SOLIDS–LIQUID SEPARATION: AN IMPORTANT STEP IN THE RECYCLING OF DAIRY COW WASTES[1, 2]

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Abstract

Use of a solids–liquid separator in the manegement of dairy cattle wastes may *(a)* reduce labor requirements, *(b)* make mechanical handling more feasible, *(c)* improve automation, *(d)* produce solids with economic value, and *(e)* produce a liquid that may be handled by ordinary equipment and treated to produce potable water and fertilizer. In solids-liquid separation of dairy cattle wastes, macro-colloidal (> 5μ) and larger solid particles are partially removed from the liquid portion by screens, sieves, and compressors. The two products produced are *(a)* wet solids and *(b)* a dilute liquid. The solids contain about 45 to 80% water depending on the systems used and are stable in nature. The solids have little or no odor and may be dried and used for bedding, refeeding, or mulch, thus having economic value. The liquid is dark brown in color and contains about 85-90% of the 5-day BOD and only about 1-3% suspended and dissolved solids. It may be handled by ordinary equipment and does not require special liquid pumps and high-powered tractors for mixing, pumping, and conveying. The liquid may be irrigated directly onto crops and soils or it may be treated to make potable water and a more concentrated fertilizer.

For some 5 to 7 years several researchers have been diligently seeking a "break through" in farm animal waste handling and management. They have been looking for a system that has or is: *(a)* low labor requirements, *(b)* mechanical handling and treatment, *(c)* automatic or nearly automatic controls, *(d)* non-pollutional (low odor, BOD, and nutrient discharge), and *(e)* economical. Furthermore, it seems that the farm animal producer expects such a development. Solids-liquid separation appears to be a step in this direction.

The dairy farm situation

In general the dairy farm has not needed a new system for large quantities of wastes as much as the beef producer, swine grower, or poultry raiser. Dairy sizes in terms of numbers of animals per acre generally have not been as great as these other enterprises. For example, it is difficult to name a 10,000 head dairy operation. Yet there are many such beef-cattle operations and some equivalent swine and poultry operations. Although there are rumors that the dairy herd size is going to increase to 80 to 85 within the near future, the average dairy herd is still less than 50 cows *(2)*.

Dairy operations have also generally been connected directly to or with a farming operation of some 160 or more acres of land. Thus, the ratio of animals per acre has been generally quite low, and it has been a problem of simply (if it may be put in such terms) returning the wastes (manure, waste water, etc.) to the land by some means. With the relatively small quantity of wastes, it was almost impossible to pollute land, water, or air if normal discretion was used. Nevertheless, many dairy farmers would like to have a "better system" for waste management in their present operation. Increases in the size of operations in the future may require such improvements.

Waste disposal is a very important aspect of commercial dairy farming. A cow produces several pounds of manure/pound of milk and this waste must be disposed of in a safe, inoffensive manner. Tables 1 and 2 give the properties of fresh dairy cow manure *(3)*. At present there are numerous disposal or treatment methods being used, each with its own advantages and disadvantages. One modification that may improve these methods in solids-liquid separation.

Table 1. Some Properties of Dairy Cattle Manure

Average daily manure production	107.8 lb.
Portion of manure as feces	68.8%
Portion of manure as urine	31.2%
Percent body weight	7.22%
Moisture content of feces	82.7%
Moisture content of urine	95.1%
Average moisture content of manure	87.5%
Fixed solids in feces	13.8%
Fixed solids in urine	37.6%
BOD of straight manure (urine plus feces)	25,600 ppm
BOD per day	2.76 lb.

Table 2. Chemical Contents of Dairy Cattle Manure

	Lb/ton manure								
Moisture content	N	P	K	S	Ca	Fe	Mg	US	Fat
79%	11.2	2.0	10.2	1.0	5.6	0.08	2.2	322	7

[1]The author expresses his appreciation to Lee G. Carlson and Roger Swanson, Environmental Division, Babson Bros., Inc., 2100 S. York Rd., Oak Brook, Illinois 60521, and to Don D. Jones, Graduate Assistant, Dept. of Agricultural Engineering, Purdue University, Lafayette, Indiana 47907 for their assistance in the preparation of this paper.

