items; and a large capacity tin-lined still of commercial manufacture used in conjunction with a carbon filter and deionizing column.

Water sources for examples 8 and 9 both had high growth-promoting residuals. One was a result of excessive solder flux used in connecting pipes; the other, a result of a slug of material released from an exhausted carbon filter in the system.

In an entirely different application of this test, Jones and Greenberg (4) used the procedure to show presence of growth-stimulating substances in redwood storage tanks. These examples indicate that a test procedure can be developed to provide additional information about the quality of distilled water with particular emphasis on its suitability for microbiological uses.

References


SANITATION STANDARDS–A BRIEF HISTORY OF THEIR DEVELOPMENT

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Man has equated his needs to dependency upon common denominators in all fields of human endeavor: language, law, folkways, taboos, moral codes, ceremonies, religious rituals, educational procedures, social and business customs, and industrial practices. The process whereby these have become standards have involved establishing through authority, custom or general consent, a rule or model to be followed.

In developing standards, human need is the stimulus. English common law is perhaps the best example of how this should be effected. The establishing of law by this method has been one of the strongest and most fundamental forces in the development of our society. It is slow but it requires that each law reflect the consensus of all that will be concerned with its subject matter, and thus it provides for a more gradual transition than other systems of legal jurisprudence.

Modern society has removed much of the opportunity for the close association that development of laws or standards under this system originally required. Recourse, by necessity, has been to decisions by highly specialized groups but, unless representative individuals with backgrounds or contact understanding of the areas to be standardized are included, the results often assume the nature of autocratic decrees. There is nothing more useless than a standard or part of a standard that attempt to answer needs by the decree method. Questions settled by this method do not remain settled because they have not been solved but only decided.

History is replete with notable failures in standardization because the human element was ignored. Shih Huang-Ti was a founder of the Chinese Empire and under him was built the Great Wall. In his design for Chinese unity he created one law, one weight, and one measure. The Great Wall stood, but not his weights and measures. He had ignored social standards and customs which rendered his design impractical. Sanitation standards must be compatible with existing social standards such as manners or customs; otherwise they become square pegs in round holes and the resulting irritations render them impractical.

1 Presented at Annual Meeting of the Mississippi Association of Sanitarians, May 7, 1965 at Jackson, Mississippi.
The rapid advance of technology has resulted in the bringing of more and more people together into cities, factories and other groupings. Attendant needs for the development of sanitation standards along with other standards has accelerated accordingly. This situation has been viewed by many with increasing fear of the consequences. They fear that the world will be reduced to dull mediocrity through increasing standardization. One school goes so far as to predict that the machine age through technologic development, specializations and standardization will either destroy the race or reduce it to a completely static condition similar to the communal life of ants and bees.

This fear is based upon an underlying misconception of standardization as a static solution to a problem. "Once solved, forever solved" is not a truism. A contemporary standard merely represents the best way to do a thing— at the moment. When the future uncovers a better method, it will be incorporated into a new standard. Today, scientific research is the important ingredient in this process and one which we will place increasing dependence upon in the development of future standards.

**EARLY SANITARY STANDARDS**

The origin of sanitary standards predates man's written history. The books of Leviticus and Deuteronomy in the Old Testament contain some of the earliest written laws on sanitation. These laws evolved around the disposal of human wastes and the use of certain foods. In Deuteronomy, one finds the first mention of excreta disposal: "Thou shalt have a place also without the camp, whith thee shalt go forth abroad. And thou shalt have a paddle upon thy weapon: and it shall be when thou wilt ease thyself abroad, thou shalt dig therewith, and shall turn back and cover that which cometh from thee."

The Jewish people of that period determined that sanitation was a way of life necessary to their survival. Their consideration of these laws as moral codes resulted in their incorporation into Jewish religious law.

