable endosperm, sufficient diastatic power, controlled protein content, and a high yield of fermentable extract. Through the efforts of the Malting Barley Improvement Association, the USDA, and midwestern and western universities continued progress in malting barley development has occurred *(10, 11, 12, 13)*. Hannchen, Traill, Larker, Trophy, Dickson—these are names given to genetic variations and hybrids of barley used during the past few years. A most recent and significant work of the Brewing Industry Research Foundation in Great Britain indicates that malt can be produced without embryo growth in less than one-half the time taken for conventional malting *(14)*. Quality parameters of brewers' malt are detailed in Table 1.

In addition to these physical and chemical analyses, the brewer and the FDA is interested in insect and rodent infestation, insecticide residual, and mycotoxins. Methods used for these determinations are found in publications of the American Association of Cereal Chemists and the Association of Official Analytical Chemists *(15, 16)*.

Several major changes in production methods affecting beer quality have occurred during this century. The first of these was "chillproofing." The colloidal protein in beer coagulates to form haze at low temperatures. In 1911, Leo Wallerstein patented a method to treat beer with the proteolytic enzyme papain *(36)*. This treatment, now in universal use, gives beer protection against chill haze. The enzyme preparation is added after the primary filtration and

Table 1. Summary of Analysis of Midwestern Type Malts[1]

Physical characteristics	Average	Chemical analysis	Average
Bushel weight, Lb.	41	Moisture %	4.4
1000 Kernel weight, g, as Is	30.5	Extract, fine grind, as is %	74.9
1000 Kernel weight, g, dry Basis	29.2	Extract, fine grind, dry basis %	78.3
Foreign seeds %	0.2	Extract, coarse grind, as is %	73.1
Broken kernals %	0.3	Extract, coarse grind, dry basis %	76.5
Growth: 0 - 1/4 %	1	F-C difference %	1.8
1/4 - 1/2 %	2	Color, lab. wort, °SRM	1.46
1/2 - 3/4 %	6	Diastatic power, degrees	132
3/4 - 1 %	90	Total protein, as is %	11.95
Overgrown %	1	Total protein, dry basis %	12.5
Mealiness: Mealy %	97	Soluble protein, as is %	4.83
Half Mealy %	3	Soluble protein, dry basis	5.05
Glassy %	0	S/T Ratio	40.4
Assortment: On 7/64 Screen %	26.1		
On 6/64 Screen %	51.9		
On 5/64 Screen %	20.5		
Thru %	1.5		

[1]Reprinted, with permission, *Brewers Digest*, Vol. 47, No. 4, p. 76.

is allowed storage time to react. The beer is then polish-filtered before packaging. Haze formation can also result from the combination of beer colloids with trace metals, tannins, polyphenols, and polypeptides.

The interest in haze formation led to the study of beer oxidation. Volumes could be compiled with the literature concerning the causes, analyses, and preventive measures of oxidation. Air is injected into wort to provide oxygen for yeast reproduction. Any air absorbed during storage, filtration, or packaging has a detrimental effect on the beer. Until 1968, the analytical method was a measurement of the volume of air mixed with carbon dioxide that could be shaken out of a beer sample *(16)*. It is now possible to measure dissolved oxygen in beer using a portable or in-line analyzer *(23)*.

Beer filtration is an interesting and important quality area. During fermentation, the beer is very turbid. It contains millions of yeast cells per milliliter, protein precipitates referred to as trub, hop resins, and carbohydrate gums. Following fermentation and yeast separation, the natural sedimentation aids in clarification of the beer. But, to produce a brilliant, clear product, filtration is required. Use of diatomaceous earth has just about replaced the pulp filter *(11, 30)*. Quality considerations during this processing are carbon dioxide retention, air or dissolved oxygen content, turbidity levels, and sanitation.

Pasteur focused attention on the microbiological causes of beer spoilage. It was not until 1950 that a practical method for yeast suppression in bacteriological plate cultures of beer samples was discovered *(17)*. The antibiotic cyclohexamide ("Actidione", The Upjohn Co.) is added to the agar plating medium to supress yeast colony development while bacterial growth is not affected. The microscope always had been the basic tool for bacteriological examination of yeast slurry and other non-filtered beer samples, but the use of "Actidione" immediately increased the sensitivity of control. Plating techniques were developed to give results with repeatable accuracy. Washing with ammonium persulfate-phosphoric acid was often used to purify yeast slurry on a regular basis because of the lack of sensitivity and accuracy of the microscopic estimation of contaminant levels *(5)*. It is now possible to specify bacteriological control limits for all operations from wort processing to packaging.