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

Some general waste handling terminology

Several waste handling terms are being used which may not be entirely clear. Some of them are discussed below:

Recycling. This term usually means one or two things. It can mean simply returning the waste materials to the soil where they are degraded by the natural organisms for reuse by plants along with the sun's energy to produce more feed. Others have used the term to mean the direct return of the wastes to the animal as a feed or in combination with other feeds for direct consumption by the animal. Both are correct terms and are used in this paper, however, they are differentiated between as used. The use of a portion of the solids for bedding may also be referred to as recycling.

Solids-liquid separation. Generally solids-liquid separation means the removal of the macro-colloidal and larger solid particles from its liquid support media. The division is not "clear cut" but generally any particle less than about 5 μ is considered to act about the same as if it were dissolved and generally remains in suspension with only slight settling if any. Some engineers prefer to use the terms suspended and settleable solids but again they do not apply to all conditions as some suspended material in animal wastes may be quite large. Therefore, it is assumed that solids-liquid separation is the removal of most of the matter above 5 μ or slightly larger from the liquid.

Solids-liquid separation is a fairly new technique in livestock waste management. There are presently about 30 solids-liquid separators installed in dairies, mostly in California, to screen out fiber, undigested feed, and other large particles contained in liquid manure *(6)*. There is also one in Ohio *(12)*.

Biodegradability and non-biodegradability. Most or maybe all organic materials are theoretically biodegradable if given sufficient time with the right bacteria at the correct temperature. Nevertheless the terms biodegradable and non-biodegradable have come to mean something slightly different to many sanitary engineers and perhaps to others. Generally the term "biodegradable" has come to mean something that can be readily hydrolyzed and broken down into more basic forms in a few days.

If the above definition holds for ordinary treatment (anaerobic or aerobic treatment for 4 or 5 days), animal wastes could be said to contain much non-biodegradable material. This "non-biodegradable" quantity may be as high as 60 or 70% of the total solids in the wastes (manure). The author once conducted an aerobic digestion experiment with dairy cow manure for over 180 days only to find that over one-half of the organic solids still remained in the unreduced form. The remaining organic matter consisted generally of fibrous material and undigested feed particles which would have eventually broken down but which would have required more time.

The separated solids and liquid

Products from the solids-liquid separator still contain the original materials found in the wastes but they are in a different form, and are more manageable and usable.

The solids contain about 40 to 60% of the suspended and settleable solid of the raw wastes. These solids are made up mainly of undigested feed particles such as stems of hay, particles of corn, silage cuts, and other large pieces that have defied digestion within the ruminant. Of course some bacterial cells and other stable organics and inorganics are also in the mixture. These materials are often referred to as non-biodegradable even though they could possibly be decomposed over a long period (6 months to 2 years).

Because of the non-biodegradability of the solids they are referred to as stable and contain only about 5 to 15% of the 5-day BOD of the raw wastes. The moisture content of the solids depends on the efficiency of the separator and seems to vary between about 45 and 85%. No doubt further development of the separators will provide a lower moisture content in the future.

The dried solids are light and fluffy. They are unobnoxious and may be stored or used almost any place desired. Odor is nil.

The liquid effluent from the separators contains more pollutional materials than the solids but it is in a form that may be readily handled (pumped, conveyed, etc.). Depending on the separator used and the dilution water added, the liquid contains from 0.5% to about 4% finely suspended and dissolved solids. It may be irrigated directly onto crops and soils or it may be treated further.

The liquid portion contains approximately 85 to 95% of the 5-day BOD. This means it contains by far the greatest percent of the biodegradable portion of the raw wastes. However, since it does not contain the large quantity of suspended and settleable solids that the raw wastes contain, it may be more readily aerated in an oxidation ditch or lagoon. Also the alpha factor (transfer of oxygen from the air to the mixture) would probably be considerably higher, thus lowering power requirements for providing oxygen and reducing the cost of treatment.