As communities developed and problems in water supply and waste disposal multiplied, there were many trial and error attempts to solve them. At Bismya an ancient Symerian or pre-Babylonian city estimated to have been inhabited over 4,500 years ago, excavations have uncovered cess-pool like arrangements beneath the houses. These consisted of holes dug in the ground some 45 feet in depth with the periphery having numerous clay drains. Holes were cut into these drains and the entire system packed with sand.

Water sanitation during the Roman period involved the use of the settling principal at the source of water by use of a reservoir. Intermediate sediment basins are found throughout the aqueducts. The final reservoir greatly resembled many of the covered slow-sand filters used in this country during the early 20th century. Roman engineers were aware that the absence of light prevented or altogether checked the growth of algae and other objectionable forms of water vegetation. This visible era of sanitation was productive of many useful sanitary standards that are still applicable today.

The Romans in their water delivery system used pipes of lead, burned earthenware and bored-out blocks of stone. Burned earthenware was used more frequently because records indicate that the Romans were aware of the injurious effects of lead and looked with suspicion on water that had been conducted through lead pipes.

The quantity of water supplied in Rome compared favorably with the per capita water allowances provided in the principal cities of the United States during the first two decades of this century. It was far in excess of the per capita water allowance supplied to British and European cities at this time. The Roman standard for water per capita was about 100 United States gallons per day. This quantity of water being poured into a limited area daily, created a need for some system of disposal. The resulting drains were constructed according to standards supervised by Roman civil authorities.

The Cloaca Maxima, constructed during the period 735 to 510 B.C., was initially intended to drain the low, swampy area about Rome to the Tiber river but, prior to its completion, need for a waste disposal carrier facility caused it to be used as a sewerage system for the city. Eventually every street in Rome was drained by a branch of this system.

In passing, it is interesting to note that every house or building in Rome was required to be connected to the sewer system. Unfortunately drainage systems did not extend above the first floor, and since many of the houses and buildings were multi-storied and inhabited near the top by the poor, these people had no access to the public sewer. They resorted to the practice of throwing liquid and solid waste materials from windows and balconies, oftentimes to the discomfort or injury of the pedestrians.

Conditions became so bad that the Roman Senate passed the *dejecti effusive* act, which gave damages against a person who threw or poured anything from a place or upper chamber upon a road or street frequented by a passerby, or on a place that people used for standing. The act was limited to damages for personal injury, and strangely enough, applied only during the day and not at night which was the most dangerous time. This act was the first written
legal instrument to deal with sanitary nuisances.

Standards for personal hygiene originated with the practice of bathing. At first it was done for pleasure, cleanliness and health. The practice was later incorporated into a daily religious ritual and required the drawing up of facility standards in order that the populace could be accommodated. According to Pliny, Rome needed no medicine but the public baths for 600 years.

**The Dark Ages**

With the fall of Rome, development of sanitary standards came to a standstill and existing standards regressed to an unbelievable point. The following 1000 years produced nothing except scourge upon scourge of filth diseases. It is estimated that 40,000-100,000 victims died during this period from filth diseases alone which could have been prevented by application of the sanitary standards employed by the Romans.

The brotherhood of knights, noted for their skill in combat, adopted a creed of uncleanness as being next to godliness. Clergy and laymen vied to see who could live in the most filthy manner. Filth was considered as an outward indication of inward piety and sanctification.

By the late 16th century, the impact of these filth diseases upon human life stirred the sleeping giant of compassion in men’s minds in the Christian world and resulted in the creation of a movement for improvement in sanitary manners. The Spaniards repaired the Roman aquaducts in their country and utilized them, the teachings of Hippocrates and other ancients were rediscovered, but the exercise of their application in terms of the existing folkways and religious beliefs made for slow progress.

In 1665 when plague exacted its terrible toll of human life in London, much blind effort was directed toward establishing standards to improve the sanitary environment. Most were standards deducted from erroneous concepts of disease, such as the burning of pitch to purify the air, the firing of cannon to drive miasma away, and the wearing of amulets. John Cay, an English physician, had earlier written a pamphlet advising the people to take away the cause of disease by ditches, burying of dead bodies, removing dung hills, avoiding carrions and letting in open air.

