SELECTED PROBLEMS OF HAZARDOUS WASTE MANAGEMENT IN CALIFORNIA

JANUARY 1970

REPORT OF THE HAZARDOUS WASTES WORKING GROUP
OF THE GOVERNOR'S TASK FORCE ON SOLID WASTE MANAGEMENT

GOVERNOR'S TASK FORCE ON SOLID WASTE MANAGEMENT

SACRAMENTO

January 2, 1970

My dear Governor

It is my privilege to submit SELECTED PROBLEMS OF HAZARDOUS WASTE MANAGEMENT IN CALIFORNIA.

General findings and recommendations concerning State requirements and policies as well as specific responsibilities of a designated State agency are presented in REPORT OF THE GOVERNOR'S TASK FORCE ON SOLID WASTE MANAGEMENT. This volume presents in some detail those Task Force recommendations dealing with certain critical problem areas uncovered by the Task Force.

Respectfully,

Frank R. Dansby
Chairman
Governor's Task Force on Solid Waste Management

The Honorable Ronald Reagan
Governor of California
Sacramento, California 95814

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GOVERNOR'S TASK FORCE ON SOLID WASTE MANAGEMENT

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PREFACE

This report is concerned with those wastes which present a hazard to human, animal, or plant life when not managed properly.

FINDINGS AND MAJOR RECOMMENDATIONS are listed in Section I. In section II, GENERAL INTRODUCTION TO HAZARDOUS WASTES, hazardous wastes are defined, chemical and biological contamination are discussed and the responsibilities and method of approach of the Working Group are described.

In each of the following sections a selected problem is discussed and recommendations concerning the specific area are made:

Section III, CHEMICAL AND PETROLEUM INDUSTRY WASTES

Section IV, DRUGS, HYPODERMIC NEEDLES, MEDICAL SUPPLIES, ETC.

Section V, RADIOACTIVE WASTES

Section VI, SEWAGE TREATMENT SLUDGE

Section VII, FEDERAL AND MILITARY

In the appendix selected data from Dr. Thrift D. Hanks, Solid Waste/Disease Relationships and from Sanitary Engineering Research Laboratory, Comprehensive Studies of Solid Waste Management - Second Annual Report are adapted. These data identify solid waste sources and indicate hazardous constituents. These data were used as a framework for the screening, review and analysis of the Hazardous Waste problem in California conducted by the Working Group.

CONTENTS

I.
FINDINGS AND MAJOR RECOMMENDATIONS

The effective Solid Waste Management Program which California needs cannot be accomplished within the framework of existing legislation. Therefore, the Working Group recommends consideration of its findings and prompt passage of appropriate legislation to accomplish the general recommendations listed in Table I-1.

To date, the following hazardous wastes have been examined by the Working Group in detail: (1) Chemical and Petroleum Industry Wastes; (2) Drugs, Hypodermic Needles, Medical Supplies, etc; (3) Radioactive Wastes; (4) Sewage Treatment Sludge; (5) Federal and Military. We have found that, for these special problem areas, it is unlikely that questionnaire surveys and voluntary self-reporting can provide an adequate data base for problem identification and definition and program development. Further, since these special problems tend to be concentrated in specific localities, standard projection and extrapolation techniques tend to understate the statewide picture in terms of potential damage to the environment and the population. Therefore, in order to acquire the necessary data base and information for adequate problem definition, and for the development of special standards, the Working Group urges the implementation of the functional recommendations of Table I-2 by the designated State agency.

Table I-1. General Findings and Recommendations

CHEMICAL AND PETROLEUM		DRUGS, HYPODERMIC NEEDLES, MEDICAL SUPPLIES, ETC.	
CP 1	Develop a uniform system for the classification or coding of waste chemicals as to type and degree of hazard.	DM 1	Develop basic information on solid waste management practices within the drug industry in California: (1) to determine the number, location and size of drug industry production and processing centers; (2) to determine and evaluate present practices, needs, and problem areas of industrial solid waste management within the industry; (3) to provide data by type on quantities of solid waste generated by the various drug manufacturing firms, information an solid waste generation points within the production processes, other sources of solid wastes from the plants, storage practices, collection, disposal or treatment methods, and point of discharge.
CP 2	Conduct a detailed field survey of the major chemical and petroleum waste generators and a questionnaire survey of the smaller firms ta develop information on generation of hazardous wastes by location of point of generation, amount of waste generated by type and degree of hazard, company ownership, specific identification of the official responsible for disposal, and the current means and points of disposal. The questionnaire survey should be validated by on-site verification of an appropriate sample and a further check with the haulers involved.	DM 2	Determine the nature and extent of the problems associated with disposal af unused, used, or partially used containers, bottles, hypodermic syringes, hypodermic needles, drugs, medicines, medical supplies and other similar items, including bandages and dressings in the State of California.
CP 3	Develop special standards of design and/or operation far collection, storage, transport and/or disposal sites receiving hazordous wastes and methods of audit and control to assure compliance with the standards.	DM 3	Should this problem be reported as "major" or "important" by any significant number of jurisdictions in the State, then enabling legislation should be passed by the State Legislature to require the designated State Agency to establish standards and regulations in respect to the collection of, transportation for disposal, and disposal of discarded drugs, drug containers, syringes, and other contaminated or single-use medical supplies as used by physicians, hospitals, clinics, and similar health care facilities.

Table I-1. General Findings and Recommendations (Continued)

RADIOACTIVE MATERIALS	
RM 1	Survey current situation to determine: the generators; quantity and radioactive level of wastes produced; frequency and costs of collection; equipment used; and points of discharge ar disposal.
RM 2	Conduct a field study and investigation to assure that all radioactive wastes generated within the State enter the formal collection and disposal system.
RM 3	Re-examine current standards, practices, and monitoring and enforcement techniques to assure that they are adequate in meeting the current and future needs of California.
SEWAGE TREATMENT SLUDGE	
ST 1	Study the ecology of the Santa Monica Bay to assure that changes induced by the reduction in nutriments reaching the coastal waters do not cause great damage to the ecological balance. Consider solutions such as treatment and insertion of sewer sludge from the Hyperion plant into the shallow coastal waters and other methods.
ST 2	Study contamination in the San Francisco Bay area to determine the relationship of the disposal of sewage sludge in landfills and the identified contamination. Establish standards and regulations for collection, transportation, and disposal of these sludges, if study indicates such are applicable.
ST 3	Study ecology of all shallow coastal waters off populated areas of California to understand changes brought about by various degrees and methods of treatment and disposal of sludge and associated problems.
FEDERAL AND MILITARY	
FM 1	Survey Federal installations and activities for quantities and characteristics of wastes generated and provisions made for the collection, storage, and disposal of these wastes.
FM 2	For each category of wastes where special procedures are required for storage, collection, transport, or disposal, prepare recommended standards, regulations, operating procedures, or control procedures for issue in the public press and for possible incorporation in Federal legislation.
FM 3	Seek legislation which will: require the Federal Government to clean up areas of Federally caused pollution or will authorize the State to do so and recover the costs from the Federal Government; and establish appropriate standards for Federal installations and activities which assure that the Federal Government ceases to cause pollution.

