# BIOMEDICAL WASTE MANAGEMENT

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# BIOMEDICAL WASTE MANAGEMENT - PROBLEMS AND PERSPECTIVES: LEGAL, ADMINISTRATIVE AND FISCAL VIEWPOINT

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## ABSTRACT

In recent years, the costs for the disposal of low level radioactive wastes have escalated and the states in which commercial waste disposal sites are located have also been insisting on "hold harmless" and indemnity agreements from the users of such sites. Coupled with the above, the uncertainty associated with the sites being kept open, has created a significant problem for the generators of low level wastes, forcing them to look for alternatives such as incineration. This paper attempts to provide an insight into the problem of low level radioactive wastes disposal from the legal, administrative and fiscal viewpoint as it pertains to a state-supported teaching medical institution. Some aspects of public relations are also covered.

## INTRODUCTION

The University of Illinois at Chicago, Health Sciences Center is a state-supported teaching medical institution of 600 bed capacity and holds a Type-A Broad Scope License issued by the U. S. Nuclear Regulatory Commission, enabling the utilization of a variety of unsealed and sealed sources of byproduct materials for diagnosis, therapy and research. Apart from the clinical applications, such byproduct materials are also being used in the School of Basic Medical Sciences, in 365 laboratories by 128 authorized users and their staff.

Our Byproduct Material Inventory and Disposition Reports for the year 1982 reveal that a grand total of 17 Trillion Becquerels of byproduct materials have been procured. However, the sealed sources (27.9 Billion Becquerels) and most of the short-lived isotopes, particularly Moly-Tech generators (7 Trillion Becquerels) do not present any problem from the standpoint of disposal of low level wastes (LLW). A significant portion of the other unsealed sources ranging from Tritium to Thallium-201, does end up as dry (solid) wastes, liquid wastes, scintillation cocktails and as biological wastes, amounting to a total activity of 41.3 Billion Becquerels emanating mainly from the various research laboratories.

From the disposal standpoint, one talks about volume of wastes in various forms rather than their radioactivity content in Becquerels. Table I gives the volumes of radioactive wastes generated at the Health Sciences Center from the year 1978 through 1982.

Table I

Volume of Radioactive Wastes Generated Over the Years

| Type of Waste | Volume in Cubic Feet | | | |
|---|---|---|---|---|
| | 1978 | 1979 | 1980 | 1982 |
| Solid | 1185 | 1647 | 1925 | 2528 |
| Liquid Scintillation Vials | 355 | 551 | 720 | 1101 |
| Liquid | 33 | 80 | 64 | 99 |
| Biological | 37 | 60 | 117 | 324 |

Table II provides data on the increase in costs over the recent years for the disposal of low level radioactive wastes through a commercial vendor. It is our experience that the disposal costs amount to approximately 25% to 30% of the total budget for our Radiation Safety Office.

Table II

Increase in Disposal Costs Over the Years

| ITEM | Dollars Per Cubic Feet | | | | |
|---|---|---|---|---|---|
| | 1978 | 1979 | 1980 | 1981 | 1982 |
| Dry, solid waste | 2.90 | 9.25 | 15.25 | 23.50 | 24.77 |
| Regulated scintillation vials | 4.90 | 9.25 | 19.05 | 25.35 | 26.98 |
| Liquid waste | 2.40 | 9.25 | 18.75 | 25.60 | 26.87 |
| Animal waste | 4.90 | 9.25 | 19.60 | 24.75 | 26.08 |
| Empty 55 gal. steel drums (cost/drum) | 12.25 | 13.95 | 13.95 | 16.95 | 16.95 |
| Empty 30 gal. steel drums (cost/drum) | 8.75 | 11.25 | 11.25 | 15.25 | 15.25 |
| Vermiculite bags #4 (cost/bag) | 3.25 | 5.25 | 5.25 | 5.25 | 5.25 |

Being a major medical center in the greater Chicago area, our institution also produces significant quantities of chemical wastes and hospital-based infectious and biological wastes as well. However, the problem that the University has faced recently pertains principally to the disposal of the above-mentioned low level radioactive wastes and the incinerable chemical waste only. The latter amounts to approximately 15,000 lbs/year.