Quarantine was recognized as an old principle of preventing the spread of disease even during this period. Watchmen were mobilized for posting at infected households to prevent exit and entry. This type of quarantine was complete, and the misery of the shut-ins was terrible with no food, water or care. There were 100,000 deaths in London during this epidemic and the type of quarantine employed possibly contributed materially to this total.

**A New Day Dawns**

With the industrial revolution which began about 1750, the need for sanitary standards increased as populations became more concentrated in cities. This situation initiated the search for scientific knowledge in developing standards. By 1832 the literature makes reference to orders by English boards of health for sanitary measures against cholera. The order had to do with the continual burning of pitch and tar and the strewing of lime throughout the streets.

In 1848 a public health act for England was passed, establishing a general board of health. It was given the authority to provide measures of protection against the epidemic of cholera and the board’s first action was the establishment of “systems” of precautionary measures. These were directed toward the improvement of environmental conditions in depressed and “offensive” localities. It provided in part, “to keep the persons and the dwelling place clean, to allow of no sinks close to the house, to admit of no poultry or animals within the house, to keep every apartment as airy as possible by ventilation and to prevent crowding wherever there are sick.”

These board action “systems” had the effect of law with penalties for noncompliance. The severity of the penalties depended upon the period and the conditions under which the violations occurred. When epidemics were raging the magistrate counts meted out severe penalties but, during those periods without epidemics the charges were usually dismissed, creating caution on the part of the health officials and limiting their effectiveness. Present day counterparts to this situation are frequently experienced by the public health profession.

Although the historic stink of the Thames in 1858, resulting from the dumping of raw sewage from 3,000,000 London inhabitants, did not produce the predicted epidemic, its offensive nature moved parliament to action in demanding investigations into sewage handling methods. These provided important information for the later control of sewage wastes.

During this period, the United States was considerably behind the Europeans in sanitary methodology. In 1857 Julius W. Adams was commissioned to prepare plans for sewering the city of Brooklyn, New York. He found the engineering profession of that day wholly without data of any kind to guide in proportioning sewers. Construction was haphazard and failures commonplace. Failures were given wide publicity and consequently the engineering profession was not highly regarded as a reliable source for corrective measures during that period. Most of the
real accomplishments in sanitary science during that period came from isolated investigations by individuals in the medical profession.

The period between 1850 and 1900 produced more research in the field of sanitation than had been produced during the previous eighteen centuries. England developed the slow sand filter and in looking for chemicals to destroy sewage they discovered those substances which we employ today in water purification.

In 1887, a Mr. Dibden presented a paper before the English Institute of Civil Engineers, discounting the use of chemicals for sewage destruction. He pointed out that the use of the bacterial organisms in sewage was a method whereby its organic matter could be made innocuous. This turned the investigations in the right direction and the Massachusetts State Board of Health perfected this method of sewage treatment.

Air ventilation standards for industry and public places were developed during this time. Strangely enough they were first applied to prisons in an effort to revive the miasma theory. Every scientific method known at that time was applied to the analysis of air in such places and, although they failed to substantiate the miasma theory, their results became the base-line for ventilation standards. Medical authorities of the British Army devised the first scientific garbage and trash disposal methods about 1860 and in 1885 Lieutenant H. I. Reilly, United States Army, built the first American garbage furnace. Known as the “garbage destructor”, many of these were still being used in 1944.