A solids–liquid waste management system

Solids-liquid separation should be thought of as an integral part in a new system such as the following. *(a)* Solids and liquids are flushed or scraped to a 2- or 3-day capacity holding tank. *(b)* The waste mixture is mixed and pumped by a submersible pump (about 5 horsepower) to the solids-liquid separator. *(c)* The solids are separated from the liquids by the solids-liquid separator using screens, sieves, presses, etc. *(d)* Solids are discharged to an open storage for drying before reuse as (i) bedding, (ii) feed, (iii) mulch, or (iv) returned to land. *(e)* Liquids are discharged to a holding lagoon or tank prior to (i) irrigation onto soil and crops or (ii) further treatment. A 2 to 3-horsepower, electrically driven pump will move the liquids for either purpose. *(f)* A simple, low cost irrigation system can be permanently installed to sprinkle or flood irrigate some given crop and land. One and one-half-inch plastic pipe can be placed underground to convey the liquids to desired locations in the field. If an irrigation system is used, it should be designed properly taking into account the permeability of the soil, sealing characteristics of the liquid, and the nutrients therein.

Winter operation requires some special consideration. For example, the holding tank or lagoon must be large enough to hold the liquids through the season of frozen soil if irrigation is not permitted during such a period. This is a time when maximum recirculation of the wash water should be used to avoid any excess water use which would require a larger storage capacity.

The storage provided should be given some special attention and consideration. An outdoor lagoon type storage provides the most economical unit. However such a storage should be located where no runoff will enter it. The cost of such a lagoon is relatively low regardless of location as the excavated soil may be used to elevate the sides thereby increasing the volume. A capacity of about 2 ft^3/cow/day for about 180 days should be the minimum lagoon storage.

Odor control may be an important item for consideration in the near future in all systems. With the liquid stored in the lagoon this may be somewhat of a problem but it can be easily controlled by aeration if necessary. It appears that aeration equivalent to about the 5-day BOD would do a satisfactory job of controlling odor. This past year at the Purdue Dairy Center, the odor of whole wastes accumulating in a storage lagoon from about 130 dairy cows during November to April, was controlled by one 5-horsepower floating aerator. The aerator was not turned on until the ice melted in March. So odors can be controlled if necessary but it costs extra. According to Koelliker and Miner *(8)* effluent irrigated from an anaerobic lagoon loses its odor producing capabilities within hours after being exposed to the open air.

The *solids* produced by the above waste management systems with a solids-liquid separator may have many useful or even profitable uses. As mentioned before, the separated solids are large, relatively inert particles and may be dried, incinerated, composted, or used directly as soil conditioners. Dried or composted solids have been used for livestock bedding, refeeding, or mulch or organic matter for soil conditioning. When properly dried, the waste solids form a light fluffy litter that has been found satisfactory for bedding in free stalls with no staining of the cows *(4)*. It may be an even better source of calf bedding than wood shavings because the calves do not eat the manure solids and because the dry solids absorbs about four times their own weight in liquids. With money saved on litter the dairyman may be able to cover much of the expense of separation as well as making the remaining liquid manure considerably easier to dispose of. Dairy manure solids have also been tested in poultry houses and has been reported to be an excellent floor litter for growing chicks *(14)*.

Dried or composted solids may have a potential as a mulch or soil conditioner. In California, a golf course has used the dried manure as a mulch over grass seed placed on bald spots caused by excess salinity. When spread over the seed at 3/8 to 3/4-inch thick, vigorous green grass sprang up within several days. The mulch apparently worked to overcome the salinity problem by holding moisture near the soil surface and preventing the grass seed from drying out. In Washington state, a county purchased manure solids from a local dairy at $3/yard for use in flower and shrub beds. They reported excellent results *(4)*.