## LEGAL AND CONTRACTUAL PROBLEMS

The crisis with respect to LLW disposal manifested itself to the University in early 1980 not only in the form of escalating costs but also liability requirements imposed by the sites which the University could not assume. From a purely Health Physics standpoint, whenever any institution ships low level radioactive wastes containing relatively innocuous byproduct materials such as Tritium and Carbon 14 of low specific activity, it is unlikely that a major incident will occur at the burial site resulting in a class action suit against the users of the site for possible radiobiological consequences to the people at large residing in the vicinity of such burial site. However, from a purely legal standpoint this problem presents a different perspective.

For example, the State of Washington's indemnification certificate based on the Governor of Washington's Executive Order dated November 19, 1979, states interlia, "The undersigned shall indemnify and hold harmless the State of Washington, in an amount not to exceed $1,000,000.00 per individual who may be injured, provided that indemnification shall not exceed $5,000,000.00 in total, for each occurrence, from any and all claims, suits, losses, damage, injury and expenses to any person whomsoever or to property arising or growing out of or in any manner connected with the activities performed under this order".

However, according to the Illinois Statutes, the Board of Trustees in the exercise of any of the powers "shall not create any liability or indebtedness in excess of the funds in the hands of the Treasurer of the University at the time of creating such liability or indebtedness and which may be specially and properly applied to the payment of the same". The University does have the specific exemption to go in for self insurance for some of its operations, the implications being that the University will pay as and when a claim arises, pertaining to this insurance.

The word "hold harmless" in the indemnification certificate implies, however, the legal meaning "without regard to time or amount". Even under the self-insurance concept, the dollar term "$5,000,000.00 in total, for each occurrence" is huge enough as not to enable the University to tie-down for a single operation (of low level waste disposal) only. Investigations also revealed that underwriting any contractually assumed obligation, using outside insurance companies is difficult and cumbersome for the University. Hence the University could not assume the liability requirements imposed by the disposal sites for the disposal of its radioactive wastes.

It is also apparent to the generators of radioactive wastes who are shipping the LLW to a site such as Richland, Washington that a burial site may accumulate waste drums from different institutions, containing byproduct materials of various chemicals and radiochemical toxicities, transported under varying physical conditions, the drums being packed, processed or buried by individuals of varying attitudes towards safety requirements or regulatory compliance. From the LLW disposal standpoint, there are at least three parties who are involved; the generator, the shipper and the site-operators (and their employees). If an institution were to "hire" another party to transport or process such LLW, the principles of the Law of Agency can be evoked (i.e.) one is liable for the "commission" or "omission" done by the agents, should a claim arises.

The terms "any and all claims, suits, losses, damage, injury and expenses to any person" mentioned in the indemnity certificate may be viewed as follows: Any employee at the disposal site, for example, may develop an injury/illness which may have a proximate or remote causal nexus to exposure to radiation and/or radioactive materials. So long as it is job-related, the principles of Workmen's Compensation laws may be evoked. Unlike in the "negligence" cases under the tenets of common law, no breach of any standard need to be proven by the plaintiff in the Workmen's Compensation cases. What he needs to establish is that there is damage and that the injury is job-related. One may anticipate however that such Workmen's Compensation claims may be only a few over the years?!

The third paragraph of the same certificate does however, state, that "Except for any violation of applicable existing state or federal statute or regulation respecting packaging and shipment, inspection and acceptance of any item, or container or material covered by this certification by the State of Washington or a duly authorized contractor shall release the party who executed this certificate from any and all requirement of indemnification from injury or loss".

The terms "except for any violation of applicable existing state or federal statute or regulation respecting packaging and shipment" demand application of the professional standard of care. In the cases involving ordinary negligence, the plaintiff has to prove that:

a. There was a duty on the part of the defendant(s) towards the plaintiff (to ensure health and safety in waste disposal operations)
b. There was a breach of that duty (i.e., breach of applicable standard of care with respect to packaging etc.)
c. There was an injury with proximate cause
d. Damages

Although expert testimonies are usually involved in proving or disproving some of the above requirements, it is usually difficult for a plaintiff to prove "proximate cause" in radiation injury cases.