**Development of Milk and Food Sanitation**

Standards for the heat destruction of organisms in foods were referred to in 1848 by Robert Angus Smith, M.D. in his report to the English Metropolitan Commission of Inquiry. This report in part read: “This I find has been stated by Dr. Playfair in his evidence. That violent organic which has killed so many in Germany, sausage-poison, is destroyed by hot water. Although perhaps we do not boil or heat meat at all times to the temperature necessary, the uneven part of a piece of beef is frequently red, a color which is removed according to Liebig, at a temperature so low as 140 degrees Fahrenheit. This is the temperature at which, if I recollect, Dr. Henry said that the pestilential matter was removed, showing that at about this point a change occurs in organized matter, making it incapable of its former decompositions.” It is interesting to note that this 140°F., which later became incorporated by Pasteur in his pasteurization process, indicates that much of Pasteur’s findings were based on earlier work.

Attempts to establish milk sanitation standards originated about 1857 in certain English communities where epidemics of typhoid fever were traced to milk supplies. Doctor Michael Todd, an epidemiologist of that period, not only established that milk was the vehicle in these particular epidemics but in 1867 showed that milk was a vehicle in a scarlet fever epidemic. In 1877 an epidemic of diphtheria was traced to a milk supply. These were notable contributions because bacteriology was as yet an undeveloped science.

Koch devised his method of solid cultures for bacteria in 1881. This opened the door to the investigative measurement of the bacterial quality of milk which could be interpreted in terms of environmental conditions surrounding its production and handling. This method along with epidemiological reports were laid before the International Medical Congress in 1881 and drew universal attention to milk as a vehicle of infectious disease, creating pressure for the adoption of standards. The first standards had been incorporated in the form of regulations for the production and handling of milk in 1879 by a committee in the Board of Health for England. Known as the “dairies, cowsheds and milk shops order of July 1879,” it was amended in 1885 and 1886.

In the United States standards for milk evolved from fundamental investigations on the sources of bacteria in the food product by H. S. Conn at Middletown, Connecticut in 1889. In 1892, Sedwick and Batchelder reported on a laboratory method used in examining Boston milk which brought to the public’s attention the importance of dairy sanitation.

**Development of Regulatory Action**

In 1893 sanitary control of certified milk based on laboratory methods was initiated by Dr. H. L. Coit and Stephen Francisco at Montclair, N. J. and in 1894-1895 H. L. Russell at Madison, Wisconsin, established definitions of the sanitary quality of milk through the use of laboratory methods. By 1896 the New York City Board of Health established a permit system governing the sale of milk. Its right to enforce the attendant rules and regulations of this permit system was challenged in 1905. The case eventually reached the United States Supreme Court, which sustained their action and thereafter established the right of officially constituted boards of health to control the sanitary quality of municipal milk supplies. This right has never been successfully opposed.

The publicity given to this case resulted in accelerated regulatory activity in the sanitary control of milk. Between that time and the 1920’s many cities adopted milk sanitation ordinances which were as varied in their methods as they were in their effectiveness. It remained for Leslie Frank and Urban
Davis Franklin to develop in 1924 a standard milk ordinance that would establish effective uniform standards.

Food standards originated through a legal relationship with nuisances. The Nuisance Removal Act of 1855 in England sets forth extensive powers of medical officers of health and their representatives who were designated inspectors of nuisances in the condemning and seizing of unwholesome food or food products. It was this act that originated the right of officials to inspect “at all reasonable times.” The criteria for condemnation and seizure was based on the appearance of the meat of food and stated, “If any of the substances mentioned appear diseased or unsound or unwholesome, or unfit for the food of man, he may seize and carry away the same himself or by an assistant, in order to have the same dealt with by justice.” Justice included destruction, payment of a penalty or confinement, the decision resting with the magistrate.

It was not until 1878 that the United States developed any quantitative standards for food. In that year, the Commissioner of Agriculture reported on the examination of sophisticated tea. This was followed by many others until in 1883 the initial bulletin of the Chemical Division of the Department of Agriculture was issued to the public. From that time the Chemical Division began to assume responsibility for the development of standards for foods.