Research in refeeding of livestock solids has been reported for swine, poultry, and sheep wastes but it is unlikely that government health agencies will permit refeeding for dairy cows for some time to come. The Federal Food, Drug, and Cosmetic Act of 1938 prohibits interstate commerce in adulterated or misbranded foods and drugs. "The Act" does not distinguish between food used solely for animals as opposed to food used solely for man. It deems a food adulterated if that food contains any poisonous or deleterious substance which may render it injurious to health, if it contains any food additive which is unsafe, or if it consists in whole or in part of any filthy, putrid or decomposed substance *(14)*.

At present, while not sanctioning the reuse of manure as an animal feed, the FDA does not discourage research in this area. It will continue to review information on waste products as research makes the facts available. When sufficient information is available on whether a specific waste is safe for consumption by the target species and that the meat and by-products from the animals are safe for consumption, the FDA will review their objections to the use of animal wastes in livestock diet *(14)*. At present, refeeding is still in the research stage and should not be attempted without government permission and strict controls *(15)*.

The liquid portion has a potential use in the production of protein by yeast or bacteria *(9, 10)*. Although the mechanics of such a system need to be simplified somewhat, this type of conversion may have much potential, not only in refeeding, but in the manufacture of commercial products. It seems that refeeding, either directly or through protein production, would yield significant improvements in feed conversion by making several passes through the animal.

Solids-liquid separators

Currently there are at least three solids-liquid separators and separation systems in limited use for dairy cow wastes. There are other separators being developed but the status of their adaptation to dairy cow wastes is unknown.

Basically all the solids-liquid separators require that dairy cow wastes be collected, diluted (amount of dilution varies with separators), and mixed in a sump prior to discharge or pumping to the separator mechanism. From this point on the separation is performed by the equipment. Three such separators are discussed briefly below:

The SWECO Vibro-Energy Separator is a screening device that vibrates about its center of mass. Vibration is accomplished by eccentric weights on the upper and lower ends of the motor shaft. Rotation of the top weight creates vibration in the horizontal plane, which causes materials to move across the screen to the periphery. The lower weight acts to tilt the machine, causing vibration in the vertical and tangential planes. The screen (available in various meshes) which varies in diameter from 18 to 60 inches is dosed in the center with the diluted wastes. The liquid portion falls on through. Solids are caught on the screen which vibrates (moves) them to the exterior from whence they are discharged at the periphery next to the shroud into a stack. According to Fairbank *(5)*, the separator works quite well as long as the manure is diluted with 10 to 12 volumes of water. This might be called a high dilution rate and could lead to problems of water supply.

The solids as they come from the above separator contain approximately 80% moisture. However, they are relative "clean" and stable as they have been washed with the highly diluted water. After the solids have been spread in the sun to dry for a few days they become an ordorless, inert material which may be used for bedding, chicken litter, or a mushroom growing medium.

The liquid portion contains less than 0.5% solids and is ready for irrigating onto crops and soils. It is usually not acceptable for discharge into ditches without further treatment. Treatment which would remove more solids may be desirable as it could then be used to dilute the raw wastes.

The Bauer Hydrasieve for solids-liquid separation has no moving parts. It was developed primarily as a thickener for the pulp and paper industry. However, it has been found to be adaptable to other industries such as sewage treatment, food processing, chemical processing, etc. The heart of the Hydrasieve is a screen assembly of specially designed wires with unique singular curves. The physical structure of the device resembles the traditional flat side-hill screen, but the technique of separation of the solids from fluids is basically different from other static screens. The Hydrasieve achieves fluid removal by a hydraulic surface attachment utilizing the Coanda effect on a multiplicity of essentially V-section screen bars which between the supporting members are formed in a single arc, the apex of which is directed in the sense of the slurry flow *(7)*.

Solids of animal wastes coming from the Hydrasieve contain approximately 80% water and are ready for further processing (drying, composting, etc.).