With respect to the application of the principles of law, either from the standpoint of ordinary negligence, or the Workmen's Compensation, under the present climate, (particularly when the scientists are not sure of cause-effect relationships pertaining to low-level radiation exposures), one may speculate that the courts may be willing to shift the burden of proof (of causation) from the shoulders of a plaintiff in radiation injury cases. If so, any agreement made by present-day administrators of a given institution with respect to LLW disposal, may become an albatross around the neck of a future administrator?!

The question arises as to what one can do under these circumstances? One may think of "secondary indemnifications". A shipper may be asked to underwrite the insurance. But there is no guarantee that the same shipper may be in business at the time claims are made. One may think of buying insurance from outside; but the insurance industry (particularly in the field of nuclear insurance) may be regulated and it may be cumbersome to procure a suitable insurance. One has also the option to assume the risk, keeping the fingers crossed. Finally, one may look into other methods for the disposal of LLW, such as incineration.

## ROLE OF ADMINISTRATORS

When the crisis was reported to the Vice-Chancellor for Health Affairs, a special study group was appointed composed of the Director for Space Utilization, the Directors of Environmental Health and Safety Office and Radiation Safety Offices, the Superintendent of Building Maintenance, et al to evolve a viable program for the disposal of all wastes. This adhoc committee considered all the wastes, viz, radioactive, chemical, infectious, animal and ordinary) and also considered the various disposal methods (transfer to authorized vendors, sewage disposal, atmospheric release, storage for decay, incineration and specific disposal of certain wastes). After analyzing the regulatory requirements of U. S. NRC, U.S. DOT, Illinois DOT, Illinois Department of Nuclear Safety, Federal and State EPA, OSHA and the City of Chicago, the committee recommended that the University should consider procuring and commissioning a modern incinerator for the disposal of all applicable wastes.

The performance standards, emission controls and operating requirements establish rigid design parameters for hazardous waste incinerator manufacturers. In this connection, the U. S. EPA has published interim final rules for "Incinerator Standards for Owners and Operators of Hazardous Waste Management Facilities on January 23, 1981 in 40 CFR Part 264, subpart O. These regulations provide guidelines for:

a. Permits
b. Trial burns
c. Waste burns
d. Performance standards
e. Emission control
f. Operating requirements, and
g. Monitoring and inspections.

The Illinois Pollution Control Board has recently published "Operating Standards for Incinerators". These regulations provide guidelines for:

a. Permits
b. Shelter, sanitary facilities, and emergency communications
c. Roads, ramps and traffic flow
d. Controlled access
e. Fire protection
f. Visual screening
g. Time of operation
h. Dust, litter and ash removal

The above factors thus provide site requirements for an incinerator installation.

The U. S. NRC has published a bulletin entitled "Information Required for Commission Approval of Treatment or Disposal by Incineration" to all licensees which provide the requirements for:

a. List of byproduct materials to be incinerated
b. Concentration in the effluents
c. Incinerator stack height
d. Heights and distances of neighboring structures
e. Proximity to air-intakes
f. Rated air flow of incinerator
g. Ash removal
h. Personnel safety, education and training
i. Frequency of burns.

The City of Chicago, Department of Inspectional Services, in addition to the above agencies, must approve of the make, model or type of incinerator to be installed. Thus the plans and specifications of the incinerator installation are also subject to the Department approval.

The adhoc committee then searched for a list of manufacturers of incinerators (Table III), to find out which product will meet the needs of the University and enable us to comply with the various regulatory requirements. The list in Table III is by no means a complete list and there may be other manufacturers who may be able to supply a suitable incinerator, according to specifications.

