Chapter 4

HAZARDOUS WASTE GENERATION BY BERKELEY DRY CLEANERS

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Introduction

Dry cleaning refers to the process of removing stains, dirt and other contaminants from clothing using a volatile, commercially moisture-free solvent, with subsequent purification of the solvent by filtration and/or distillation. The solvents used are hazardous materials and thus any wastes contaminated with these solvents are hazardous wastes. This paper will examine the character, generation and disposal of dry cleaning hazardous waste in Berkeley, California.

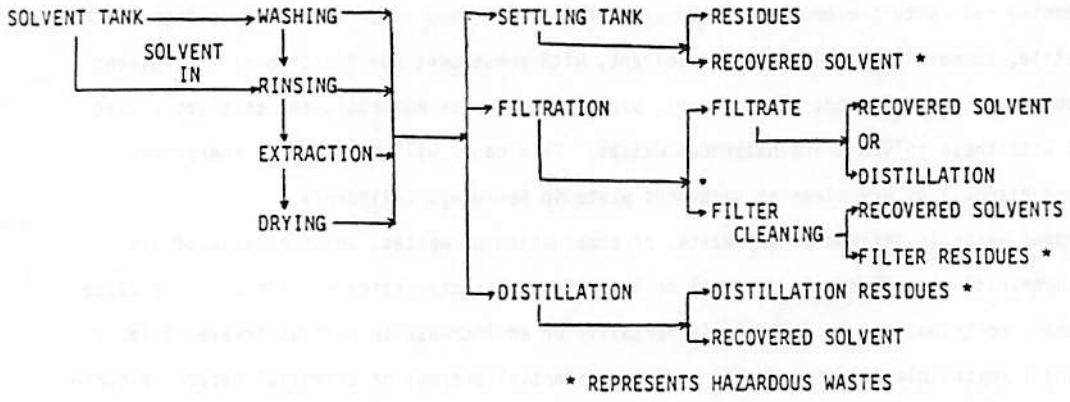
A hazardous waste is defined as any waste, or combination of wastes, which because of its quantity, concentration or physical, chemical or infectious characteristics may either: (1) cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating irreversible illness; or (2) pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported, or disposed of, or otherwise managed (Health and Safety Code, Div. 20, Ch. 6.5, Sec. 25117). For the purpose of this paper, a hazardous material becomes a hazardous waste when it can no longer be used for its intended purpose. These wastes are regulated under federal, state, and local laws. For further discussion of the regulations governing hazardous wastes, see the paper by Lynelle Johnson.

The Dry Cleaning Process

The dry cleaning process is a nine step process.

I. Marking and invoicing
II. Classifying
III. Dry cleaning
IV. Wet cleaning - soap and water cleaning, used only if necessary
V. Spotting
VI. Finishing - ironing and pressing
VII. Repairing
VIII. Inspecting
IX. Assembling and packaging

Hazardous wastes are produced in Step III, Dry cleaning. This step is shown in more detail in Figure 1. Dry cleaning involves the cleaning of batches of clothing by mechanical agitation in a volatile non-aqueous solvent bath. The clothing is then rinsed, spun and dried (Figure 1a). Used solvents are recovered and purified using filtration, distillation or settling tanks (Figure 1b).



(a) Dry Cleaning (b) Solvent Recovery/Chemical Recycling

Figure 1. Solvent Flow in Dry Cleaning

The Solvents

The solvents used in the dry cleaning process are hazardous materials. As shown in Figure 1, these hazardous materials become hazardous wastes during the process of solvent recovery. There are a number of requirements that a dry cleaning solvent must meet to be acceptable to the trade (Martin and Fulton, 1958):

(1) It must not weaken, dissolve, or shrink the ordinary textile fibers.

(2) It must not bleed the common dyes from fibers.

(3) It must be an acceptable solvent for fats and oils.

(4) It must not impart any objectionable odor to drycleaned textiles.

(5) It should be sufficiently volatile to permit reclamation by distillation and to permit garments to be dried without prolonged heating at excessive temperatures.

(6) It must be noncorrosive to metals, either when dry or in the presence of water.

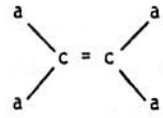
(7) It must be relatively nontoxic.

(8) It must have a flash point of 100°F or above, or better still, be nonflammable, if it is to comply with most fire regulations.

