# WATER QUALITY ACT OF 1965 - IMPACT ON THE DAIRY AND FOOD INDUSTRY[1]

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On May 10, 1966 the Federal Water Pollution Control Administration was transferred to the Department of the Interior and Secretary Stewart L. Udal immediately issued guidelines to the States for setting of water quality standards on the interstate waters. Under the Federal Water Quality Act of 1965 the States are required to set quality standards on interstate waters by June 30, 1967. If a State fails to set adequate standards they will be set by the Secretary of the Interior. By May 10th, 1966, twenty seven States had indicated their intention to meet the '67 deadline.

The guidelines require that economic, health, conservation, and aesthetic values be considered in determining the most appropriate use of a stream and that the States hold public hearings before setting quality standards. Secretary Udall said "President Johnson has made it clear that no one has the right to use America's rivers and America's waterways that belong to all the people as a sewer".

The May, 1966, guidelines for establishing water quality standards for interstate waters under the Water Quality Act of 1965, Public Law 89-234, provide that standards adopted by a State will become standards applicable if:

1. The State authorities file by October 2, 1966, a letter of intent that the State after public hearings will, before June 30, 1967, adopt water quality criteria applicable to interstate waters or portions thereof within the State, and a plan for the implementation and enforcement of the criteria;
2. The State subsequently adopts such criteria and plan; and,
3. The Secretary determines that the State criteria and plan are consistent with the purposes of the Act.

## ESTABLISHING WATER QUALITY STANDARDS

Guidelines in the Act itself indicate that in establishing quality standards considerations be given to the use and value of the water for public water supplies, propagation of fish and wildlife, recreational purposes, agricultural, industrial and other legitimate uses. Any discharge of matter into interstate waters which reduces the quality of such waters below the established standards (whether the matter causing such reduction is discharged directly into such waters or into tributaries and then reaches such waters), is subject to abatement. There should be a constant effort to improve the quality of a water supply. The principal objective is the orderly development and improvement of our water resources without the necessity of adversary proceedings which inevitably develop into enforcement cases. The standards should be applied on the basis of the water quality requirements of present and future uses after due consideration of all factors and variables involved.

The standards should be designed to "enhance the quality of the water" and in any case must maintain existing water quality. No standards will be approved which provide for the use of any stream for the principal purpose of transporting wastes.

No standard will be approved which allows any wastes amenable to treatment or control to be discharged into any interstate water without treatment or control or which does not require all wastes, prior to discharge into any interstate water to receive the best practical treatment or control unless it can be demonstrated that a lesser degree of treatment or control will provide for water quality enhancement commensurate with proposed present and future water uses. It is anticipated that after establishing the initial standards periodic review and revision will be required.

"Interstate waters" include all rivers, lakes and other waters which form a part of the boundary between a State and another State or foreign country, as well as coastal waters, such as those along straight ocean coasts, the waters along indented coasts which are subject to tidal flow, and the waters of the Great Lakes. The Department of the Interior does not limit "interstate waters" to those portions at the point at which they flow across or form a state boundary but the water quality standards are to apply to the entire stretch of the interstate waters within a State. Tributaries of interstate waters, not in themselves interstate waters, are not directly subject to the quality control standards but if they carry any matter into the interstate waters which reduces the quality below established standards, this is subject to abatement.

[1]Presented at the 53rd Annual Meeting, International Association of Milk, Food and Environmental Sanitarians, Inc., Minneapolis, Minn., August 15-18, 1966.

### NEW YORK STATE MINIMUM SPECIFICATIONS

No doubt, as in New York State, the water quality standards when established in other States will be based on the "best use" of the water now or in the near future. This "best use" may vary from drinking water, bathing, fishing to industrial, agricultural and drainage. And the requirements for waste treatment before discharge may vary from tertiary treatment and chlorination, to secondary treatment and in a few cases, primary treatment.