Table I-2 Functional Recommendations

FINDINGS	RECOMMENDATIONS
The environment, including its quality aspects, is a dynamic system continually changing both in time and in space. A sound environmental quality program must be geared to this dynamism. All State policies and practices in the field should be reviewed periodically and revised as appropriate. The State's Solid Waste Management Program should consider all of the significant factors that affect environmental quality. To do this, it will be necessary to substantially increase the magnitude and scope of planning efforts which must be fully coordinated with planning for the protection and development of natural resources. As the State's economy expands and the quantity of wastes becomes larger, knowledge concerning environmental quality must be expanded, and a comprehensive approach involving all levels of government, industry and agriculture is required.	The State should centralize its Solid Waste Program Management responsibilities and authority for planning and program activities in a single, existing State agency: The State Department of Public Health.
Adequate basic data concerning quality and other matters are necessary prerequisites to the establishment of reasonable quality objectives and standards, and for enforcement. Basic data collection programs must be comprehensive and be initiated far enough in advance of need to provide information covering a wide variety of conditions. Basic data collection must be a continuing program because of the dynamic nature of the system. The current basic data programs of the federal, state and local agencies are not adequate.	The designated State agency should be directed to institute and maintain an accurate inventory and appropriate projections of solid waste generation. An appropriate inventory would include information on: (1) the generation of wastes by location of point of generation; (2) amount of waste generated by type and degree of hazard; (3) identification of company ownership and specific identification of the official responsible for disposal; (4) description of current means of disposal and identification of the points of disposal or discharge.
A vested right cannot be acquired to generate or to dispose of waste into the environment, or to continue to generate or dispose of wastes at any particular level of quality, once initiated. Periodic revision and upgrading of requirements will be necessary to adapt to changing conditions, and to accommodate new discharges as the State's economy expands and its population increases. The interrelationships between waste generators and dischargers and the effects of their discharges must be recognized in the setting of requirements and in other quality control actions.	The designated State agency should be directed to develop special standards of design and/or operation for collection, storage, transport and/or for disposal sites receiving hazardous wastes and to periodically review and update these standards.
Current monitoring and surveillance programs are inadequate. Enforcement will be a greater and more difficult problem in the future due to the much greater volume of waste that will be generated, the greater scope and variety of corrective actions required, the magnitude of the costs involved, and the far more complicated interrelationships between the many kinds of waste discharges, and between the general population and the dischargers.	The designated State agency should be directed to develop methods of audit and control to assure an adequate level of compliance with the standards.
In order to achieve adequate planning and to assure an adequate degree of enforcement of new environmental quality legislation, all responsible parties involved in the generation and production, collection, transfer, transport, and/or disposal of hazardous wastes should be involved in the planning process. All waste dischargers and others contributing to quality problems should share equitably in the costs of achieving and maintaining the requisite levels of quality. Ideally, waste dischargers should pay the social and economic costs of any residual effects of their discharges, rather than having those costs passed on to others.	A permanent advisory board composed of informed citizens in the areas of sanitary engineering, ecology, economics, public health, municipal planning, land use, disposal system operation, etc., along with representatives from other affected public and private concerns should be appointed by the Governor to assist the designated State agency in formulating guidelines and/or standards.
In addition to identifying all waste generators and personnel of responsibility in the waste generation process, to assure the adequate and open development of public policy and fair, impartial and adequate enforcement of standards and regulations, it is necessary to identify all persons of responsibility within the entire solid waste management process.	As a minimum, licensing and inspection requirements should include the requirement for complete disclosure of all parties at interest as individuals, partners, officers, directors, or stockholders of more than 2 percent of any company, partnership, corporation, or business entity, engaged in the collection, transfer, transport or disposal of waste material destined for introduction to the land or water environment of California.
Various wastes have been identified as possibly hazardous and as requiring further information and possible development of special standards and controls (e.g., segregation or separate collection, special equipment, and special records). One such waste is magnesium fines. It has been reported that for lack of a legal disposal site at the present time, some producers have been "bootlegging" these highly explosive materials into regular Class II landfills. This practice has resulted in numerous fires and explosions during the past 12 months. Liquid, chemical and oily wastes, injected into water courses in greater amounts than prescribed, can become cumulatively hazardous. To date, lack of adequate numbers of enforcement personnel has precluded State Water Quality Control Boards in industrially-impacted areas from maintaining adequate inspection of producers' premises, and disposal practices. Acid and other mine drainage pollution has been suggested as a possible area of concern and is currently under investigation by the Working Group.	The designated State agency should undertake a survey of points of discharge, and associated quantitative and qualitative description of the discharges, of hazardous liquid wastes in order to evaluate the magnitude of the problem and as a basis for the development of adequate standards and controls.

II.
GENERAL INTRODUCTION TO HAZARDOUS WASTES

1. BACKGROUND

The Hazardous Wastes Working Group of the Governor's Task Force on Solid Waste Management is concerned with those wastes which present a hazard to human, animal, or plant life when not managed properly. These toxic or hazardous wastes often require special handling and under most circumstances require disposal on a case-by-case basis.*

Hazardous wastes are of both chemical and biological origin. Included in the category of hazardous wastes are industrial chemicals and sludges; residues of chemicals, paints, dyes, solvents, adhesives, oils, plating and pickling liquors remaining on metal cuttings, sawdust, paper, wood or cloth, or remaining in discarded containers; explosives and flammable materials; fines and dusts from exotic materials; exotic liquids, and acids and caustic liquids and solids; leachings from mineral wastes; leachings from landfills, herbicides and herbicide containers; pesticides, by-products of pesticide production, and pesticide containers; pathological and infectious wastes, disposable syringes, pills, and drugs from physicians' offices, clinics, hospitals and veterinary facilities; radioactive materials, sewage treatment; and other similar materials.

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*See, for example, the Final Report of Study Panel to the California State Water Resources Control Board (March 1969): "Consideration was given to the problem of indiscriminate dumping by industrial [liquid] waste haulers in the Los Angeles and San Francisco metropolitan areas. Suggestions ranged from the regional board licensing of waste haulers to requiring the establishment of local ordinances for such activities. The regulation of waste haulers is a complicated subject involving local government, regulation of the waste dumps, and policing. It is recommended that the State Water Resources Control Board, in conjunction with the regional boards, develop and implement a program for regulation of industrial waste haulers and make necessary legislative recommendations to the next session of the Legislature".

a. Chemical Contamination

The rapid acceleration of industrial technology has resulted in the introduction of new and exotic materials into man's environment at an increasingly rapid rate. According to Charles C. Johnson, Jr., Administrator of the Consumer Protection and Environmental Health Service of the U.S. Department of Health, Education, and Welfare, every year more than 500 new chemicals and chemical compounds are introduced into industry along with countless operational innovations. Little or nothing is known about the effects of many of these compounds, individually or in combination. Thus, researchers such as Hanks, McGauhey and others have pointed out the necessity for identifying and cataloging the industrial processes and specific agents generated by these industrial processes which may offer potential hazards in order to assure that the generation of these potential hazards does not result in harmful effects to man, nor to his environment.*

Surveillance, evaluation and planning must be continuous. First, there is the standard problem of preventing deleterious concentrations of uncommon constituents and toxic compounds at authorized disposal activities and controlling the unauthorized disposal of toxic or hazardous industrial wastes. Second, there is the ever present possibility that a changing industrial process or a new chemical substance could cause long lasting damage to the environment within a relatively short time period, unless the problems were identified and neutralized promptly. To initiate corrective action before a problem becomes acute and forces are set in motion which may well be irreversible except over long time periods, potential problems must be anticipated, the necessary information and data must be obtained, and plans must be formulated in advance. Additional research is required in order to develop the necessary information. For example, there is a need to study: factors influencing leaching, movements of compounds through soil, chemical reactions of materials during soil migration, ultimate fate and nature of materials, determination of tolerable levels for those hazardous materials which may escape into the environment, safe limits of lifetime exposures to toxic materials, nature of injuries if excessive amounts are absorbed, means for detecting subclinical effects, and therapeutic measures.

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*Classification distinctions such as "liquid waste" and "solid waste" are not meaningful. The problem is pollution — no matter what the source. Once the pollutant is in the environment, it may never be known whether the original source was originally classified as a "liquid" or a "solid" waste. For example, the Report of the Committee on Public Works, United States Senate, 7 August 1969 (p. 20) contains an account of a spill of a hazardous substance. On July 9, 1969, about 450,000 gallons of acid-leaching material was released into the San Francisco River; 50,000 dead fish were counted in the first 4 miles of the river within 10 hours of the discharge. The Supervisors of Los Angeles County have also recognized this as a joint problem in their Motion on Liquid Waste, dated September 23, 1969.

Two types of chemicals are of special concern: carcinogens and pesticides. Most proofs of carcinogenesis in humans are limited to occupational exposures but there is probably a general population exposure of unknown magnitude. Various reports substantiate this assumption in one way or another and give emphasis to the urgent need for comprehensive chemical, experimental, and epidemiologic studies to determine actual hazards.

Pesticides may find their way into solid wastes by four principal routes: production wastes, containers containing pesticides, food wastes, and by direct application to wastes to control pests. Once in the wastes, they are subjected to leaching as are other compounds. Although there is little or no medical evidence that adverse effects have occurred, there is an immediate need for attention to the problem of buildup of persistent pesticides in the total environment. The Secretary of the Interior has been quoted as stating, "Not until we have a systematic monitoring scheme, designed to tell us how much of what is where, will we be able to detect incipient problems early enough to prevent damage." Possible chemical changes in pesticide residues are of interest, and there is a definite requirement for better analytical methods and schemes for detection and identification.

Studies are needed on the nature of trace element chemical pollutants and their physiological significance in terms of disease and nutritional problems.

b. Biological Contamination

Of primary concern (in regard to free biological agents of disease) is whether or not the method of disposal, or the products of treatment which are to be used in agriculture or other industries, permit survival and transmission of disease organisms to humans, plants, or animals.