The liquid contains around 1 to 2% solids and is ready for further treatment or irrigation onto crops and soils. It is not of a quality that is acceptable to be discharged into a stream.

Babson Bros. Company, recognizing the need for a farm animal waste treatment system has also developed a solids-liquid separator for specific use with dairy cow wastes. This separator goes beyond the normal solids-liquid separation in that plans are to treat the liquids and to produce potable water and fertilizer. The unit is referred to as Babson Bros. Co. TRU (total recycle unit). Although some successful prototypes have been fabricated and are in use it is still in the developmental stage.

Briefly the Babson Bros. solids-liquid separator consists of a loading hopper with a rewash mechanism, a sloping screen onto which the wastes are directed from the hopper, and a porous belt to accept the solids as they roll off the screen. The solids are then conveyed through a "roller-squeezer" to remove excess moisture before final discharge. A dilution of about one part water to one part manure is needed to make the separator function at its optimum. Final plans include adding a second conveyor and roller-squeezer to further reduce the moisture content to produce a more readily manageable product.

Solids produced by the separator contain about 45 to 50% moisture and give a "clean appearance." The solids dry rapidly when spread out in a thin layer and have been used successfully for bedding.

The liquid discharged from the separator contains 3% to 4% dissolved and finely suspended solids. Plans are to treat this material in such a way as to separate much of the remaining solids and nutrients thereby producing a potable water and a concentrated fertilizer. However, it may be irrigated directly onto crops and soil without additional treatment but it contains matter that may close the pores of some soils.

Other solids-liquid separators are available but only a few are being adapted for use with animal wastes.

Solids-liquid separation and present waste management

To see how solids-liquid separation may fit into dairy wastes management systems, it may be helpful to first review dairy waste treatment systems now in operation.

Scraping and water flushing-holding tank-land disposal. This is perhaps the most commonly used method of dairy waste management. Pens, gutters, and driveways are washed down with water under pressure and the washwater drains by gravity into a manure storage tank. The waste is then stored until the dairyman's work schedule and the weather permit field disposal. One of the primary difficulties of this system is that the waste in the holding tank is under anaerobic conditions and noxious odors produced can cause difficulty unless proper ventilation is provided.

Solids-liquid separation could be provided by using two holding tanks in series with a shaker screen for solids-liquid separation in between. This would allow a small separator to work continuously at a low rate of flow even though water flushing is done periodically. Here the first tank would be merely a sump to hold the waste until it can be processed. Solids-liquid separation would not have a major beneficial effect for odor control in this system since the high pollution strength liquid would still be stored under septic conditions. The major advantage of using a separator in this system would be in transporting the separated liquid to the land disposal site. With most of the suspended solids removed, the liquid could be easily pumped to the field without fouling transport pipes or irrigation nozzles. The need of an extra tractor is eliminated and not "tied up" in pumping liquid manure since a small sewage pump can easily do the job. Also the power and time required to "homogenize" (mix) the solids and liquid is eliminated.

The effluent liquid from the separator is still very unstable and would probably not be suitable for reuse in flushing. This system would therefore require a relatively large volume of fresh water for flushing and dilution.

Water flushing-aerobic unit-land disposal. This is identical to system just described except that an aerobic unit is substituted for the holding tank. This system would not have problems with odors but does have the disadvantage of a higher cost because of a large power demand for a mechanically aerated oxidation ditch or aerated lagoon or because of a large area and construction cost for an oxidation pond.

This system could be improved by adding a solids-liquid separator before aerobic treatment. This would decrease the cost of aerobic treatment with an oxidation pond because it would decrease sedimentation in the pond and therefore increase the useful life of the pond. Separation would also decrease cost with the mechanically aerated systems since much of the power normally provided is to keep solids in the unit in suspension. Also the rate of transfer of oxygen from the air to the wastes (alpha factor) is improved with a decrease in solids concentration.

It may be advantageous to use the effluent from the aerobic unit to supplement the flushing water supply. This would tend to dilute the waste, aid the separation process, and decrease the amount of fresh water needed. Also, excess water would not accrue in the lagoon.