The minimum water quality standards in New York apply to the "receiving waters after opportunity for reasonable dilution and mixture with the waters discharged thereto" and include the following items and specifications:

| ITEMS | SPECIFICATIONS |
|---|---|
| 1. Floating solids; settleable solids; sludge deposits. | None which are readily visible and attributable to sewage, industrial wastes and other wastes or which deleteriously increase the amounts of these constituents. |
| 2. Sewage or waste effluents. | None which are not effectively disinfected for drinking, culinary or food processing, or for bathing. |
| 3. pH | Range between 6.0 and 9.5 for agricultural or source of industrial cooling or process water. Range between 6.5 and 8.5 for higher uses. |
| 4. Dissolved oxygen. | Not less than 3.0 ppm for agricultural or source of industrial cooling or process water. For higher uses, not less than 4.0 ppm for non-trout waters; not less than 5.0 ppm for trout waters. |
| 5. Toxic wastes, deleterious substances, colored or other waters or heated liquids. | None alone or in combination with other substances or wastes in sufficient amounts or at such temperatures as to prevent fish survival or impair the waters for any other best usage as determined for the specific waters. |
| | Maximum concentrations of certain toxic pollutants in non-trout waters of 80 ppm alkalinity or more may be: |
| Ammonia or Ammonium compounds | 2.0 ppm ($NH_3$) at pH 8.0 or above |
| Cyanide | 0.1 ppm (CN) |
| Ferro — or Ferricyanide | 0.4 ppm $Fe(CN_6)$ |
| Copper | 0.2 ppm (Cu) |
| Zinc | 0.3 ppm (Zn) |
| Cadmium | 0.3 ppm (Cd) |

Thus the water quality standards established under the Federal Water Quality Act of 1965 may apply to all interstate waters and by extension to all waters which flow into interstate waters. All municipal and industrial wastes which discharge into these waters must be treated. This treatment in nearly all cases will be at least secondary treatment and in an increasing number of cases tertiary treatment.

### DISPOSAL OF DAIRY AND FOOD PLANT WASTES

For the dairy and food plant this means disposal of the plant wastes either in such a way that the wastes do not pollute any water which in turn may pollute interstate water, or treatment in combination with municipal wastes or in a separate industrial waste treatment plant.

In New York State the "basic policy is to eliminate pollution economically although effectively. This can generally best be served by the construction of one plant serving municipal and industrial needs rather than those needs being served by separate plants. A municipal sewage treatment plant may be designed to receive an unlimited percentage of industrial wastes and the municipally remain eligible to receive state aid for construction and operation and maintenance". State aid may amount to 30 per cent of the construction cost and 30 per cent of the costs of operation and maintenance.

Federal aid for the construction of plants for the treatment of municipal wastes with industrial wastes may be available up to 30 per cent of the construction cost and if the plant is part of a comprehensive regional plan, an additional 3 per cent of the construction cost may be available. Thus a considerable portion of the construction costs for a combined municipal and industrial waste treatment plant may be available. In such cases combined treatment may be very advantageous.

Milk is a nearly perfect food for people and microorganisms. The organic matter from milk in waste water stimulates growth of microorganisms and the consequent use of roughly 1 pound of dissolved oxygen for each pound of organic milk solids.

The pollutional effects of dairy wastes in streams and lakes are (1) mainly the reduction in dissolved oxygen below the levels at which normal aquatic life will thrive, and also (2) the creation of suspended solids which may interfere with oxygen transfer in fish gills or may settle as a sludge blanket on the stream bottom and so prevent the growth of the normal biota, and rarely (3) a shift in pH, temperature and/or concentration of toxic matter in the water so that it no longer supports normal aquatic life.

The dairy industry is well aware of operating costs

and so has investigated and tried many variations in methods of dairy waste treatment which appeared to offer more satisfactory treatment with lower costs. Many dairy and food processing plants are located in areas where it is not economically practical to discharge the wastes to a municipal waste treatment plant and it then becomes necessary to provide industrial waste treatment. Industrial wastes have been treated satisfactorily by many different methods including land irrigation, lagooning, activated sludge treatment and trickling filter treatment. The most economical, satisfactory and desirable waste treatment for a specific plant will depend upon local conditions.