Change has also taken place in beer packaging. Bottles and cans have replaced kegs as the major containers for beer. The returnable bottle has given way to the twist-off non-returnable and the "tin" can is now made of tin-free steel with a pop open, aluminum end. The all aluminum can has found its way to the market and research is underway to use containers other than metal. The quality of incoming materials has received emphasis. Packaging machinery has been improved resulting in high-speed operation and very low oxygen addition.

TABLE 2. SUMMARY OF ANALYSIS OF AMERICAN BEERS[1]

	1951	1971
Apparent extract, %	2.89	2.51
Real extract, %	4.56	4.16
Original extract, °Plato	11.50	11.17
Degree of attenuation, %	60.3	62.8
Alcohol by weight, %	3.55	3.61
Reducing sugars (Maltose), %	1.18	1.08
Acidity (Lactic acid), %	0.14	0.13
pH	4.25	4.22
Protein (N × 6.25), %	0.33	0.33
Color °SRM	3.0	2.8
Bitterness units	—	15.8[2]
Air content, ml	2.3	1.4
Gas volumes (Air corrected)	2.57	2.67

[1]Reprinted, with permission, *Brewers Digest*, Vol. 26, No. 10, p. T140, Vol. 46, No. 11, p. 84.
[2]Average, 1964, 18.8, *Brewers Digest*, Vol. 39, No. 8, p. 65.

THE TREND TO LIGHTER BEER

The industry trend during the past 20 years has been toward the production of a light beer; see Table 2. The definition for "light" is less satiating, less color, and mild flavor. Although individuals have their own definitions for flavor, we must agree that beer is no longer a robust, hearty, strong-flavored beverage. Most American beer is now refreshing and pleasant tasting. To achieve this change, brewers have gradually reduced the specific gravity of the wort using new varieties of malting barley and by varying the malt/adjunct ratio. Hop flavor has also been reduced. The traditional method of hops utilization was the addition of dried hop flowers or cones to the boiling wort in the kettle. Hop extracts are now in common use. Although patents for hop extraction have been recorded since 1869, the general use of extract did not begin until 1964. Consumption of commercial hop extract has risen from 1000 lb. in 1963 to over 3,000,000 lb. in 1970 *(15)*. The control of hop addition and subsequent flavor effect was in the hands of the brewer. No standard laboratory technique for hop flavor analysis or bitterness value was available until 1964 when after nine years of work, the European Brewing Congress and the American Society of Brewing Chemists, in joint action, published a method for this measurement *(4)*. Among the advantages listed for the use of hop extracts are the significant reduction in storage space required, the stability of hop quality in extract form, and the ease of maintaining a standard of bitterness in beer *(14)*.

As a direct result of the change to a lighter, milder brew, the quality of flavor has been a paramount objective. The darker, strong flavored beers of the past tended to mask nuances of flavor caused by wooden vessels, oxidation, process variations, etc. This masking effect has now been removed and flavors contributed by very low levels of alcohols, aldehydes, ketones, mercaptans, phenols, fusel oils, etc. are discernible to the taste. Brewing and flavor chemists, aided by modern laboratory techniques, have published generously on beer flavor and its control. A most comprehensive review of this vast subject has been compiled by Rosculet, listing over 1500 references *(32, 33)*. Some of the methods used to measure flavor characteristics include headspace sampling, direct injection, gas entrainment, liquid-liquid extraction, and liquid-solid extraction, all for subsequent gas chromatographic analysis *(28)*.

Beer Stability

Of concern to the brewer and beer drinker is the stability of beer or shelf life. Stability can be classified into two main categories, chemical and biological. Chemical stability is achieved through the proper balance of colloidal systems and their reaction with trace elements *(20)*. Biological stability is the result of good process sanitation plus pasteurization of the packaged beer or the aseptic filling after either bulk pasteurization or micro-filtration. A high degree of sanitation control is required to consistently package beer aseptically *(24, 26)*. This sanitation control begins with wort processing and carries through fermentation, storage, prefiltration, and final filtration. Aseptic conditions are achieved as a result of the combined efforts of the master brewers, engineers, brewery workers, and quality control technicians. The ultimate test is the bacteriological condition of the product after processing. Certain lactic acid bacteria and species of wild yeast present a potential spoilage situation when their concentration is <10 viable microorganisms in 12 oz. of packaged beer *(6, 7, 18)*.