Water flushing-anaerobic unit-aerobic unit-land disposal. Basically, an anaerobic unit has the function of converting suspended solids in a waste to dissolved organic compounds and gases. In other words, a liquid waste is produced from a solid waste with a net loss in pollution potential.

Since the solids produced by solids-liquid separation are large relatively inert particles, they are not modified very much by either anaerobic or aerobic treatment. They may, however, cause sedimentation problems in both units and therefore a separator in the waste flow line may help to remove this material before it reaches the treatment unit. It may be feasible to use the effluent from the aerobic treatment unit for flushing here also.

In-house oxidation unit-holding unit-land disposal. If a dairy is set up with an in-house oxidation ditch, the solids-liquid separator has no place before treatment. The solids and liquids fall into the ditch through the slotted floor directly into the ditch. However, immediately after treatment in the oxidation ditch, the solids-liquid separator would be advantageous since the solids could be removed for other uses and the liquids irrigated onto land or some returned to the ditch for dilution purposes. One of the difficulties with oxidation ditches is their tendency to become "over loaded" with solids that either settle out or result in poor oxygen transfer or poor mixing in the ditch. The solids-liquid separator used in this way would eliminate this difficulty.

In-housing holding unit-land disposal. This system involves use of a holding tank under either a slotted floor or one into which wastes may be scraped. The wastes can be held in this unit for whatever storage period it was designed. The entire wastes are then usually mixed by a tractor-driven pump and recirculator before spreading on the soil. A second tractor is used to convey the "liquid" wastes to the field for spreading onto the land. If this system is working entirely satisfactory for the dairy producer and tractor power and odors are not problems, perhaps the solids-liquid separator has no place. However if there are problems with the system perhaps the installation of a slightly deeper sump in one or two ends of the storage could serve as a collection pit for pumping to a solids-liquid separator. Then by use of such a separator solids could be removed with the liquid going *(a)* onto land by irrigation, *(b)* into an outside storage, or *(c)* returned to the underfloor pit for dilution of incoming wastes. Some dilution is necessary to properly operate a solids-liquid separator anyway and liquid flushing to the sump in the pit is also required.

Other waste management systems without solids-liquid separation

Drying entire wastes. If the entire waste of dairy cows is dried, solids-liquid separation has no place in the system. *Incineration* with the ash being returned to the land also has no need of a solids-liquid separator. However most animal wastes will not furnish sufficient heat to incinerate themselves. Gases and particulate matter discharged to the air are also pollutional and costly to control. Therefore this system has not received wide acceptance.

Composting. Most wastes contain too much water to compost properly without mechanical aids and addition of dry organic solids. A solids-liquid separator that does not require much dilution or one in which the separated liquids are returned for dilution could possibly improve composting of animal wastes.

Other waste management systems improved by solids-liquid separation

Refeeding. A solids-liquid separation may be a big assist for refeeding either as a dry feed mix or silage.

Protein production. The liquid portion with the nutrients is the part of the wastes that are needed for this according to Nye *(9)*. Other fermentation processes also require the liquid without the inert solids.

Building blocks. The liquid portion must be removed in this process, thus solids-liquid separation is desirable.

Raw material for oil. Generally a solids-liquid separation would help this process. The solids are needed without much of the liquid although a quantity of the organics left in the liquid are also useful in this process.

Methane production from dairy waste could become a reality with the liquid portion of the wastes which contains much readily usable materials for the methane formers.