### CURRENT METHODS OF WASTE TREATMENT

Usually it will be desirable to segregate the liquid wastes before disposal. Sanitary wastes from toilets and washrooms in most cases should go to municipal sewers or to a septic tank and underground drain field. Strong wastes, such as surplus skim milk, butter milk and whey, should be collected and preferably used for human or animal feeding in the liquid state or after concentrating and/or drying. Frequently other strong wastes may be disposed of on isolated land satisfactorily at less expense than by treatment. Clean cooling waters may be discharged to storm sewers or directly to the stream. Contaminated wash waters, equipment and floor rinsings should be treated.

Every practical effort should be made to reduce avoidable waste to a minimum by an effective waste prevention and waste savings program which has the whole-hearted support of plant management.

Preferably after the plant has segregated the wastes and practiced waste savings and waste prevention so that it is a normal operation, a waste survey should be made to determine the volume and $BOD_5$ strength of floor wastes to be treated. This survey should cover a sufficient time to show the variations during the week, particularly for the periods when there is insufficient supervision. This survey data should include production data so that the results can be projected for the period of 7 to 10 days of peak production. These calculations for waste flow and $BOD_5$ during peak production should be used for the design of waste treatment by various methods.

Originally it was reported that with spray irrigation of dairy wastes the limiting factor was the hydraulic load and that the BOD content had little or no effect. Now after thirteen years experience it is apparent that microbial growth in the pore space of the soil is stimulated by high BOD concentrations and may greatly reduce the infiltration rate. So far this problem has not been reported with low concentrations of BOD, 200 to 500 ppm, in the applied waste. Much land will permit an initial average waste application of 6,000 gallons per wetted acre per day.

Ridge and furrow or seepage trench systems initially may handle 3 to 5 gallons of waste per day per square foot of wetted area and due to microbial growth in the soil after one to three years handle only 1.0 to 1.5 gallons per day per square foot of wetted area in spite of annual removal of sludge from the furrows or trenches. The initial cost of irrigation systems may be relatively low but the maintenance problems in cold weather or in sludge removal can be expensive. Odor problems may occur while the trench system is being dried and during the removal of up to 0.4 cubic foot of wet sludge per square foot of trench bottom.

Trickling filters have been used for many years for treating dairy waste and have a relatively high capital cost, a relatively low operating cost, a reported good ability to absorb shock loads and have given BOD reductions of about 80 to 93% based on raw waste and clarified effluent. High BOD concentrations in the applied waste tend to cause excessive slime growth on the filter media and ponding unless there is adequate hydraulic flow to remove the excess growth. High-rate, two-stage recirculating trickling filters have given better results than standard rate filters. Clarifiers and sludge digesters or other methods of excess sludge disposal are required.

For the treatment of dairy waste the standard activated sludge method has undergone many modifications. Retention time in the aeration tank has been increased from about six hours for domestic sewage to one or two days in many dairy waste treatment plants and to more than five days in others in order to reduce the BOD concentration of strong raw wastes to 40 pounds $BOD_5$ or less per 1000 cubic feet in the aeration tank. Then the clarifier can operate satisfactorily even with a sludge volume index of 200. With complete return of sludge to aeration the active sludge mass and volume in the aeration tank give good equalization of "slug" loads of raw waste.

The air supply should be adequate to maintain a minimum of some DO (dissolved oxyen) except for short periods of time, up to six hours per day. Many ways have been used to introduce air into the waste. With dairy waste the clogging of porous air diffusion devices has been a serious problem and various proprietary devices have been used. Penberthy educators using recirculated mixed liquid with air under blower pressure (pressure jets) or under atmospheric pressure (suction jets) have been used satisfactorily except for clogging problems. As a result a number of treatment plants have ceased to recirculate liquid

and use the jets for air only and claim satisfactory results.

### USE OF MECHANICAL SURFACE AERATORS

Mechanical surface aerators have enjoyed recent popularity. In non-freezing weather they appear to be non-clogging and be reasonably efficient in oxygen transfer. However, in sub-zero weather there have been reports of severe icing problems.