The classical method for beer preservation has been the tunnel pasteurizer. Bottled or canned beer is conveyed through a series of heated water sprays that gradually increase the beer temperature to 60 C. This heat is maintained for several minutes and the temperature is reduced. After a study of thermal death times of spoilage organisms, the concept of pasteurization units was used *(19)*. One pasteurization unit represents exposure to 60 C for 1 min. During the past few years, along with the trend toward lighter beer, the number of pasteurization units used to preserve beer has been gradually reduced. The reason is two-fold. Sanitary conditions of processing and filling have been improved presenting fewer organisms to be pasteurized. Over-pasteurization has an unfavorable effect on flavor. With these reasons in mind, along with economical factors, bulk pasteurization or microfiltration are used by some brewers.

Sanitation in the Brewery

Twenty years ago many breweries used an open wort cooler of the Baudelot type. Hot wort flowed over an arrangement of pipes that carried a circulating refrigerant. The cooled wort collected in a trough below the pipes and was then pumped to the yeast starters, which in many instances were also open vessels. The potential for wort contamination with this system was very high. Another factor that influenced this potential was manual cleaning of wort process equipment. Modern breweries are now equipped with closed coolers and closed yeast starters. Carefully designed clean-in-place (CIP) systems remove residue and sanitize the equipment with improved quality and efficiency. Wort contamination is almost a thing of the past. The use of wood for fermenting or storage tanks has disappeared along with inherent problems. Another term, now common to design engineers and operating personnel, is sanitary valves, many of which are a part of automated transfer systems. Beer meters, used to tally tax totals, were piston operated and difficult to sanitize. New models are electronic sensing devices that measure volume flow through a beer transfer line with no sanitation problem. Another tradition in processing, the rubber beer hose, is gradually being replaced by stationary, stainless steel transfer lines. The quality of beer process sanitation has improved to the point that, in many instances, 100-ml samples for bacteriological examination have replaced 1-ml samples.

An advantage for brewers in the area of microbiology is the limiting nature of the product. Few organisms other than yeast, and lactic acid and acetic acid bacteria can survive in beer. No pathogenic bacteria are able to use beer as a growth medium *(19)*. The low pH, absence of oxygen, presence of hops, alcohol, and high carbon dioxide tension combine to create this unfavorable condition for disease bacteria. The organisms usually associated with beer spoilage are facultative anaerobic lactic acid bacteria that produce haze and diacetyl. Wild yeast that ferment dextrins and other polysaccharides are also able to cause spoilage in unpasteurized beer. *Acetobacter* will spoil beer if the oxygen content is unusually high.

The most significant microorganism of concern to brewers and to the quality of the beer is the culture yeast. Brief mention has been made as to the nature of beer and ale yeast. In either instance, the culture

yeast is the heart of the fermentation. It must be propagated under sterile conditions and kept sanitary through its generations of use by rigorous attention to the cleaning and handling of process equipment. A diseased yeast culture would have catastrophic effects on the quality of beer. Most breweries have some form of pure culture propagation equipment to insure a regular supply of high quality yeast. The number of generations that a yeast is used depends upon the overall sanitation program in the yeast handling and fermenting areas, the physiological condition of the yeast cells, and the experienced judgement of the master brewer.

Since the time of Pasteur, brewers have practiced sanitation with all the tools and material available. As knowledge of bacteriology, chemistry, and sanitary engineering increased, so did the efficiency of the cleaning methods. Certainly the rudiments of good manufacturing practice had been in effect. Many directives contained in the Federal legislation that became effective in 1969 have been standard operating procedure for some time in breweries. Pest control has been given serious attention for many years. A large midwest grain processor has played a significant role in the application of the Good Manufacturing Practices (GMPs) to brewery operations by providing seminars for managers and supervisors *(2)*. This training has led to self-compliance programs in an effort to cooperate with the FDA. Continued progress is still the watch word in sanitation of beer processing.

We can conclude from this brief review of brewing quality control, its history and progress, that the ancient art of brewing is now a dynamic, well organized combination of science and experience. Change, for the sake of improved methods, better quality, and profit oriented efficiency is a basic part of the brewing industry. Technology is shared through the workings and publications of the Master Brewers Association of America (MBAA), the American Society of Brewing Chemists (ASBC), the Malting Barley Improvement Association (MBIA), the United States Brewers Association (USBA), and the European Brewing Congress (EBC). Research and application of new instrumental techniques will continue to provide the brewers and their customers with a beverage of ever-increasing quality.