An important concern at disposal sites is the possibility that organisms may migrate through the soil, as a result of leaching and movement of ground water, and pollute water supplies. As early as 1927, E. coli. was known to remain viable for 31 months in experimentally polluted ground water.* Later studies provided data concerning movement of bacteria through soils and factors affecting it. A few investigations have indicated that detergents affect movement of bacteria through soil; however this problem is one which should receive additional attention in research.

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*Fecal or Escherichia coli constitute about 90 percent of the coliforms discharged in fecal matter.

Sludge from various types and comprehensiveness of sewage treatment presents a solid waste problem of considerable magnitude. Sludge may be used in agriculure after a process such as composting.* When sludge is used as a soil conditioner, viable organisms may be carried to water supplies by surface runoff; the pathogens may offer an occupational exposure to agriculture or sanitation workers, or may contaminate foodstuffs. Because of these potential problems, additional information is needed on pathogen survival and methods for assuring their destruction, removal of pathogens by various treatment processes, and better methods for detection and enumeration of pathogens.

Consideration should be given to certain marine aspects of disposal of sludges. In using ocean disposal methods, it is important to dilute the wastes and dispose of them so that they neither adversely affect the ecology adjacent to the outfall, nor return to shore. On the other hand, sewage treatment sludge could conceivably be used to supply nutriments to the shallow coastal waters which have had their ecology changed due to man-induced deprivation of such nutriments.** Little is known of the benefits and costs of such processes. Research to gain an understanding of the action of waves, currents, tides, and winds in the dispersion process is thus important.

Since the contribution of solid wastes to potential disease transmission is not well defined, research is needed to develop models of the urbanization phenomenon (which include the ecologic aspects of zoonosis and wastes) for use in investigations of potential epidemic hazards.

2. RESPONSIBILITIES AND METHODS OF APPROACH

The Hazardous Wastes Working Group was charged with responsibility for developing a quantitative and qualitative understanding of the problems related to the handling and disposal of hazardous waste

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*Fair and Geyer (Water Supply and Waste Water Disposal, p. 767) caution that such "utilization of sewage sludges is circumscribed by the hygienic hazards involved. Pathogenic bacteria, viruses, protozoa (cysts), and worms (eggs) can survive sewage treatment and be included in the sludge. There, they will persist for long times and cannot be fully destroyed by digestion or air-drying. Although the numbers of surviving organisms decrease appreciably in the normal course of events, only heat-dried sludge can be considered fully safe."

**The damming of almost all California streams leading to the coast, the paving and subsequent sweeping of streets, coupled with the disposal of sewage treatment sludge either on land or deep at sea (as is done in Santa Monica Bay, at the edge of an underwater cavern, below the thermal incline) deprives the shallow coastal waters of their normal supply of nutriments.

materials and with evaluating: (a) the adequacy of the methods utilized to handle and dispose of the material; and (b) the degree of hazardousness to the public and the environment from these wastes. In evaluating these wastes, the Working Group was to consider the following:

1) What can be done to minimize the quantities of these wastes being produced?

2) To what extent should these wastes be incorporated with other domestic and commercial wastes and what would be the effect on existing solid waste systems?

3) What special precautions, regulations, or standards are needed to properly handle and dispose of these wastes?

4) Who should have the responsibility for the proper management, control, handling and enforcement of regulations regarding these wastes?

The Working Group, in selecting which aspects of the general problem area to explore in-depth, attempted to focus on problems which are unevaluated as environmental hazards. To accomplish this, many discussions were held and a variety of reports and articles were reviewed. Two reports were utilized to provide the Working Group with its classification framework: (1) Thrift G. Hanks, Solid Waste/Disease Relationships; and (2) Sanitary Engineering Research Laboratory (SERL), University of California Berkeley, Comprehensive Studies of Solid Wastes Management - Second Annual Report. The Working Group followed, in general, the objective and procedures outlined by SERL. Thus, a description of the SERL objectives and procedures [as modified by the Working Group] is relevant.

The principal objective was a systematic screening of data on the types and composition of solid wastes and on the processes of handling and disposal for the purpose of:

1) Identifying those fractions which might have environmental and public health implications.

2) Evaluating the public health significance and environmental fate of the various fractions in relation to wastes processing and disposal.

3) Identifying those constituents of the solid waste stream which merit intensive study.

4) Suggesting means of keeping those components shown to constitute a significant hazard from entering the environment in such a manner as to cause damage to human, animal, or plant life.

Procedures were as follows: A series of tables was prepared by a survey technique involving five major steps as well as the exercise of value judgments of both qualitative and quantitative factors. These steps were sequential in nature and included:

1) Classifying of wastes as to source (e.g., domestic, industrial, etc.

2) Identifying of the individual components of each class (e.g., wood, iron, plastics, etc.)

3) Listing of the chemical nature of each component (e.g., cellulose, lignin, etc.).

4) Listing the chemical nature of any breakdown products to which each component might be converted in each of the several disposal processes (i.e., incineration, landfill, composting).

5) Assessing the environmental and public health significance of the components and their breakdown products.

In making the evaluation necessary to Step 5), three criteria were utilized as a basis for value judgments: (a) magnitude of the component in the waste stream, (b) likelihood of a given component entering the environment, and (c) the effects of any given component if released to the environment.

In applying these criteria, it is recognized that magnitude is a relative term in the context of environmental significance. Trace amounts of one class of substance might have a profound effect on public health were it released to the environment, whereas large amounts of other types might be present before they constitute a threat to the public health. An example of the former is cadmium. Ingestion of a milligram or two per kilogram of body weight is sufficient to have dire effects on an individual. On the other hand, an appreciable amount of iron is needed to constitute a hazard. In either case, however, the significance of any substance in any amount in solid wastes is dependent upon it being released to the environment under circumstances which might injure man, either directly or through depletion of his crops or animal resources. Inasmuch as both original substances and their breakdown products may be involved and the long-term significance of dangerous materials sequestered in the ground are speculative, a considerable degree of subjective reasoning enters into an evaluation of the likelihood that any material will enter the environment even if it is present in the waste stream in significant amounts. Obviously, an insoluble material has a far less chance of entering the environment than one that is highly soluble.

In assessing whether a particular waste product is to be considered as "hazardous," the following criterion is used: If a material adversely

affects human health, or has significant adverse effects on plant or animal life if released to the environment at any stage in solid waste management, then it is considered hazardous.

In some cases materials which occur in solid wastes have already been demonstrated as toxic. Thus, elements such as cadmium, lead, beryllium, and other metals, although normally present only in trace amounts, should be thoroughly followed from their entrance into the wastes stream until and including the time of their final disposal. The same should be done of other materials which, in their pristine state may be innocuous enough, but when subjected to certain treatment processes form toxic substances. Plastics containing chlorine are a case in point. When incinerated, such plastics are converted to volatile chlorine products highly toxic in nature.

Table II-1 lists various major industries by Standard Industrial Classification, describes the waste generating processes for each industry, and lists the hazardous wastes to be expected. The Appendix contains more detailed materials on sources of hazardous wastes, hazardous constituents of these wastes, means of treatment or disposal, and environmental fate of hazardous wastes in relation to disposal means.

Table II-1 Sources and Types of Hazardous Industrial Wastes

Standard Industrial Classification		Waste Generating Processes	Expected Hazardous Wastes
Group Code	Group Classification		
19	Ordinance and Accessories	Manufacturing and assembling	Metal filings, plastics, chemical residues
24	Lumber and Wood Products	Sawmills, mill work plants, wooden container manufacture, and manufacturing of miscellaneous wood products	Metal filings, plastics, glues, sealers, paints, solvents
25	Furniture, Wood	Manufacture of household and office furniture, partitions, office and store fixtures, and mattresses	Those listed under Code 24
25	Furniture, Metal	Manufacture of household and office furniture, lockers, bedsprings, and frames	Metal filings, plastics, resins, adhesives
26	Paper and Allied Products	Paper manufacture, conversion of paper and paperboard, manufacture of paperboard boxes and containers	Chemicals, paper coatings and fillers, inks, glues
27	Printing and Publishing	Newspaper publishing, printing, lithography, engraving and bookbinding	Metal filings, chemicals, inks
28	Chemicals and Related	Manufacture and preparation of inorganic chemicals (ranges from drugs and soups to paints and varnishes, and explosives)	Organic and inorganic chemicals, metal filings, plastics, oils, paints, solvents, pigments
31	Leather and Leather Products	Leather tanning and finishing; manufacture of leather	Dyes, oils, processing and curing compounds
34	Fabricated Metal Products	Manufacture of metal cans, hand tools, general hardware, non-electric heating apparatus, plumbing fixtures, fabricated structural products, wire, farm machinery and equipment, coating and engraving of metal	Metal filings, slag, scale, coatings, solvents, lubricants, pickling liquors
35	Machinery (except electrical)	Manufacture of equipment for construction, mining, elevators, moving stairways, conveyors, industrial trucks, trailers, stackers, machine tools, etc.	Slag, metal scrap and filings, plastics, resins, paints, solvents, petroleum
37	Transportation Equipment	Manufacture of motor vehicles, truck and bus bodies, motor vehicle parts and accessories, aircraft and parts and boat building and repairing motorcycles and bicycles and parts, etc.	Metal scrap and filings, fiber, plastics, paints, solvents, petroleum products
39	Miscellaneous Manufacturing	Manufacture of jewelry, silverware, plated ware, toys, amusement, sporting and athletic goods, costume novelties, buttons, brooms, brushes, signs, and advertising displays	Metal filings, plastics, resins, adhesives, paints, and solvents

