tional Confectioners' Association for transmission to the offending manufacturers, are the methods which will give prompt and satisfactory results.

These manufacturers are very keen to merit public confidence and when the situation is placed fairly and squarely before them with the weight of organized effort back of the protest, I believe that improvement will be rapid and permanent.

I therefore recommend that the Section of Food and Drugs of the American Public Health Association express its disapproval of objectionable forms of candy playthings such as purses, necklaces, etc., and instruct its secretary to take up the matter of formulating a definite protest for communication to the proper officers of the National Confectioners' Association.*

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*Professor LaWall's recommendation to communicate with the National Confectioners' Association was favorably acted upon by the Section.

THE TREATMENT OF SWIMMING POOL WATER WITH ULTRAVIOLET RAYS

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Read before the Sanitary Engineering Section of the American Public Health Association at the Fiftieth Annual Meeting, New York City, November 17, 1921

MANY factors have combined, in recent years, to promote the use of the indoor swimming pools. The ever increasing contamination of our lakes and rivers with domestic and commercial waste is rapidly forcing those who seek safe bathing away from the natural out-of-door bathing beach. The "old swimming hole" no longer exists in the degree of purity and inviting appearance in which it did 50 years ago. The municipal bathing beach and the bath house facilities provided in the large cities on our lakes and rivers have been found far from adequate for the public needs. In Chicago, Cleveland, and Detroit, difficulty is experienced in maintaining the water in safe condition, and the fact that the period of use of appurtenances is but three to four months at most, brings the cost, in many instances, very near that of an indoor pool.

The ability to swim is now a common requirement for graduation from high school, and the pool is, therefore, a part of the standard equipment of most new buildings.

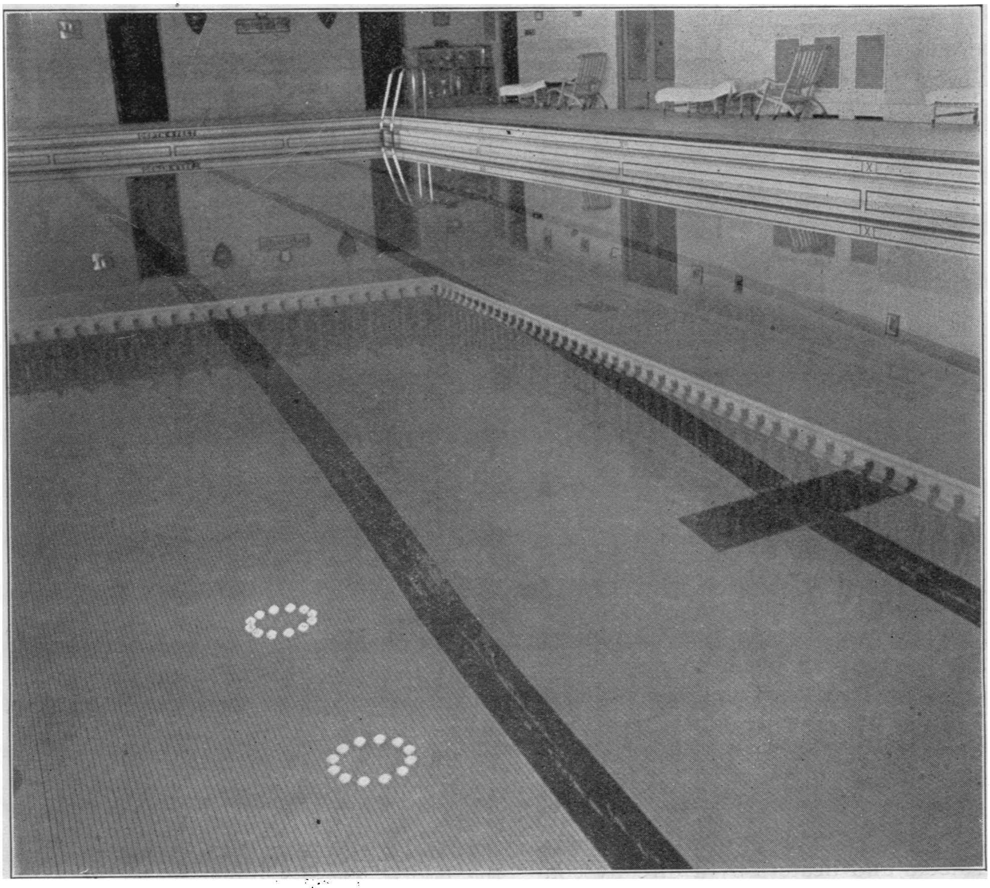
With greater use of indoor pools, the public is demanding that a higher sanitary standard shall prevail. It is no longer sufficient that the water be clear. The patrons, as well as the swimming instructors, are learning the significance of bacteriological results, and show a keen appreciation of the results obtained by the method of treatment employed.