Table III

List of Incinerator Manufacturers

1. Environmental Control Products
   P. O. Box 15753
   Charlotte, NC 28210

2. Vulcan
United Penn Building
Wilkes Barre, PA 18703

3. Morse Boulger, Inc.
53-09 79th Place
Corona, NY 11368

4. Kelly Co., Inc.
6720 N. Teutonia Ave.
Milwaukee, WI 53209

5. Air Pollution Control Systems (Consumat)
Box 488
Mechanicsville, VA 23111

6. New Way Industries, Inc.
P. O. Box 109
Dover, NJ 07801

7. Sunbeam Equipment Corp
Sunbeam Comtro
Suite 410B
Century Plaza Building
Meadville, PA 16335

8. Wasteco
20675 S. W. 105 St.
Tualatin, OR 97062

9. Industronics Inc.
489 Sullivan Ave.
P. O. Box Drawer G
South Windsor, CT 06074

10. Basic Environmental Engineering, Inc.
21W161 Hill Street
Glen Ellyn, IL 60137

11. T. T. Therm-Tec Midwest
P. O. Box 784
Wisconsin 54494

12. Waste Technology Inc.
P. O. Box 748
Red Bank, NJ 07701

## COST IMPACT

An analysis of the waste disposal has depicted costs encountered in sterilizing or incinerating wastes on the premises, hauling wastes to a transfer point and paying to dump them or paying a vendor to remove and dispose of special types of wastes. The very collection of wastes involved some fixed costs regardless of the means of disposal. Examples of such fixed costs are:

a. Transporting from the point of generation to a receptacle;
b. Lining the receptacle with plastic liners;
c. Gathering the material from such receptacles to a transport system;
d. Any refrigeration costs, if necessary;
e. Labelling of wastes

These costs remain the same regardless of the means of disposal and hence not estimated.

The overall estimated cost of the incinerator installation would involve the following items:

| | | |
|---|---|---|
| 1. | Equipment cost | $210,000 |
| 2. | General architectural work (site work, concrete, roofing, etc.,) | $ 33,000 |
| 3. | Electrical work (power, motor controls, fixtures, etc.) | $ 34,500 |
| 4. | Mechanical work (receiving, erection,gas, water, sewers, etc.) | $ 53,000 |
| 5. | Professional services | $ 17,350 |
| 6. | Contingency cost | $ 12,150 |
| | TOTAL | $360,000 |

It is estimated that this anticipated capital investment of $360,000 would require a payback period of about 7 years based mostly on fiscal year 1980 costs for alternate disposal methods.

## ENVIRONMENTAL IMPACT

Incineration of chemical wastes may produce several actions, assuming the temperature at which incineration takes place is sufficient. These would include:

a. Vaporization of chemical compounds
b. Oxidation of vapors
c. Emission of unoxidized solids, liquids and gases
d. Melting of solids to liquids
e. Formation of chemical intermediates
f. Recombination of chemical products

The specifications of the proposed incinerator can be such as to achieve a destruction efficiency of 99.99%, a combustion efficiency of 99.9% and a particulate emission efficiency of less than 0.08 grain per cubic feet of air.

If the incineration of chemical wastes were to be conducted under close supervision with careful control of the temperature at which incineration takes place, air flow, quantities (small) of chemicals and combination of chemicals to be incinerated, the other concerns such as (a) particulate emissions, (b) concentrations in air of oxides of Sulfur, Nitrogen, Carbon, etc., can be within legal limits.

Some of the Hydrocarbons (Example: alcohols, aldehydes, ketones, esters, etc.), may escape destruction if temperature, feed rate, fuel supply and retention time are not adequate. Again, with proper controls of the above factors, these emissions can be reduced to a negligible amount.

It may be necessary to exclude from the incineration list, a few entities such as heavy metal compounds since they are known to produce unacceptable, hazardous pollution. Thus with appropriate consideration of the results anticipated and close supervision of the incinerator operations, the environmental impact caused by incineration of chemical wastes could be reduced to a level as low as reasonably achievable.

From the environmental release of radioactive vapors and gases, when specific quantities of a variety of radioactive wastes are incinerated, our calculations (based on Pasquill's equation) show that the annual increase in radiation exposure to the general public due to incineration would be equiva-

lent to increasing the natural background radiation level in our area from 1.05 milliSievert/year to 1.05042 milliSievert/year i.e. the additional radiation exposure to the general public would be only 0.00042 milliSievert/year due to the release of radioactive gases and vapors.

## PUBLIC RELATIONS

If an institution were to consider an incinerator as a viable, economical and safe facility for the disposal of toxic wastes, low level radioactive wastes, infectious wastes, etc., it must also take into account the public's perception of radioactive and toxic materials and of the "risks" these pose to human health; for, perceptions are what will give birth to any public action or reaction related to the proposed development and operation of an incinerator.