III. CHEMICAL AND PETROLEUM INDUSTRY WASTES

1. BACKGROUND

a. Total

The State Department of Public Health, in their Interim Report, Status of Solid Waste Management in California (1968), estimated that 463,000 tons of chemical and petroleum industry wastes (126,800 and 336,800 tons, respectively) were produced in California in 1967. The major portion of these wastes (82.5 percent) were produced in Los Angeles and Contra Costa Counties. An additional 15 counties produced only between 200 and 13,600 tons (See Figure III-1 and Table III-1 and 2).

b. Chemical Wastes

Recent questionnaire surveys of chemical industry wastes, taken during the past 3 years by three different groups, show a variation in the waste generation factor of almost two-to-one, as shown in Table III-3. In 1966-67, the Manufacturing Chemists Association (MCA) conducted a survey of their membership which indicated that 120,000 tons of solid wastes were produced by their members in California during 1966* The MCA represents only those companies that manufacture chemicals, essentially SIC Code 281, Industrial Chemicals, and SIC Code 287, Agricultural Chemicals. The MCA obtained information from 84 chemical plants employing 12,594 persons in California. These data indicated an approximate waste production rate of 9.5 tons per employee/year.

In 1967, with the cooperation and assistance of the Chemical Industries Council of Northern California, the State Department of Public Health

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*Manufacturing Chemists Association, "Environmental Management in the Chemical Manufacturing Industry - a 1967 Survey of the Members of the Manufacturing Chemists Association."

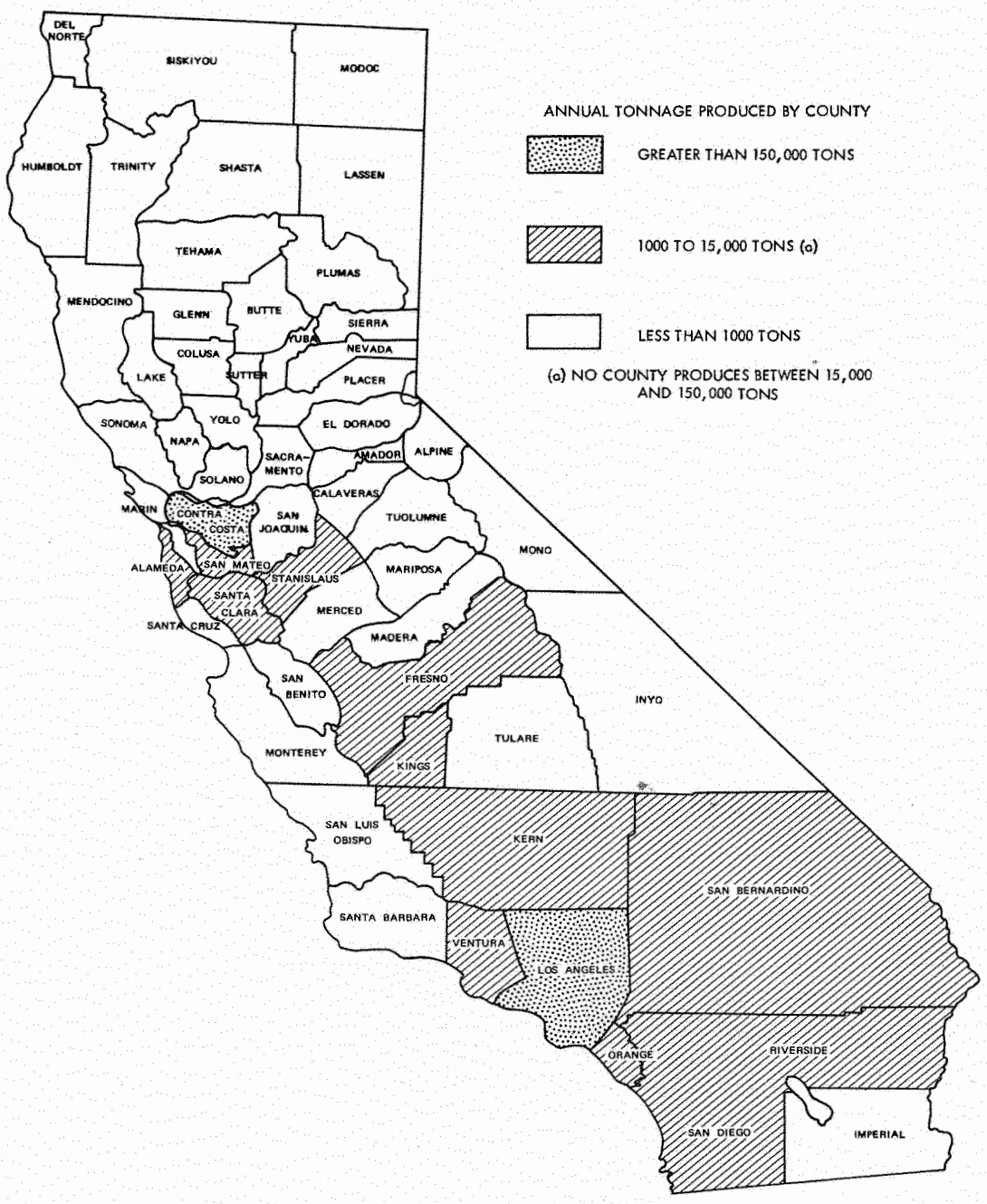

Figure III-1. Distribution of Chemical and Petroleum Industry Wastes, 1967*

*California Department of Public Health.

Table III-1. Chemical and Petroleum Industry Wastes in California 1967* (in tons)

Type of Waste	Area			
	Los Angeles County	Contra Costa County	Rest of State	Total for California
Chemical	a	25,000	a	126,800[d]
Petroleum	a	127,100[c]	a	336,800[d]
Total	230,000[b]	152,100[b]	1,200[b]	463,600[d]

Symbols:
a Not reported
b From Table III-7, page III-29 of State Report.
c 121,800 tons of waste from petroleum refining; 5300 tons, other.
d From Table III-6, page III-27 of State Report.

Table III-2. Chemical and Petroleum Waste Generation Factors - California State Department of Public Health 1968

SIC Code	Industry	Tons/Employee/Year
Series 28 (minus 281,285)	Chemical	0.5
281	Industrial Inorganic and Organic Chemicals	10.0
285	Paint Manufacturing	2.25
Series 29 (minus 2911)	Petroleum	10.0
2911	Petroleum Refining	23.5

*Source: Status of Solid Waste Management in California (1968)

Table III-3. Recent Surveys of Chemical Industry Wastes in California

	Manufacturing Chemists Association (MCA)	California State Department of Public Health	Governor's Task Force on Solid Waste	Bureau of Solid Waste Management - National Survey
Year	1966 - 7	1967 - 8	1969	1969 - 70
Number of firms surveyed in California	84 (statewide)	8 (Northern California only)	29 (Southern California only)	*
Total waste found in survey (in tons)	120,000	24,000	80,000	*
Total number of employees in survey	12,594	2,350	4,929	*
Waste generation factor** tons/ employee/year	9.5	10.1	16.1	*
Total chemical industry wastes in California (in tons), based on each survey	120,000	126,800	200,000	*

*Data not yet available.

**This figure is included to show relative comparisons but is not particularly meaningful, since different segments of the chemical industry develop widely differing quantities of waste. Thus, specific multipliers must be developed, as appropriate, for various segments of the chemical industry.

conducted a questionnaire survey of chemical solid waste production and disposal in the San Francisco Bay Area. An industrial waste survey form developed by the Department was mailed by the Council to their membership. The returned forms from eight firms in Contra Costa County (representing more than 25 percent of the total statewide employment in SIC Code 281, Industrial Inorganic and Organic Chemicals) were used in developing the waste factor of 10 tons per employee/year for SIC Code 281. These eight firms employed approximately 2350 persons and during 1967 produced approximately 24,000 tons of solid and semi-solid wastes. These wastes consisted of slurries, sludges, dusts, containers and other packaging materials, dunnage, and normal rubbish. Approximately 23 percent of the wastes were disposed of by onsite landfilling, and 77 percent were either picked up by private refuse collectors or industrial waste haulers.