Unfortunately, endogenous respiration will not burn up all of the new protoplasm formed and at 20 C about 5% of protoplasm is oxidized daily to insoluble inert organic matter which tends to add to the sludge mass in the system. Unless circumstances permit the discharge of considerable suspended sludge solids in the clarifier effluent, it will be necessary to provide facilities for excess sludge. These may be a sludge digester or holding tank, sludge lagoons, polishing ponds, sand beds, or direct disposal on land.

Lagoons with natural aeration are being used extensively for domestic waste, combined domestic and dairy waste, and a few cases for dairy waste only. Exceeding the design load reportedly has been the cause of odor problems and unsatisfactory treatment. Where the organic load has been less than 30 pounds of BOD per acre per day under Minnesota operating conditions, results appear to be satisfactory.

Mechanical surface aerators have made it possible to greatly increase the BOD loading in shallow lagoons and to decrease the retention line. A Florida citrus plant with a 3.9 acre mechanically aerated lagoon 4 feet deep has handled more than 1000 pounds BOD per day per acre with about 40-HP per acre, and a retention time of 12 days and shown a BOD reduction of more than 93% in the lagoon.

When supplied with adequate air and agitation, biological activity apparently continues at a sufficient rate at temperatures just above freezing to give a more than 90% reduction in BOD as shown by the January, 1965, study of the Glenwood, Minnesota, oxidation ditch sewage treatment plant by the Minnesota Department of Health. Mechanically aerated basins have been used for dairy waste at one plant in Wisconsin and one plant in Illinois. Results appear to be promising.

With wastes from dairy by-products plants it is desirable for normal sludge growth to determine the relative amounts of $BOD_5$, total phosphorous, and total nitrogen and preferably to provide nutrient supplementation if the ratio is less than 100 to 1 to 6, respectively.

### SUMMARY

Under the Water Quality Act of 1965 the States are required to establish quality standards on interstate waters and a plan for implementation and enforcement which is acceptable to the Secretary of the Interior or he will do so. These standards are to enhance the quality of the water and to be subject to periodic review and revision. It is expected that at least secondary treatment of all industrial and municipal wastes will be required before discharge to a watercourse.

Dairy wastes preferably should be treated with municipal wastes in a combination treatment plant. Where this is not practical, dairy wastes can be treated by land irrigation, lagooning, trickling filters, or modifications of the activated sludge process. Costs of treatment are dependent upon the local situation.

## PUBLICATIONS OF INTEREST

**Editorial Note: Listed below are books, pamphlets and reprints on a variety of subjects considered to be of interest. Requests for material should be addressed to the source indicated. Note cost of books and certain items.**

USDA Handbook on Insecticides. Directions and precautions for safe agricultural use of more than 100 insecticides are updated and summarized. No. AH-313. Supt. of Doc., Govt. Printing Office, Wash., D. C. 20402. $1.25.

Trichinosis: How it affects you, how it affects your hogs, what you can do about it. Office of Information, USDA, Wash., D. C. 20250.

The Bacteriological, Chemical and Physical Requirements for Commercial Egg Cleaning. Market Res. Dept. No. 740. Office of Information, USDA, Wash., D. C. 20250.

Procedures Governing the Cooperative State-PHS Program for Certification of Interstate Milk Shippers. PHS Bull. No. 1046. Supt. of Doc., Govt. Printing Office, Wash., D. C. 20402.

Review of Baking Industry Sanitation Standards. H. P. Milleville and Paul Gelber. Food Processing and Marketing. 27, No. 2 P. 73, 1966.

Sanitation Standards for Baking Equipment, 23 units. Baking Industry Sanitation Standards Comm. 521 Fifth Ave., New York, N. Y. 10017. 25c.

Volume-Weight Conversion Factors for Milk. Marketing Res. Dept. No. 701. Consumer Mktg. Serv., Dairy Div., USDA. Wash., D. C.