In 1889 Congress appropriated funds directly to the Chemical Division and authorized them to extend their investigations to drugs and liquors. American foods at that time were extensively adulterated with physically damaging substances. Control measures were inadequate and Congress passed an act in 1896, providing for general publicity of the Chemical Division’s findings. Food manufacturers strenuously objected and later appropriations carried the requirement that, before publication of adverse findings, an opportunity be afforded the manufacturer to appear before the Secretary of Agriculture for a hearing. This was the progenitor of hearings provided for in later laws prior to punitive action or criminal prosecutions.

From 1902 to 1907 the Department of Agriculture carried out the historic experiment that was to result in effective food and drug laws. Doctor Harvey W. White, then head of the Chemical Division, conceived and directed the famous poison squad service of experiments. These experiments were performed upon twelve young male volunteers who subjected themselves to a diet designed to determine the safety of preservatives. The results indicated that many substances were injurious to human health.

These findings received much publicity and occurred in conjunction with a growing resentment by farmers over the adulteration of market milk, butter, lard, meat and other foods by the food industry. Public clamor for standards was so great that by 1906 most of the states had passed pure food laws. Despite these laws, manifold abuses developed more rapidly. Articles by Samuel Hopkins Adams, Edward Bok, Mark Sullivan and Upton Sinclair along with support from the National Association of State Dairy and Food Departments and the American Medical Association, resulted in President Theodore Roosevelt forcefully calling for food and drug legislation. After considerable debate the Food and Drugs Act of 1906 was passed.

The Division of Chemistry of the Department of Agriculture became the Bureau of Chemistry. It continued under this title until 1927 when it was separated from the Department of Agriculture and was renamed as the Food, Drug and Insecticide Administration. In 1930 the designation was shortened to the Food and Drug Administration.

In the broad field of sanitation as it now exists, I have attempted to cover the origin of those standards in the areas upon which the science was built. Future standards and the future development of sanitary science itself rests upon these foundations.

These future standards will have to keep pace with the impact of technology upon the environment. Space travel, atomic-industrial processes, modern agricultural methods and food processing procedures along with metropolitanism are but a few of the developing aspects in our civilization. In our time we shall be required to provide standard solutions to the problems engendered by their impact upon the environment.

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ASSOCIATION AFFAIRS

CERTIFICATES OF REGISTRATION ISSUED AT INDIANA SANITARIANS ANNUAL MEETING

Highlighting the annual meeting of the Indiana Association of Sanitarians, Inc., on October 5-7, 1965, was the awarding of certificates of registration to 172 Professional Registered Sanitarians under the Acts of 1963 of the Indiana General Assembly. Mr. Paul Welch, Chairman of the State Board of Registration for Professional Sanitarians, presented the certificates to the newly registered sanitarians.

During the two day program the general session topics included a very interesting report by James H. McCoy, Past President of the Association, and Administrative Assistant, Special Health Services, Indiana State Board of Health, on the 1965 Indiana Law concerning the enabling of county boards of health throughout the state. Aimed at better administration of local county health departments this legislation should have a decided effect on the tax base for the support of local departments and the salaries of local public health personnel, including the public health sanitarian. Mr. James E. Goodpasture, Director of Environmental Health and Preventive Medicine, Student Health Service, Indiana University told of his role as member and chairman of the Monroe Board of Health and the upgrading of that county's health and environmental sanitation services including the challenge posed by the new Monroe Reservoir, the largest man-made lake in Indiana.

Sectional educational sessions included topics such as Sanitary Control of the School Environment, Private Waste Disposal, Private Water Supplies, New Developments in the Painting of Retail Food Establishments, Procedures for Evaluating Food Service Sanitation Programs, Salmonellosis Related to Eggs and Egg Products, Major Changes in the Public Health Service Milk Ordinance and Code, Liquid Manure Handling Systems, New Methods of Waste Disposal by Deep Well Injection, Industry Looks at the Sanitarian, and A Physician's Opinion of Public Health. A unique presentation was the reading of...