Summary

Farm animal wastes are a mixture of water (about 87.5%) and solids (12.5%). The total solids are composed of a mixture of large particles of non-biodegradable organic solids, dissolved or finely suspended biodegradable organic solids, dissolved inorganic solids, and bacterial cells. Separation of the large non-biodegradable portion of organic solids from the mixture is a desirable step in that it provides the following: *(a)* Solids that may be used for bedding, refeeding, mulch and other by-products which have economic value to the dairyman. *(b)* A liquid that is easy to pump, contains most of the 5-day BOD but which is readily treatable by aeration to control odor, is irrigable, contains most of the nutrients, and is desirable as a fertilizer. *(c)* A liquid that can be readily treated to produce potable water and concentrated fertilizer. *(d)* An important step in mechanizing and automating waste management. *(e)* A step that improves present waste management systems by reducing power requirements of two or more tractors for mixing, pumping, and spreading and making possible the management of the wastes with ordinary equipment.

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REPORT OF COMMITTEE ON FOOD EQUIPMENT

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questions, pointed out that revision of the PHS Vending Code could require several years and that, in the meantime, his agency, in his opinion, would not disapprove of: *(a)* reasonable standards for specialized types of equipment; and *(b)* state/local amendment of definitions to specify the types of equipment not subject to licensing and routine inspection.

At the conclusion of this discussion, members of AMHIC further charged the Committee on Coin-operated Special Devices or Dispensers to appropriately consider the foregoing matters and that a proposed Standard for Special Devices or Dispensers be developed by AMHIC. The Committee on Special Devices has met, and a report should be available in the near future to this Committee and other interested persons for review and comment.

The *Evaluation Manual*, policies and procedures, and other educational materials developed by AMHIC and/or NAMA may be obtained from the National Automatic Merchandising Association, 7 South Dearborn Street, Chicago, Illinois, 60603.

Seal of approval

The advisability and feasibility of a NAMA Seal of Approval program and its application to NAMA evaluated vending machines was thoroughly discussed, and the members of AMHIC indicated their favor of an in-depth exploration of a seal program by instructing the Committee on Education and Training to explore all aspects of a seal of approval program and to submit its recommendations to AMHIC.

The Committee on Education and Training developed a survey procedure concerning essential aspects of a seal of approval program; and using this procedure, it has surveyed certain public health and industry personnel as an initial step in implementing its new charge to explore a NAMA Seal of Approval program for Vending Machines. The Committee has started tabulating initial survey findings and should have a very interesting report including recommendations for review at the next meeting of AMHIC.

Other activities

The NAMA staff reported that the relationship of the NAMA *Vending Machine Evaluation Manual* as an official standard to the application of the Occupational Safety and Health Act of 1970 is being explored. Further, the NAMA *Labeling Guide* including a statement on proposals to require ingredient listing of mandatory ingredients of standardized food has been submitted to the Federal Food and Drug Administration for approval; and the pending proposals to the U. S. Department of Agriculture to determine the application of the Federal Meat and Poultry Inspection Programs to Commissaries has delayed completion of the AMHIC Commissary Guide. In addition, a new bulletin on Heart Pacemakers and Microwave Ovens which has been published recently by NAMA should prove beneficial to all sanitarians in answering questions concerning the hazard potential to pacemaker users from association with microwave ovens.

RECOMMENDATIONS

(a) The Association reaffirm its support of the National Sanitation Foundation and the National Automatic Merchandising Association and continue to work with these two organizations in developing acceptable standards and educational materials for the food industry and public health.

(b) The Association urges all sanitarians to obtain a complete set of the National Sanitation Foundation's Food Equipment Standards and Criteria and a copy of the National Automatic Merchandising Association—Automatic Merchandising Health-Industry Council's Vending Machine Evaluation Manual and related materials; to evaluate each piece of food equipment and vending machine in the field to determine compliance with the applicable sanitation guidelines; and to let this Committee and the appropriate evaluation agency know of any manufacturer, installer, or operator failing to comply with these guidelines.

(c) The Association urges all sanitarians and regulatory agencies to support the work of the Association's Committee, submit suggestions for developing new guidelines and for amending same, and subscribe, by law or administrative policy, to the principles represented by the *Standards, Criteria, and Evaluation Manual for Food Equipment and Vending Machines.*

This report of the Committee on Food Equipment Sanitary Standards respectfully submitted by:

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