REFERENCES

1. Anheuser-Busch, Inc. 1971. Beer its history. Anheuser-Busch, Inc., St. Louis, p. 24.

2. Anonymous. 1971. Lauhoff's management seminar in good manufacturing practices. Brewers Digest 46:2:58-62.

3. Birmingham, F. 1970. Falstaff's complete beer book, Award Tandem Books, New York, London, p. 151.

4. Bishop, L. R. 1964. Measurement of bitterness in beer, J. Inst. Brewing 70:489-497.

5. Brenner, M. W. 1970. A practical brewers view of diacetyl. Master Brew. Ass. Amer. Tech. Quart. 7(1):43-49.

6. Brumsted, D. D., and P. R. Glenister. 1962. The viability of minimal populations of a wild yeast in beer: Possible implications for bulk pasteurization. Amer. Soc. Brew. Chem. Annu. Proc., p. 72-76.

7. Brumsted, D. D., and P. R. Glenister. 1963. The viability of minimal populations of a *Lactobacillus* species in beer in relation to biological control limits for bulk pasteurization. Amer. Soc. Brew. Chem. Annu. Proc., p. 12-15.

8. Campbell, A. D., and J. T. Funkhouser. 1966. Collaborative study on the analysis of aflatoxins in peanut butter, J. Ass. Offic. Anal. Chem. 49:730-739.

9. Cereal laboratory methods, 7th ed. 1962. 28:41-70, Amer. Ass. Cereal Chem. Inc., St. Paul, Minn.

10. Crabb, D., B. H. Kirsop, and G. H. Palmer. 1972. Production and brewing value of malt made without embryo growth. Amer. Soc. Brew. Chem. Annu. Proc. *(In press)*.

11. DeClerk, J. 1957. A textbook of brewing, volume 1. Chapman and Hall, Ltd., London, p. 587.

12. Foote, W. H. 1965. Hannchen barley production in Oregon, its future. Master Brew, Ass. Amer. Tech. Quart. 2:230-232.

13. Foster, A. E. 1967. Development of hybrid barley for the midwest. Master Brew. Ass. Amer. Tech. Quart. 4: 231-232.

14. Friedrich, E. F. 1969. The use hop extracts in brewing. Master Brew. Tech. Quart. 6:175-178.

15. Grant, H. L. 1970. Hop extracts: Past, present and predicted. Master Brew. Tech. Quart. 7:241-245.

16. Gray, P. P. 1938. Air and carbon dioxide in beer, Wallerstein Lab. Commun. 1:21-32.

17. Green, S. R., and P. P. Gray. 1950. A differential procedure applicable to bacteriological investigation in brewing. Amer. Soc. Brew. Chem. Annu. Proc., p. 19-32.

18. Greenspan, R. R. 1966. The viability of minimal numbers of *Saccharomyces diastaticus* in beer. Amer. Soc. Brew. Chem. Annu. Proc., p. 109-112.

19. Haas, G. J. 1960. Microbial control methods in the brewery. p. 113-162. *In* W. W. Umbreit (ed) Advances in applied microbiology, volume 2. Academic Press, New York and London.

20. Heron, J. R. 1971. The non-biological stability of beer, Brewers Digest 46(6):68.

21. Herz, K. O. 1964. Taebernaemontanus on sixteenth century beer. Wallerstein Lab. Commu. 27:93-94; 111-113.

22. Herz, K. O. 1967. The literature of brewing. Wallerstein Lab. Commu. 30:101-129.

23. Hunt, W., O. Espadas. and S. L. Lee. 1968. The dissolved oxygen analyzer and its applications in improving beer quality. Master Brew. Ass. Amer. Tech. Quart., 5:167-170.

24. Jesukawicz, J. 1967. Process conditions affecting the efficiency of millipore filter systems, Master Brew. Ass. Amer. Tech. Quart., 4:257-259.

25. Jorgensen, A., Rewritten by Hanson, A. 1948. Microorganisms and fermentation, 15th ed. Chas. Griffin and Co., Ltd., London, p. 550.