During the past few years, newspaper, television and radio reports have been rife with the dangers and problems posed by such disasters and near disasters as the State of New York's "Love Canal" toxic chemical dump, Three Mile Island and the PCB contamination in Michigan. In the spring of 1979, for example, the Chicago Tribune ran a series of reports on the possible health effects the A-bomb tests of the 1950s and uranium mining have had on residents in western states such as Colorado and Utah. The radioactive fallout of these tests as well as the wastes (uranium tailings) created by uranium mining are being blamed for high rates of cancer, leukemia and other formidable health problems among affected populations. Tribune headlines screamed: "Uranium Mining Leaves A Legacy of Cancer Fear," "Grand Junction: Dying of Radiation--or Rumors," and "Town Counts Dead Years After A-Tests."

WLS-TV (Channel 7) in Chicago recently completed a week-long series of news reports about unnecessary exposure to medical and dental x-rays, faulty x-ray equipment and thelack of expertise and knowledge on the part of some who operate x-ray equipment. During one of the segments, reporter Roberta Baskin very emphatically stated that radioactivity causes cancer and genetic defects, leaving the viewer with the impression that exposures to even the miniscule percent of a roentgen will eventually lead to a host of horrible health problems and eventually death.

In an editorial that appeared in the Charlottesville (VA) Observer recently, editors lamented the "possibility of dumping nuclear wastes into the city's (Charlottesville) sewer system" and said such plans "boggle the mind". "'Familiarity breeds contempt', this adage, the newspaper continued, "may serve a useful purpose in some cases, but not in the case of nuclear materials. More accurately, 'familiarity breeds death.'"

Media pronouncements like those made in the Observer or by WLS-TV only serve to fan the public's fears of radioactivity and toxic wastes--fears already heightened by discoveries of illegal toxic waste dumping sites, evidence of ineffective or complete lack of government control of waste sites (such as "Love Canal"), reports of violations at nuclear power facilities and poorly-researched and unsafe government practices such as the exposure of large numbers of people to radioactive fallout during the testing of "dirty" A-bombs in the 1950s or exposure of Vietnam veterans to the toxic Agent Orange in the 1960s and early 1970s.

Not only do some people fear and distrust the generators of toxic and radioactive wastes, they fear and distrust the government licensing and regulatory agencies charged with the protection of the public. This fear and mistrust may have a potentially negative impact on the institution's plan to construct a hazardous waste incinerator, and therefore, must be considered when developing a public relations strategy.

Based on the above analysis of the emotions and fears that hazardous wastes or the mere mention of such terms as "toxic wastes" can evoke and the potential support for or against the institution's plans for the incinerator, the authors would like to suggest a "middle-of-the-road" or low-key public information/education strategy that excludes any "veil of secrecy" over the project, and yet does not cause to promote any anti-nuclear or anti-incinerator resentment and opposition where none may exist to start with. The disadvantage of trying "to cross the bridge after we reach it" i.e. to maintain a policy of secrecy regarding the incinerator project, is that almost nothing remains a secret forever. Once the news of the incinerator "leaks out" the institution's public image and credibility as a "good neighbor" and "community supporter" could be seriously hurt and it is likely that a wave of community and/or media opposition may develop and even stymie construction of the facility. Overcoming the general fears about radioactive waste, distrust of industries and institutions that generate such waste and suspicion of government agencies charged with protecting the public interest is difficult enough from a public relation/public information standpoint. However, the task becomes even more complicated if the public believes the institution is being less than candid and is trying secretly to push the project to completion. Nothing would create community resistance quicker than the belief that the institution was attempting to circumvent community input and expression of viewpoints and was forcing upon the area a project that could ultimately have a negative impact on employees, students and area residents.

To go the opposite extreme of formal announcements of the proposed incinerator, press releases and even leaflets distributed door-to-door in the surrounding communities might serve only to foment opposition where none now exists--literally smoke out the extremists--and, perhaps, engender media reports that are less than complimentary to the institution and inaccurate in their portrayal of the project.

The "middle-of-the-road" public relations approach would however include a comprehensive but low-key information campaign, utilizing local community newspapers and one-on-one contact with key individuals or groups in the community whose support of the incinerator project would be valuable or whose opposition requires an effective response from the institution.

Thus, pre-gathered information would allow the institution to respond in an effective, timely fashion to the concerns and information requests of groups or individuals (including representatives of the media), who may be concerned about or at least interested in the institution's plans for the incinerator.

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