The waste production factor of 2.25 tons per employee per year was used by the State for paint manufacturing firms (SIC Code 285) and the factor of 0.5 ton per employee for the remaining employment in SIC Code 28. It was considered reasonable that these plants would not have as large a waste factor as the large basic chemical processing plants; however, as the Department has pointed out, these two factors need further evaluation. An estimate of total statewide production of 126,800 tons of chemical wastes for 1967 was determined by applying the above factors to statewide employment data. Approximately 100,000 tons were produced by the plants engaged in manufacturing industrial chemicals (SIC 281) and the remaining 26,800 tons were produced by the other plants listed under the classification, Chemical and Allied Products (SIC 28).

The Governor's Task Force on Solid Waste Management, in cooperation with the Chemical Industrial Council (CIC) of Southern California, recently conducted a survey similar to that just mentioned. In order to derive results compatible with those obtained by the Department, the Hazardous Wastes Working Group used survey forms and related instructions identical to those used by the State. In this case, however, completed questionnaires were returned to an official of the CIC who assisted the Working Group in data reduction and analysis. Of 40 firms approached 29 completed their questionnaires. These firms represent 4929 employees and generate approximately 80,000 tons of solid and semi-solid wastes per year for an approximate waste production rate of 16.1 tons per employee/year.

The Federal Government, specifically the Bureau of Solid Waste Management, has undertaken nationwide study of chemical industry solid wastes.* However, the Task Force has been informed that, although a

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*National Industrial Solid Waste Management Study - the Chemical Industry; Contract No. CPE 69-5; Awarded to Traveler's Research, Inc., Hartford, Connecticut; June 1969 to 1970, PHS Publication No. 1897, Supplement, p.12.

questionnaire survey will be mailed to chemical firms in California, there are no plans to conduct detailed field surveys of these firms in the State. Representatives of the State should monitor the California phase of this effort to ascertain that all data acquired and techniques developed will be made available to the pertinent State agency. This questionnaire survey may serve as a benchmark for the more comprehensive State agency on-site surveys recommended below.

c. Petroleum Wastes

A survey of the four major petroleum refineries in Contra Costa County was conducted jointly by the Western Oil and Gas Association (WOGA) and the California Department of Public Health. A survey form was completed by each firm, and the data tabulated by WOGA. The 115,655 tons produced by these refineries represented 95 percent of the petroleum refining wastes produced in Contra Costa County and 37 percent of that produced in the State. Based on these data, a waste production factor (23.5 tons per employee per year) was developed for SIC Code 2911 (Petroleum Refining). Inasmuch as industries that are related to petroleum refining are similar to the chemical industry, a similar factor of 10 tons per employee per year was applied to these employment data. These factors were used in determining the statewide total of 336,800 tons of wastes produced from petroleum refining and related industries.

The data on solid waste production, characteristics, and method of disposal for the four major refineries in Contra Costa County are shown in Table III-4. As shown, 46 percent of the waste is disposed of in a landfill on-site and 54 percent is disposed of via private industrial waste haulers and offsite landfills.

To date, the California Department of Public Health has not obtained equivalent data for Southern California. The Hazardous Wastes Working Group of the Governor's Task Force has established lines of communication with WOGA in Los Angeles, and is in the process of conducting a joint survey. These findings will be presented in a supplementary memo.

2. PROBLEMS

Because of their toxic nature special public health problems are associated with the handling and disposal of many chemical and petroleum wastes. A report to the U.S. Public Health Service* presents a discussion of disease associated with chemical wastes. It is reported that hazardous chemical wastes can adversely affect the public health in a number of ways depending on the method of disposal, the nature of the end product, its concentration, and the effective dose in the population.

*T.G. Hanks, "Solid Waste/Disease Relationships," PHS No. 999-UIH-6, 1967.

Table III-4 Petroleum Refining Solid Waste Production and Disposal Contra Costa County - 1967*

Type of Waste	Tonnage Produced	Characteristics			Place of Disposal (Percentage)	
		Organic	Inorganic	Toxic	Onsite	Offsite
Solids						
Cat. cracking catalyst	8,530		X		23	77
Other catalysts, clay, ond desiccant	8,260		X		85	15
Coke and carbon fires	80	X			100	0
Miscellaneous solids such as fly ash	2,500		X		12	88
Rubbish from plant cleanup	6,700	X	X		8	92
Semi-solids						
Sludges -- tank cleaning, water treatment, etc.	54,300	X	X		13	87
Silt	35,000		X		100	0
TEL waste	270	X		X	100	0
Acid tars	15	X		X	0	100
Total	115,655				46%	54%

*Data provided by Western Oil and Gas Association

Human beings can be subjected to the toxic action of chemical wastes by direct contact, inhalation of dust, drinking or contact with contaminated water, eating contaminated foods, and contact with or breathing the fumes from open burning or incineration.

An example of the type of problem which can occur is one that was investigated during 1966 by the California Department of Public Health. In this case the reclamation, transportation, and disposal of chemical sludge containing tetraethyl lead caused illness to workers. In another incident, large quantities of chemical wastes were being disposed at a public disposal site, and although the tractor operator was required to mix the chemical wastes with other refuse, neither the site operator nor the industrial waste hauler knew much about the wastes other than its source was a large chemical company. A third example is the open dumping of toxic chemical wastes at a disposal site adjacent to San Francisco Bay.

It is mandatory to determine, accurately, the quantities and characteristics of chemical and petroleum industry wastes generated in California. The results from the MCA and Department surveys were in very good agreement. Both, however, resulted in substantially lower waste generation factors than that obtained by the Working Group. Whether the previous two surveys reflected information supplied by the haulers for these firms is unknown. It is also unknown whether the results of the questionnaires were verified by on-site inspections. Some individual comparisons with waste haulers were made by the Working Group. These were in good agreement with the Working Group's survey results: that the estimates of the quantities of these wastes reported, as carried by the waste haulers, exceeded by a factor of almost two, the quantities of these same wastes reported as generated by the application of the Department's standard generation factors.

In general, the use of questionnaires, as the sole basis for data gathering, can lead to underestimating. Detailed field surveys are required, throughout the State, by the Department of Public Health representatives in order to obtain an accurate estimate of chemicals and petroleum industry wastes. Both industries have shown a great willingness to cooperate with the Working Group. They recognize that the economic collection and disposal of their solid and semi-solid wastes will be a requirement for their continued growth. But, they also realize that stringent air, water and soil pollution standards on their wastes will probably have an inhibiting influence on their continued growth. For these reasons, major portions of the chemical industry, in Southern California at least, are considering relocation to sparsely populated areas, and an exodus has begun to San Bernardino and Riverside Counties.

Probably many additional sources of contamination should receive attention. For example, the U.S. Department of the Interior reports that used and uncollected motor oil presents a serious domestic problem. According to the Department, some 350 million gallons of used motor

oil must be disposed of annually by more than 210,000 gasoline filling stations in this country. Since changes in labeling requirements and in the tax laws have put more than half the re-refiners of used motor oil out of business, the petroleum industry has no means for collecting the used oil, and the oil often finds its way into city sewers, simply because it is the easiest way to dispose of the material. In 1968 at hearings on some 20 bills dealing with the various pollution threats to this nation, Rep. George H. Fallon (D. - Md.) also pointed out this aspect of the oil pollution threat and the need for the control of used and uncollected motor oil.

3. RECOMMENDATIONS

It is recommended that:

a. A uniform system for the classification or coding of waste chemicals as to type and degree of hazard should be developed.

b. A detailed field survey of the major chemical and petroleum waste generators and a questionnaire survey of the smaller chemical and petroleum waste generators should be undertaken to develop information on generation of hazardous wastes by location of point of generation, amount of waste generated by type and degree of hazard, company ownership, specific identification of the official responsible for disposal, and the current means and points of disposal or discharge. The questionnaire survey should be validated by on-site verification of an appropriate sample and a further check with the haulers involved.

c. Special standards of design and/or operation for collection, storage, transport and/or disposal sites receiving hazardous wastes should be developed along with methods of audit and control to assure compliance with the standards.