A high degree of efficiency of operation coupled with ability to give nearly continuous service is now required of treatment plants. The treatment of swimming pool water has developed more rapidly than the treatment of municipal supplies. There was first a period of draw and fill, when the only treatment was to fill the pool and after some use empty the water to waste. This may be compared with the period when cities confronted with a contaminated water supply sought a new source which was as yet undefiled. Second, came the period of filtration, when in most instances the water from a contaminated source was filtered, to render it suitable for use. Next came the period of sterilization when the load became too heavy to be handled by filters alone, and some form of sterilization had to be provided to take care of the overload.

From this point on, the problem of municipal supply and swimming pool treatment begins to differ essentially. The municipal supply has reached its goal of delivering pure water to the consumer, but the swimming pool is, by the nature of its use, continually contaminated. The danger, which is believed to exist as a result of this continuous contamination, is not infrequently questioned, and the argument is put forth that the instances of disease, which have been traceable to swimming pools, do not at all compare with the number of patrons. We find the explanation of this seeming discrepancy in the fact that the virulence of many pathogenic organisms decreases rapidly outside of the human body. Infections, therefore, are probably in most cases limited to the group using the pool at the same time, so that the infectious material while still fresh, is washed onto the mucous membranes.

The supervision of the bathers, requirement of preliminary baths, and other common items of sanitary control, will do much to maintain a safe water, but are not in themselves sufficient. Just as in the protection of our milk supply we must rely on pasteurization, even though we have dairy inspection, so in our swimming pools we must rely on a carefully planned method of water treatment, even though a first line of defense is thrown up in the form of sanitary supervision of the bathers.

It has been the good fortune of the writer to have an opportunity to make a rather complete study of the operation of a well built and carefully operated swimming pool at the Detroit Athletic Club, and I believe the results are of such



Swimming Pool, Detroit Athletic Club

a nature as to be of interest to all who are confronted with the problem of swimming pool treatment.

The pool under consideration is located on the fourth floor of the building with exposure on the south and east sides, so that it is adequately lighted during the daylight hours. The plan shown herewith, Figure 1, gives details as to size, shape of bottom, scum trough, inlets, outlet, and water distribution system. The capacity of the tank to the scum trough is 80 thousand gallons. Attention is directed to the arrangement of the inlets. There are 22 in all, placed approximately 8 feet apart around the pool at the bottom. These inlets are connected to a 3 inch header which runs entirely around the pool and connects again to the main, so that the head is uniform at each point and an equal volume of water is admitted by each inlet.

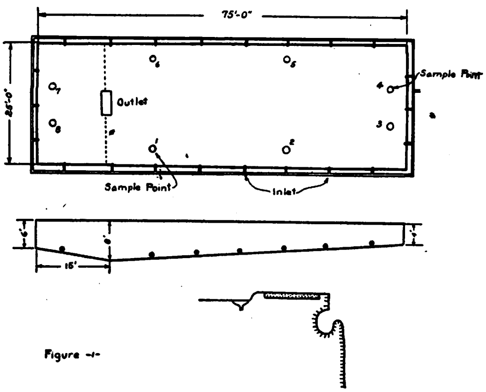


Figure -1-

The outlet is at the center of the deep section, and insures positive circulation from all parts of the pool.

The treatment plant consists of two 84-inch hygeia pressure filters and a Type E-2-2 ultraviolet ray sterilizer. (Type E-2-2 consists of two units of pressure type 1,000 gallon per hour sterilizers, which, when operated in series will handle 5,000 gallons per hour.) The water is circulated through the filters, sterilizers and heaters by a directly connected centrifugal pump, adjusted as to speed to deliver approximately 7,000 gallons per hour.

The filters are larger than are ordinarily found in swimming pool practice, and were purposely made larger to permit the filling of the pool in about six hours. As operated, the rate of filtration is 1.7 gallons per square foot per minute, which is rather low for pressure filters. The filters are ordinarily used without alum except when the pool is being refilled with fresh water.

The study of this pool was divided into three periods of one week each as follows:

First period. During the first period the pool, after a thorough cleaning, was filled with filtered city water at the rate of 7,000 gallons per hour, and during the daily period of use, from 9 A. M. to 5 P. M., filtered water was supplied to the pool and the displaced water run to waste through outlet at the same rate.

Second period. During this period, the pool, after being filled with filtered and sterilized city water at the same rate as before, was supplied with filtered and sterilized water at the rate of 7,000 gallons per hour, the displaced water running to waste as in the first instance.

Third period. During this period, the pool after being filled, as in the preceding period, was supplied with filtered and sterilized water at the rate of 7,000 gallons per hour, by recirculating the water in the pool through the treatment plant.