26. Kay, S. 1965. Aseptic filling of beer. Master Brew. Ass. Amer. Tech. Quart. 2:218-220.

27. McFarlane, W. D. 1970. Industry—sponsored research on brewing, Brew. Ind. Res. Inst., Chicago, p. 92.

28. Micketts, R. J., and R. C. Lindsay. 1972. Comparison of gas chromatographic methods of analysis of beer flavors. Amer. Soc. Brew. Chem. Annu. Proc. *(In press)*.

29. Monkton, H. A. 1965. An historical survey of English

ale and beer. Master Brew. Ass. Amer. Tech. Quart. 2:221-229.

30. Pomeranz, Y. 1971. Evaluation of malting barley: Research activities of the national barley and malt laboratory. Master Brew. Ass. Amer. Tech. Quart. 8:191-195.

31. Prechtl, C. 1956. Review of present-day cellaring practices in American brewing. Wallerstein Lab. Commu. 19:11-114.

32. Rosculet, G. 1970. Aroma and flavor of beer, part I (Origin and characterization of volatile components of beer). Brewers Digest 45(4):64.

33. Rosculet, G. 1971. Aroma and flavor of beer, part II (Origin and nature of less volatile and non-volatile components of beer). Brewers Digest 46(6):68.

34. Schaller, C. W. 1964. The production and improvement of malting barley in California. Master Brew. Ass. Amer. Tech. Quart. 1(4):226-227.

35. Van Gheluwe, J. E. A., and M. Dadic. 1970. Louis Pasteur, 100 Years of brewing science. Brewers Digest 45(4): 42-46.

36. Wallerstein, L. 1956. Chillproofing and stabilization of beer. Wallerstein Lab. Commu. 19:65; 95-105.

INTERSTATE MILK SHIPMENTS GROUP HOLDS NATIONAL CONFERENCE IN MAY

The recently reorganized National Conference on Interstate Milk Shipments will hold its 1973 meeting in Des Moines, Iowa, May 20-24. Details were announced by Conference Chairman John C. Schilling, who is assistant health commissioner, St. Louis (Mo.) Health Division.

At the Des Moines meeting, attendees will consider proposals to improve sanitation and reciprocity agreements for the movement of fluid milk and milk products among states. The Conference, organized in 1950, holds this national meeting every two years.

Attendance at the Conference sessions is open to any interested person. Individuals in government, private industry or otherwise interested in the work of the Conference are encouraged to submit proposed subjects for discussion at the Conference and to personally attend and participate. All inquiries and suggestions should be directed to the NCIMS Conference Program Committee, Suite 1105, 910 17th Street, N.W., Washington, D.C. 20006.

In its recent reorganization, the Conference discontinued the use of task forces to study various problems, and replaced them with three separate operating councils. The new councils are one on Laws and Regulations, chaired by Dudley Conner, Kentucky Dept. of Health, Frankfort; one on Responsibilities of Conference Participants, the chairman of which is Jay B. Boosinger, Florida Dept. of Agriculture, Tallahassee; and one on Application of Conference Agreements, chaired by Milton Scherpf, Hawthorn Mellody, Inc., Chicago.

Conference chairman Schilling has contacted all participants in the most recent conference meeting, requesting they submit subjects for 1973 Conference discussion to the program committee.

Mr. Schilling, a graduate of the University of Missouri, has been with the St. Louis Health Division since 1946. He served as chairman of the Sanitation Section of the Missouri Public Health Association and he is presently on the board of directors of the Missouri Mastitis Council.

Council Responsibilities

The council on Laws and Regulations is concerned with the various sanitation requirements, the control of milk supplies and other legitimate provisions that are part of the Conference Agreement. Chairman of this council is Dudley J. Connor, Director of the Grade A Milk Program in the Division of Environmental Service, Kentucky Dept. of Health, Frankfort. Connor previously served with the Kentucky Dept. of Health as supervisor in the Milk Control Program and as a milk survey officer and inspector.

The council on Responsibilities of Conference Participants is concerned with matters which relate to all conference participants--federal, state, and local governmental associations, and educational and industry representatives. Chairman of this council is Jay B. Boosinger, assistant director of dairy industry, Florida Dept. of Agriculture and Consumer Service, Tallahassee. He previously served as a dairy specialist with the Dept., and prior to that was a graduate assistant in the dairy science department of the University of Florida.

The council on Application of Conference Agreements deals with problems of reciprocity and with other conference agreements. Chairman Milton Scherpf is vice president, quality assurance for Hawthorn Mellody, Chicago. Previously he served as assistant vice president, manufacturing, and director of technical services of his company.