IV.
DRUGS, HYPODERMIC NEEDLES, MEDICAL SUPPLIES, etc.

1. BACKGROUND: THE DRUG MANUFACTURING INDUSTRY

The drug industry has been growing steadily for many years, but its growth was greatly accelerated during the Second World War by the enormous demands of the Armed Forces for life saving products manufactured by the drug industry. Acceleration of this industry continued during the following years. Each day many new products are being discovered and manufactured. The complexity of the problem is increased by the wide variation of products such as dry powdered extracts, liquid galenicals, volatile oils, dried herbs, etc. Because of the unknown nature of the wastes from the production of these products and their potential for water and air pollution, the Working Group deems it important to gather quantitative and qualitative information on all aspects of this industry's solid wastes.

The Federal Government, through the Bureau of Solid Waste Management, has issued a contract "to study and evaluate the solid waste management practices of the drug industry, SIC 283."* This SIC code includes establishments primarily engaged in manufacturing, fabricating or processing of biological or medicinal chemicals and pharmaceutical products, and also establishments primarily engaged in the grading, grinding, and milling of botanicals. The Task Force has been informed that, although a questionnaire survey will be mailed to drug firms in California, there are no plans to conduct detailed field surveys of these firms in the State. Representatives of the State should monitor the California phase of this effort to ascertain that all data acquired and techniques developed will be made available to the pertinent State agency. This questionnaire survey may serve as a benchmark for the more comprehensive State agency on-site surveys recommended below.

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*National Industrial Solid Waste Management Study - The Drug Industry; Contract No. CPE 69-7; Awarded to Litton Systems, Inc., Minneapolis, Minnesota; May 1969 to July 1970, PHS Publication No. 1897, Supplement, p.7.

2. BACKGROUND: THE LOCAL PROBLEM

In September 1963, the California Congress of Parents and Teachers voiced concern with the problem of discarded syringes and other contaminated medical supplies coming into the hands of children and youths due to the inadequate disposal practices of hospitals, clinics and physicians offices. In June 1968, the Community Health Services Chairman of the Congress of Parents and Teachers reported that the Congress still found it appropriate to be concerned with this problem due to their continued receipt of numerous complaints of such incidences.

On September 12, 1966, the City Council of Hawthorne, California unanimously adopted Ordinance 869 which regulated the disposal of unused, used, or partially used containers, bottles, hypodermic syringes, hypodermic needles, drugs, medicines, medical supplies and other similar items including bandages and dressings. According to local reports, this ordinance resulted from frequent reported instances of children playing with such wastes and of adults scavenging for both medical use and drug abuse purposes.

From 1966 to 1969 several articles appeared in the press throughout the State of California reporting similar incidences. Also, agencies such as the State Department of Vocational Standards, the Los Angeles Police Department, and the Sheriff's Office of Fresno, California, reported such incidents on the basis of their own direct investigations, as well as on the basis of parent's complaints to these agencies.

In April 1968, the Los Angeles Supervisors ordered this problem reviewed by the Los Angeles County Health Department and the Chief Administrative Officer in cooperation with the Los Angeles Medical Association. As a result of this review, the Los Angeles County Board of Supervisors, on May 21, 1968, adopted an order supporting State legislation on the disposal of drugs, hypodermic needles, etc.

During early 1968, a legislative request was made for answers to the following questions:

- Is there demonstrable need for providing State regulations regarding disposal of medical items? What problems have developed -- i.e., children having access to dangerous drugs, etc?

- Could regulation of receptacles be handled better and more easily through county health ordinances? Do some county health departments presently regulate the disposal of medical items?

In partial response to these questions, a brief survey was conducted with the Chiefs or the Narcotics Detail Heads of 34 police

departments in the State of California. The following answers were obtained to the question of whether this problem existed in their jurisdiction:

Yes	18
Yes, but limited	3
No	12
Problem given to Sheriff's Office	1

Of the 18 "yes" answers, eight cities described this problem as "major" or "important."

During the 1968 regular session of the legislature, Assembly Bill No. 1643 was introduced to require the State Department of Public Health to adopt regulations and standards with respect to the collection of, transportation for disposal, and disposal of discarded drugs, drug containers, syringes and other contaminated medical supplies as used by physicians, hospitals, clinics, etc. The bill stated that: (a) these regulations shall not apply to the disposal of drugs, containers, or devices acquired by retail consumers for their own use; and (b) these regulations shall have no force or effect until the board of supervisors of a county, by resolution, determines that such regulations are necessary for the public health and safety of the people of such county. The county may provide other resolutions to regulate the licensing of franchise holders to engage in the business of collecting such drugs, containers, and devices; to inspect all facilities for the collection and disposal of such items; and to regulate, the location, maintenance, operation, and security of disposal sites.

The State Department of Public Health, in commenting on this bill, advised that this bill would require staff augmentation at a cost of between $15,000 to $20,000 for the 1968-69 fiscal year for a study of the magnitude of the problem and for the adoption of regulations, and that there would be no increased State cost thereafter.

The bill received unanimous "do pass" recommendations by both the Public Health, and Ways and Means Committees of the Assembly but did not pass the Appropriation Committee. In commenting, the legislative analyst stated:

> "Currently the department has 35 technical positions involved in food and drug activities, including the drafting of regulations. We have been unable to determine the basis upon which the need for additional money to carry out the requirements of this bill is predicated."

In order to determine whether the problem, as reported, is sufficiently severe so as to require legislation, the Hazardous Wastes Working Group held extended discussions with some of their professional colleagues. These conversations indicated that there is a basic underlying concern with the entire problem of drug disposal on the part of the medical profession and a willingness on the part of the profession to assist in developing and applying solutions. Hence, the members of the Hazardous Wastes Working Group will be glad to assist in conducting a detailed survey of the current practices and concerns of the medical and related professions in regard to drug, medical supply and associated disposal problems.

3. RECOMMENDATIONS

It is recommended that:

a. The designated State agency should conduct a survey to develop basic information on solid waste management practices within the drug industry in California to: (1) determine the number, location and size of drug industry production and processing centers in California; (2) determine and evaluate the present practices, the needs, and the problem areas of industrial solid waste management within the industry; and (3) provide data by type on the quantities of solid waste generated by the various drug manufacturing firms, and information on the solid waste generation points within the production processes, other sources of solid wastes from the plants, storage practices, collection, disposal or treatment methods, and point of discharge or disposal.

b. The designated State agency or another appropriate agency should conduct a survey to determine the nature and extent of the problems associated with the disposal of unused, used, or partially used containers, bottles, hypodermic syringes, hypodermic needles, drugs, medicines, medical supplies and other similar items, including bandages and dressings, in the State of California.

c. Should this problem be reported as "major" or "important" by any significant number of jurisdictions in the State, enabling-legislation should be passed by the State Legislature which will require the designated State agency to establish standards and regulations in respect to the collection of, transportation for disposal, and disposal of discarded drugs, drug containers, syringes, and other contaminated or single-use medical supplies as used by physicians, hospitals, clinics, and similar health care facilities.

V.
RADIOACTIVE WASTES

1. BACKGROUND

Radioactive materials comprise all the isotopes, the nuclei of which undergo spontaneous disintegration. It is well known that extensive care and precautions must be observed in the use of such materials. The same care and precautions must also be exercised in on-site storage, handling, transportation, and final disposal of radioactive materials when they become waste. Even after it is buried or sunk, radioactive waste remains "alive;" in some cases this condition exists for thousands of years.

Regulations for the handling, transportation and disposal of radioactive wastes are specific and strict. They require, in general, that all the radioactive waste materials must be handled, transported and disposed of in such a manner, and in such a location, as will result in no significant radioactive contamination of the environment.

As little as 10 years ago, this category of waste would have had little impact on the State of California. However, with the exponential rise in the use of radioactive materials by power generation facilities, research laboratories, hospitals, industry, etc., a critical review of this category is necessary. For example, there are two power reactors currently operating in the State of California: Humboldt Bay [70 megawatt] and San Onofry [450 megawatt]. Two more power reactors are under construction: Sacramento Municipal Utility District [850 megawatt] and Diablo Canyon [1060 megawatt]. Six sites have been acquired to cover expansion for the next 20 years.

There is only one hauler operating in the State of California capable of handling high and intermediate level radioactive wastes. This hauler, Nuclear Engineering Company, Inc. of Walnut Creek, California, also handles low level radioactive and other exotic wastes. Hutchinson and Sons of San Pedro, California, handles Southern California low level wastes only.

2. PROBLEMS

Many of the users of radioactive materials are known to the Department of Public Health, State of California. However, some of those users who had obtained radioactive materials prior to the enactment of legislation have not registered with the Department.* There may be still other users who obtained their radioactive materials in an illegal manner. The State Department of Public Health enforcement agency, or participating local Health Departments, audit the users of radioactive materials every 6 months, once a year, or every 2 years depending on the damage potential of the user. This is not of sufficient frequency to accurately assess the quantity, radioactive strength, etc, of the generated wastes.