A meter was installed on the supply line, metering all water going to the pool.

During the entire study bacteriological analyses of the water in the pool were made from samples collected in the morning, just before the pool was used, and in the afternoon, just after the peak load. Eight sample points were established as shown on the plan. A study of the individual and composite samples drawn with a pipette from each station, indicated the reliability of the composite samples, which were used as representing the pool. These samples were run following the standard methods of water analysis. Plates were made of 0.1 and 1 c. c. portions, and complete records of attendance and temperature were kept. The pool is in general used by classes (both men and women) so that it was easy to establish the time of peak load, and there was very little use after the afternoon sampling period. For the most part the same individuals are concerned in all of the three periods, thus, the question of the effect of personal habits is eliminated.

In Table I is shown the results of examination of composite samples taken from the pool daily, morning and afternoon, during the three periods, as well as the average daily attendance, and the temperature of the water.

TABLE I.

BACTERIOLOGICAL EXAMINATION OF D. A. C. SWIMMING POOL
37°—24 HR. COUNT

	A. M. Max.	A. M. Min.	A. M. Av.	P. M. Max.	P. M. Min.	P. M. Av.	Av. dly. att.	Av. temp. of water	Water used.
1st. Per.	319	16	116	606	29	208	78	80	255,780 gal.
2d. Per.	77	9	28	110	17	64	66	81	244,020
3d. Per.	70	3	19	120	7	41	98	80	recirculates 7,000 gal. 1 hr.

Let us consider the results for the first period. Filtered water was added at the rate of 7,000 gallons per hour, yet the afternoon count is nearly double that of the morning. Figure II shows the rate at which purification is accomplished under these conditions, using Gage's formula.* This would indicate that a 50 per cent purification took place in the 8 hours of use. At the end of the sixth hour, which was the time of usual occurrence of the peak load, 42 per cent purification should have been accomplished. Samples of the filter effluent show an average count of 5 with a maximum of 10 and a minimum of 1.

CHART SHOWING RATE OF PURIFICATION OF D.A.C. POOL
When Supplied at the Rate of 7000 Gal. per Hour for an 8 Hour Day

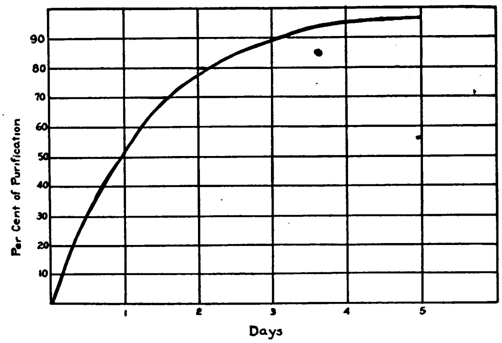


Figure -2-

Turning our attention to the second period when the rate of purification by dilution was the same as in the first period, the only difference in operation being the sterilizing of all water furnished to the pool, we had still a considerable increase of afternoon over morning count, but what is more remarkable, an average count which is but one quarter of the average during the first period. It is true that the attendance is slightly lower but the temperature is one degree higher.

Are we to presume that the lower attendance together with the fact that sterilized water was delivered to the pool are responsible for a drop of 142 bacteria per cubic centimeter in the average count after use? I, personally, do not believe so. There has been some evidence put forth in the last few years to show that the effect of ultraviolet rays on the bacteria in water is not confined to the short interval during which it is exposed to

*Note: Gage's formula $D=\left(\frac{V-v}{V}\right)n$

D=portion of dirty water remaining.
V=volume of pool.
v=volume of water added at each dilution.
n=number of successive dilutions.

the direct rays of the lamp, but that the absorption of the radiant energy by the water renders it mildly germicidal. It would seem that the results of the second period are further evidence in the support of this phenomenon.

The results of the third period show a further decline in the bacteria content of the pool, both in the morning and at peak load, in spite of a 20 per cent increase in attendance. The presence of B. Coli in the pool, though not great, is of interest. During the first period, three out of twenty-four 10 c. c. portions developed gas. During the second period five out of twenty-six 10 c. c. portions showed gas, and three out of twenty-six 10 c. c. portions during the third period showed gas.

At no time were B. Coli shown to be present in 1 c. c.

It is of interest at this time to compare the yearly average operation of this pool during the fiscal year ending June 30, 1916, which was before the installation of sterilizers, with the past year. Table II shows these results.

TABLE II.

BACTERIOLOGICAL EXAMINATION OF D. A. C. POOL YEARLY AVERAGE

	37° Count Max.	Min.	Av.	Coli. 100 c.c.
1916	216,000	0	26,700	350
1921	240	0	61	0.75

It is, of course, possible that the sanitary supervision of the bathers was better during the first period of this study than during the entire year of 1916. However, the operation of the pool is under the direction of the same person, and the patronage is essentially the same.