Because solvents must meet all of these requirements, there are very few which are sanctioned by the trade.

There are generally two types of solvents used by dry cleaners, the petroleum-based Stoddard solvents and the synthetic solvents. The term "Stoddard solvents" is a generic name and can be used by any refinery to describe a petroleum distillate that meets the United States Department of Commerce Commercial Standard for Stoddard solvents. These solvents are hazardous due to their flammability.

Synthetic solvents are chlorinated hydrocarbon or fluorocarbon solvents. Perchloroethylene (PCE), also known as tetrachloroethylene, is the solvent most commonly used. PCE is a chlorinated aliphatic hydrocarbon with the following formula:



The chlorination renders the compound less flammable and more able to dissolve stains, dirt, grease and oils. It also makes it more toxic to humans and worse for the environment because it decomposes less rapidly.

PCE vapor is irritating to the eyes and upper respiratory tract and has caused frontal sinus congestion and headaches. Direct contact with the skin can cause burns, blistering and erytherma. It can also cause motor co-ordination impairment, memory impairment and fatigue, all of which can affect worker safety (Ludwig et al., 1983).

Hazardous waste disposal is not the only problem to arise from hazardous material usage. Because the solvents used by dry cleaners are volatile, another problem is air pollution. The current Occupational Safety and Health Administration (OSHA) eight-hour Time Weighted Average (TWA) for PCE is 100 ppm (Ludwig et al., 1983). In light of a National Cancer Institute study, the National Institute for Occupational Safety and Health (NIOSH) eight-hour TWA standard has been changed from 50 ppm to a recommendation that PCE be handled as a carcinogen. Levels of exposure should be as low as reasonably achievable. There are no air standards for petroleum-based Stoddard solvents in the Dry Cleaners Law. The dry cleaners attempt to minimize solvent leakage into the air because this leakage wastes expensive solvents.

Past Work

The tragedies caused by improper disposal of hazardous wastes, as exemplified by the Love Canal and Stringfellow Quarry sites, have raised public consciousness to the need for safe hazardous waste disposal practices. Yet there have been few studies conducted to examine the hazardous waste problem of businesses which are small generators of hazardous wastes (those generating under 2200 lbs./mo.). TRW conducted a survey of businesses, including the dry cleaning industry, in an attempt to discover the magnitude of the hazardous waste being produced by small generators for the Environmental Protection Agency (TRW, 1979). The California Department of Health Services conducted a review of the current taxes, fees and regulatory requirements imposed on small quantity producers of hazardous waste (DOHS, 1983). The Environmental Protection Agency is currently conducting a survey of businesses nationwide which will include dry cleaners. The results will be published by April 30, 1985 (DeGeare, 1983).

Methodology

To determine the extent of the hazardous waste problem faced by the Berkeley dry cleaners, a telephone survey was conducted during the months of January and February, 1984. The survey used was based on the survey found in the Appendix at the end of Section IV.B., but was modified to fit the dry cleaning industry. The facilities surveyed were selected from cleaners listed in the 1983 Oakland Pacific Telephone Yellow Pages under "Cleaners". (There is no heading "Dry Cleaners".) Businesses were chosen if they were located within the Berkeley City Limits. There were 29 such businesses.

Based on survey answers, the businesses were classified in one of two categories: (1) businesses that conducted dry cleaning on the premises; or (2) businesses that sent dry cleaning to an outside plant. Only businesses falling into the first category were used to compile the hazardous waste data.

Results

Twelve of the twenty-nine dry cleaning businesses responded to the survey. Of the twelve, fifty per cent dry cleaned garments on-site. The other fifty per cent indicated that they sent the clothes requiring dry cleaning to a dry cleaning plant, 33% to a plant in Berkeley and 67% to a plant outside of Berkeley. Only those operations which dry cleaned garments on-site were used to compile the results. These data are outlined in Table 1. Approximately 12,500 pounds of clothing per month per dry cleaning business are processed.

The hazardous wastes generated by the dry cleaners in Berkeley can be characterized as filtration residues, spent filter media, distillation residues, and residues from settling tanks. The per business cost to dispose of these hazardous wastes ranges from negligible to $350 per year. To encourage businesses to dispose of their hazardous wastes properly, several alternatives were

suggested. 100% of the businesses responding indicated that they would use a free door-to-door disposal service. If a fee was charged, their participation would depend on the fee. If the service was not door-to-door, 27.6% stated that they would not use the service, while the remaining 72.4% stated that their participation would depend on the collection site's proximity to the business. If both a fee was charged and the service was not door-to-door, 42.8% indicated that they would not use the service. None of the businesses felt that recycling their hazardous wastes was economically feasible.