The disposal of radioactive waste in California is handled under the options listed in Table V-1.

Table V-1. Options for Radioactive Wastes in California

Origin	Transportation	Disposal	Applicable Paragraph of Regulations
Generation From any Source	Sewer system	Ocean	30287
	Stack, pipe, or similar conduit	Air or water	30269
	None	Burial in soil	30288
	Truck	Burial in AEC-approved landfill at Beatty, Nevada, or at Richland, Washington	Group 4

*See Groups 1 and 2 of the California Radiation Control Regulations, Title 17, Chapter 5, Subchapter 4 "Public Health" of the California Administrative Code, 1968.

The ultimate disposal of high, intermediate and some low level radioactive waste is currently accomplished at either Beatty, Nevada, or Richland, Washington, both of which are operated by Nuclear Engineering Company, Inc. The low level wastes that are not transported out of the State are disposed of by burial, injection to air or water, or dumped into a sewer system. There have been abuses of the sewer system method observed by radiation-detector devices located in sewage treatment plants. However, the violators have not been apprehended because of the difficulty of identifying the source. It is probable that abuses of other disposal methods have also occurred without detection.

There exists neither a comprehensive listing of all the users of radioactive material and their quantitative and radioactive levels generated in the State of California, nor a comprehensive monitoring, surveillance and enforcement system for the management of storage collection, haul, and disposal. As an example, data maintained by the site operator accumulates 73 percent of waste received at the Nevada burial facility under the single general heading of "Licensee."

3. RECOMMENDATIONS

It is recommended that:

a. The designated State agency should conduct a survey to determine current practices including: (1) generators of radioactive wastes; (2) the quantity and radioactive level of wastes produced; (3) the frequency and costs of collection; (4) equipment used; and (5) points of discharge or disposal.

b. The designated State agency should conduct a field study and investigation to assure that all radioactive wastes that are generated within the State enter the formal collection and disposal system.

c. The designated State agency should conduct a formal re-examination of their current standards and practices as well as monitoring and enforcement techniques to assure that they are adequate in meeting the current and future needs of California.

VI.
SEWAGE TREATMENT SLUDGE

1. BACKGROUND

In most sewage treatment processes, the liquid and solid portions of the sewage are separated, and the associated gases captured. The liquid, forming the effluent from the treatment plant is usually disposed of by dilution or, very infrequently, on land. The solids which form sludge or scum, are usually disposed on land and less frequently by dilution. The captured gases, unlike the liquid and solid portions of sewage, provide a useful by-product which is ordinarily partially recycled, with the remainder sold for power generation purposes.

The disposal of sewage solids, not the water in sewage, is the most difficult problem faced by waste water treatment plants today. Whereas, the technology for treating the liquid portion of waste water has progressed to the point where direct human reuse is entirely feasible, no such methods have evolved for the ever increasing volume of the solid portions of liquid-borne wastes.* Many of the major problems of waste water treatment such as odors, dust, and health hazards are associated with sludge disposal. Sludge disposal creates the most difficult portion of the disposal problem because the polluting potentialities, per unit of weight, are greater than those of the liquid effluent from the treatment process that produced the sludge.

Three ultimate areas of sludge disposal exist: the atmosphere, the land, and the ocean.

Cost of sludge disposal is usually a sizable portion of the total cost of waste water treatment. Sludge disposal costs alone range from

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*Testimony before the Los Angeles County Grand Jury. Appendix "D", Sale of Sewage Solids, 1967.

2 to 3 dollars per ton of dry solids, upwards to several hundred dollars per ton, depending upon the disposal method and the size of the operation, the type and properties of the sewage, and the quality of the processed effluent and sludge. The benefits and costs associated with the Los Angeles City approach, implemented at the Hyperion treatment plant, however, are not yet fully understood. Of course, the physical properties of the effluent and sludges are known and the costs of approximately $3.50/ton can be audited; the real problem in evaluation comes with the attempt to quantify the effect of interaction with the environment.

2. PROBLEMS

The problems of waste disposal to the marine environment in California are intensified by the year-round recreational and other beneficial uses of the saline receiving waters. While in colder climates, many beneficial uses are limited by short seasons or restricted by rugged topography, in California the waters are utilized extensively throughout the year.

The specific problems in California which are associated with sewage treatment sludges arise from a broad spectrum of sources. At one end of the spectrum, pollution control of sewage treatment sludge is "too good." The damming of almost all the streams and rivers leading to the coast, the paving and sweeping of the streets, coupled with the disposal of sludges either on land or in the ocean (e.g., Santa Monica Bay where sludge is inserted at the edge of an underwater cavern) at a depth where it will not be transported to the shallow coastal waters deprive these waters of their natural nutrients. This lack of nutrients has significantly modified the coastal ecology. Little is known about the extent of these changes, but it is postulated that the lack of nutriments possibly could be overcome by depositing the sludge from the Hyperion above the "thermal incline" which would enable the sludge to reach the shallow coastal waters. This problem requires additional research before it, and any possible solutions, can be assessed knowledgeably.

At the other end of the spectrum of sludge pollution problems, the San Francisco Bay - Delta Area Study* indicated that observations, at several of the more objectionable fills located on land adjacent to bodies of water, showed that water draining from these sites had high populations of fecal coliform and fecal streptococci.

More than 125 California communities dispose of their sewage effluent, after varying degrees of treatment, through submarine outfalls. The location of major outfalls is shown on Figure VI-1. With the spread of suburban areas, the development of metropolitan districts, and the extension of trunk sewers farther inland, the magnitude of marine waste disposal in California is expected to increase markedly in the next few decades.

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*"Solid Wastes and Water Quality," California Department of Public Health, 1968.

Figure VI-1. Major Submarine Outfalls in California*

*Ocean Engineering, III, compiled and edited by Richard D. Terry, North American Aviation, Inc., El Segundo, California, 1966.

3. RECOMMENDATIONS

It is recommended that:

a. The designated State agency should study the problem of the changes in the coastal ecology of Santa Monica Bay to assure that the changes induced by the reduction in nutriments reaching the coastal waters do not cause great damage to the ecological balance. Consideration should be given to the solution to the problem of insufficient nutriments in Santa Monica Bay by (1) the treatment and insertion of sewer sludge from the Hyperion Plant into the shallow coastal waters and/or (2) other methods.

b. The designated State agency should study the problem of contamination in the San Francisco Bay Area to determine the relationship of the disposal of sewage sludge in landfills and by other means in that area and reported contamination conditions in the Bay Area. The agency should establish standards and regulations with respect to the collection of transportation for, and disposal of sewage sludges, should study indicate that harmful effects are being generated by present sewage sludge disposal practices.

c. The designated State agency should study the ecology of all the shallow coastal waters off the populated areas of California to obtain an understanding of ecological changes brought about by the various degrees and methods of treatment and disposal of sewage sludge and resulting problems.

VII.
FEDERAL AND MILITARY

1. BACKGROUND

Federal activities in California are important sources of environmental pollution. For example, it is estimated that 250 million gallons of shipboard and sanitary sewage are discharged into the San Francisco Bay - Delta Area each year from vessels using the 12 deep water ports, numerous port and docking facilities, and 250 small craft harbors. It has also been estimated that the 60 assigned military vessels operating in the Bay-Delta waters contribute approximately 90 percent of the annual wastes discharged from all vessels. Senator Murphy has requested that the Secretary of the Navy take steps to remedy the increasing level of pollution in the San Francisco Bay-Delta Area. The Senator has also stated that as a member of the Senate Armed Services Committee, he stands ready to urge the Committee and the Congress to help the Department of the Navy in its efforts to stop the pollution.

2. PROBLEMS

The generation, handling, and disposal of special chemicals, toxic gases, explosives and other hazardous wastes by Federal activities is of continuing concern. The Working Group made inquiry to the Secretary of the Army concerning shipment and disposal of chemical agents. General James Hebbler, in responding, reported that there have been no Department of the Army stocks of toxic chemical agents and/or munitions disposed of within the State of California or within the waters off the California Coast during the past 3 years. There have been small laboratory samples shipped to selected military installations during the past 3 years. However, shipments of commercially-procured poisonous material for installation use, such as chlorine for water purification, insecticides and pesticides, are continuing to be made.