Under the normal operation, the water in the pool is circulated continuously at 7,000 gallons per hour, 24 hours per day, which gives a purification curve as shown in Figure III. The water remains in use for periods of 5 or 6 months without fresh water being added except what is necessary (6 or 8 inches per day) to flush off the surface and to make up for loss over the scum trough.

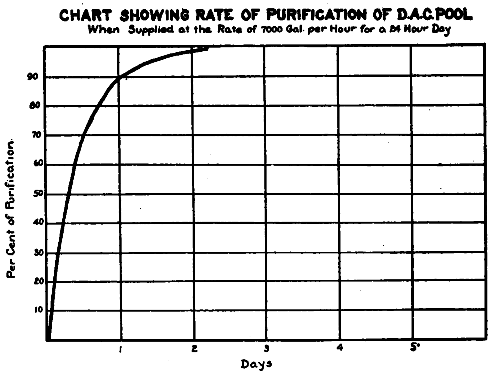


Figure -3-

The question of change of chemical content during long periods of use is frequently asked.

Table III compares the average of six chemical analyses of pool water after 5 months' use with the average chemical content of the city tap water for 22 months.

TABLE III.

COMPARATIVE TABLES OF CHEMICAL ANALYSIS OF D. A. C. POOL AND DETROIT CITY TAP WATER

	Average of 6 samples after 5 mos. use D. A. C.	Average of 22 monthly samples City Tap Water
Total solids	130.0	151.7
Non-volatile solids	73.0	100.5
Volatile organic matter	59.0	51.91
Free ammonia	0.111	0.038
Albuminoid ammonia	0.228	0.109
Chlorides	9.0	5.08
Nitrates	0.104	0.0224
Nitrites	0.0003	0.0

While there is a noticeable increase in the albuminoid and free ammonia, the chlorides and the nitrates, it is questionable if the increase is sufficient to be considered an obstacle in the way of recirculation. With water at 4 cents per thousand gallons and the central steam at 25 lb. square inch pressure at $1.05 per 1,000 lb. of condensate, the cost of treatment for the first and second period was $15.71 per day, as compared with $2.56 for the third period. This latter figure includes the interest and depreciation on the sterilizers.

The conclusions which we may safely draw from this study are:

1. That a high turnover rate and uni-

form distribution around the pool are most desirable features in swimming pool treatment.

2. That a bacteriological standard is indispensable in judging the condition of a pool, and should be used to check up any method of treatment employed.

3. That the supplying of a high grade of water to a well designed pool in large quantities and wasting to sewer will give a fair bacteriological result but is uneconomical in cost.

4. That sterilization by ultraviolet rays of swimming pool water in a recirculation system properly designed and operated gives a water in the pool which compares favorably with the government standard for drinking water.

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DENTAL WORK AS A PROPHYLACTIC MEASURE IN IMPROVING THE PHYSICAL CONDITION OF EMPLOYEES

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Read before the Industrial Hygiene Section of the American Public Health Association at the Fiftieth Annual Meeting, New York City, November 18, 1921

THE relation of dental defects to systemic conditions has been very thoroughly investigated and written about during the past few years. As is usual with the advent of new ideas, two schools of thought were quickly developed.

One school advocated extremely radical procedures, such as the ruthless extraction of all dental organs open to the slightest suspicion; the other school, ultra conservative, refused to accept the evidence shown by the remarkable restoration to health of many persons, after dental infection had been removed.

We must not allow the battle smoke of this hotly contested controversy regarding dental infection to blind us to the more important consideration of the part played in health or illness by unclean and unsanitary mouths.

It should be obvious to all that if pure water and clean wholesome food are really important factors for health, it is highly desirable to maintain the purity of the water and the wholesomeness of the food until it reaches the digestive apparatus of the individual, where it will be changed into a form that will be assimilated easily and thus sustain life and health.

It is here that the importance of mouth hygiene comes in. Of what avail is it to put pure wholesome food into a mouth filled with the decomposing debris of previous meals—of a mouth with diseased or broken down teeth?

Should it be surprising, then, that a procedure which brings about a continued clean and hygienic condition of the mouth should result in an improved physical well-being?

Careful and scientific investigation by Professor Gies, and Professor Kligler of Columbia University, shows that there is a reduction in number of at least 495 million bacteria per mm. in a fairly clean mouth as compared with a dirty one. This did not take into consideration a clean mouth.

It is safe to say the bacteria found in a clean mouth are practically harmless, while the bacteria that grow and multiply in a dirty mouth become virulent and dangerous. The long continued presence of bacterial masses in and around the teeth bring about inflammation of the gum tissues. Normal, healthy gums are practically impervious to bacterial invasion. But inflamed gums become open gateways for the entrance of harmful bacterial life into the blood-stream of the