Discussion

The quantity of hazardous wastes generated by the dry cleaners in Berkeley is minimized through the on-site recycling of the solvent. "Cooking" of the filtration and distillation residues is practiced in most of the businesses. This process removes residual solvent in the wastes, reducing the amount of hazardous waste produced while maximizing solvent recovery. Maximizing solvent recovery minimizes the cost for the solvent and thus enhances profitability.

Approximately 245 gallons of hazardous wastes are produced per month by the dry cleaners in Berkeley (Table 1). These wastes can be classified as 110 gallons per month of residues from a settling tank and 135 gallons per month of filtration and distillation residues. Dry cleaners dispose of their hazardous wastes by either (1) municipal trash pick-up to a sanitary landfill; or (2) contract hauling by a registered hazardous waste hauler. The latter method is the one required now in California.

	GENERATION		
Solvent	Percent of Businesses	Average Amount of Hazardous Waste Generated per Business	Estimated Amount of Hazardous Waste Generated per Solvent
Perchloroethylene	83.3%	11.3 gallons/month	135 gallons per month
Stoddard	16.7%	110 gallons/month	110 gallons per month
Total	100.0%	121.3 gallons/month	245 gallons per month

STORAGE		DISPOSAL		
Percentage	Method Used	Percentage	Method Used	Known Quantity/ Estimated Quantity
66.6%	55-gallon drum	50%	Registered Waste Hauler	34.2 gallons/mo 135 gallons/mo.
16.7%	Unsure	33.3%	Unsure	
16.7%	Garbage Can	16.7%	Municipal Trash Pick-up	110 gallons/mo. 110 gallons/mo.
100.0%	Total	100.0%	Total	144.2 gallons/mo. 245 gallons/mo.

Table 1. Survey Results.

The known amount of hazardous wastes being properly disposed of is 34.2 gallons per month (Table 1). This leaves a maximum potential of approximately 211 gallons per month being disposed of incorrectly. This sum was reached by subtracting the known amount of hazardous waste being properly disposed of from the projected total amount of hazardous waste generated in Berkeley. It must be stressed that this is a maximum potential and that the actual quantity will probably be less.

There were five suggested future options to encourage proper disposal of hazardous wastes. The first suggestion was to have a free, door-to-door disposal service. This option enjoyed unanimous support, but would not be practical to implement. The money to fund the collection would not be paid by the generators. If a fee were charged, participation would depend on the amount charged. The number of businesses willing to make use of this service dropped when the service was not door-to-door. This may indicate an unwillingness to assume the risk of transporting a hazardous waste. Because on-site recycling of the solvents is practiced by most of the dry cleaners completing the survey, it was not viewed as feasible to pay another company to recycle the wastes generated by their recycling process. Additional solvent recovery is possible from these hazardous wastes using a more sophisticated process (Scott, pers. comm., 1984). However, this process must be done in bulk and is not economically feasible in and of itself.

It is encouraging to note that at least fifty per cent of the businesses responding disposed of their hazardous wastes properly. There are a number of hazardous waste haulers in the Bay Area that pick up dry cleaners' hazardous wastes. These firms supply the fifty-five gallon drum for storage and pick up the drum at the business when full. If the dry cleaners cannot fill a fifty-five gallon drum in the 90-day maximum allotted time for storing a hazardous waste on-site, they can work with another plant to fill the drum together. This is why it is not felt that a disposal project is necessary for dry cleaners in Berkeley.

Conclusion

The quantity of hazardous wastes generated by the dry cleaners in Berkeley, 245 gallons per month, is not large. This quantity is minimized by the solvent recovery process. Because maximum solvent recovery is necessary for economic use of the solvent, dry cleaners have an added incentive to minimize their hazardous waste output.

It was not felt that a community recycling project was necessary. Instead, dry cleaners should be informed of the regulations regarding hazardous material usage and hazardous waste disposal. They should also be given information regarding hazardous waste hauling companies. This, together with enforcement practices, should help solve the hazardous waste disposal problems of the dry cleaners in Berkeley.

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