Field visits by members and staff aides of the Working Group to several Army installations indicate that large quantities of vehicle lubricants and oils, solvents, paints, and other similar hazardous waste materials are generated. These do not appear to be subject to special handling or control. To date we have been unable to gather sufficient definitive information to access the situation, nor can we develop an adequate estimate of its impact on the environment.

3. RECOMMENDATIONS

It is recommended that:

a. The designated State agency, in cooperation with members of California's Congressional representation, should conduct a detailed survey of the Federal installations and activities in California to determine the quantities and charcteristics of the wastes that are generated and the provisions that are made for the collection, storage, and disposal of these wastes.

b. For each classification or category of wastes where in the opinion of the designated State agency special procedures appear to be required for storage, collection, transport, or disposal, the agency should prepare recommended standards, regulations, operating procedures, or control procedures for issue in the public press and for possible incorporation in Federal legislation.

c. The State of California should request the support of California's Congressional representation in preparing legislation which will: (1) require the Federal Government to clean up areas of Federally caused pollution or will authorize the State to do so and permit the State to recover the costs from the Federal Government, and (2) establish appropriate regulations and standards for Federal installations and activities which assure that the Federal Government ceases to cause pollution.

APPENDIX
SOME HAZARDOUS SOLID WASTE SOURCES AND CONSTITUENTS

MUNICIPAL REFUSE*

Source	Waste	Composition	Means of Treatment or Disposal
Households, hotels, hospitals, institutions, stores, industry	Special wastes	Hazardous solids and liquids, explosives, pathologic wastes, radioactive wastes	Incineration, landfill, burial, salvage
Sewage treatment plants, lagoons, septic tanks	Sewage treatment residue	Solids from coarse screening and grit chambers, sludge	Incineration, landfill, composting, fertilizing

INDUSTRIAL WASTES

Source	Waste	Characteristics	Composition	Means of Treatment or Disposal
Textile mill products	Textiles, i.e., cotton, wool, and silk	Highly alkaline, colored, high BOD and temperature, high suspended solids	H_2SO_4, NaOH, aniline chlorine Starch, malt, tin and iron salts, dyes bleach, fibers, minerals	Neutralization, precipitation, trickling filtration, aeration, recovery
Cooking fibers, desizing of fabrics		Same as textile mill products	For complete list of chemicals used in textile industry, see reference	
	Rayon, other man-made materials, i.e., Acrilan, Dynel, Orlan, Nylon, etc.	Acidic, alkaline, inorganic	Sulfides and polysulfides, colloidal sulfur, NaOH, H_2SO_4, $ZnSO_4$, HCl, $NaHSO_4$, H_2S, $CaSO_4$; acrylonitrile, phenol, HNO_3; ammonia, adiponitrile, hexamethylenediamine, sodium carbonate, alcohols, ketones	Reclamation, neutralization trickling filtration, lagooning
Explosives Washing TNT and guncotton for purification, washing and pickling of cartridges		TNT, colored, acid odorous, and contains organic acids and alcohol from powder and cotton, metals, acid, oils and soaps	H_2SO_4, HNO_3, NO_2SO_3, picric acid, TNT isomers, copper, zinc, nitrogen, toluene	Dilution, neutralization, lagooning, flotation, precipitation, aeration, chlorination
Phosphate and phosphorus	Washing, screening, flating rack, condenser bleed-off	Clays, slimes, tallows, low pH, high suspended solids	Phosphorus, silico fluoride	Settling, clarification (mechanical), lagooning
Fertilizers			Nitrogen, phosphorus, potassium, sulfuric acid, traces of other chemicals	

*Adapted from:

1. Thrift G. Hanks, M. D., Solid Waste/Disease Relationships, Aerojet General Corporation, 1967.
2. Sanitary Engineering Research Laboratory, College of Engineering and School of Public Health, University of California Berkeley, Comprehensive Studies of Solid Wastes Management - Second Annual Report, 1969.

INDUSTRIAL WASTES (Continued)				
Source	Waste	Characteristics	Composition	Means of Treatment or Disposal
Coke by-products	Slag from ovens, ammonia still waste, spent acids and phenols	Suspended solids, volatile suspended solids, organic and NH_3-N, phenol, cyanide, acids, alkalis	Ammonia, benzene, H_2SO_4, phenol	Discharged to sewers, dumped, incineration
Industrial, not otherwise identified	Inorganic industrial waste or stabilization	Metals and compounds thereof	Na, K, Ca, chlorides, sulfates, bicarbonates, nitrates, phosphates, fluarides, borates, chromates, etc.	
	Metallic fumes and dusts		Pb, Va, As, Be and compounds thereof	
	Industrial wastes	Mineral fines	Chromates, heavy metals	Underground aquifers
Treating		See "Distillation"	See "Distillation"; also lead, copper, calcium	Reclamation, settling, filtration, evaporation, neutralization
Recovery		See "Distillation"; also organic esters	See "Distillation"; also iron	See "Treating"
Leather and leather products	Tanneries	Organic and inorganic, high BOD-lime sludge, hair, fleshing, tan liquor, bleach liquar, salt, blood, dirt, chrome	Chromium, sulfuric acid, nitrogen, $CaCO_3$, D_2O_5, K_2O_w, Fe	Sedimentation, lagooning
Energy producing industry Pulverized coal-fired plants; stoker-fired, cyclone-fired plants; and wet-bottom pulverized coal-fired plants	Fly-ash	Hollow spheres of fused or partially fused silicate glass or as small solid spheres of fused silicates, iron oxides or silica, unburned carbon and mineral	Silicates, iron oxide, silica	Sold for use in concrete, landfills, etc.
Electrical industry	Ash	Dust	Silicates and aluminates of Fe, Cu, Mg with small percentages of Na, K	
Metal finishing industry	Pickling and washing liquors	Toxic, waste waters	Cu and Cu alloys	Sewage
	Acid wastes	Harmful to aquatic life, salts of metals	Cu, Ni, Zn, Cr, Fe	Sewage

INDUSTRIAL WASTES (Continued)				
Source	Waste	Characteristics	Composition	Means of Treatment or Disposal
Rubber and miscellaneous plastic products	Rubber	High BOD, odor, high suspended solids, variable pH, high chlorides	Sulfuric acid, trichlorethylene, xylene, amyl alcohol, aniline benzene, chromium formaldehyde	Aeration, chlorination, sulfonation, biological treatment
Aircraft manufacturing industry	Cd and Cr+	Traces of metals	Cd and Cr+	Leaching pits
Waste treatment plants	Well-digested sludge	Blackish, amorphous, nonplastic material	Mg, Ca, Zn, Cr, Sn, Mn, Fe, Cu, Pb	Anaerobic decomposition of organic waste solids
Petroleum industry	Spent chemical	Liquid wastes with oil, acid and alkaline solutions, inorganic salts, organic acids and phenols, etc.	Clays, H_2SO_4, H_3PO_4	Streams
Drilling		Oil, brine, chemicals	Sodium, calcium, magnesium, chlorine, SO_4, bromine	Separation, evaporation, lagooning
Storage	Muds, salt, oils, natural gas			Separation, evaporation, lagooning
Distillation	Acid sludges, miscellaneous oils	Insoluble organic and inorganic salts, sulfur compounds, sulfonic and naphthenic acids, insoluble mercaptides, oil-water emulsions, soaps, waxy emulsions, oxides of metal, phenolic compounds	Na_2CO_3, $(NH_4)_2S$, Na_2S, sulfates, acid sulfates, H_2S, NaOH, NH_4OH, $Ca(OH)_2$, $(NH_4)_2SO_4$, NH_4Cl, phenols	Settling, filtration, reclamation, evaporation
	Laboratory wastes		Metallic ions, phenolics, cyanides, oils, synthetic fibers, pharmaceuticals, rubber chemicals	Landfill or dump
	Industrial wastes	Toxic metals	Pb, Be	
Insecticides	Washing and purification of products	High organic matter, toxic, acidic Chlorinated hydrocarbons: toxaphene, benzene, hexachloride, DDT, aldrin, endrin, dieldrin, lindane chlordane, methoxychlor, heptachlor	Carbon, hydrogen, chlorine, carbon disulfide, carbon tetrachloride	See Chemical plants (general)
Organic phosphorus compounds: parathion, Malathion, phosdrin, tetraethyl, pyrophosphate			Phosphorus, oxygen, carbon, hydrogen, carbon disulfide, carbon tetrachloride	
Other organic compounds			Carbonates, dinitrophenols, organic sulfur compounds, organic mercurials, rotenone, pyrethrum, nicotine, strychnine	
Inorganic substances			Copper sulfate, arsenate of lead, compounds of chlorine and fluorine, zinc phosphide, thallium sulfate, sodium fluoracetate	