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Pollution Prevention at Industrial Laundries:

Assessment Observations and Waste Reduction Options

An Industrial Pollution Prevention Project (IP3) Report

ASSESSMENT OBSERVATIONS AND OPTIONS

The emphasis of these assessments has been toward reducing the contaminants and wastes at the source as opposed to cleaning up waste water after the fact. In order to run your shop as economically and efficiently as possible, you should reduce all types of wastes including hazardous wastes, solid wastes, air emissions, and water discharges. It has become apparent that there are shortfalls in the command and control end-of-pipe regulations.

The sources of pollution within industrial laundries must be identified and solutions found which reduce or eliminate the generation of the wastes through source reduction, reuse and recycling. There will still be end-of-the-pipe requirements but it is this group's hope that by using a joint industry - government effort, the cost of complying with any future discharge regulations will be significantly reduced or in some cases eliminated altogether. Pollution prevention should be generally divided into laundry site activities and customer site activities.

Recognizing that what goes into a washing operation determines in large part what will come out of it, soiled articles and process and treatment chemicals must be screened. The most transparent thing about any large industrial laundry operation is that it begins with lots of clean water and finishes with lots of dirty water. Identifying pollutants and problems isn't easy. Its complexity varies from location to location depending on the size of the facility, the volume of water and chemicals consumed, the garment usage profile of the customers being serviced, and the specifics of local, state, and federal requirements.

This report presents several options for reducing solid and hazardous waste generation. They should all be carefully evaluated. Those which represent the highest return on the time, effort and funds invested should be the first implemented. Opportunities to reduce the volume of non-hazardous solid wastes through better supplier partnerships also exist. Some options for reducing those wastes are also presented. It is the writer's opinion that if an industrial laundry's corporate management makes a strong commitment to a continuing waste reduction program and improved customer partnerships, their plant can achieve significant waste reduction.

THE PLANTS

The Plants are primarily engaged in supplying laundered uniforms (shirts and pants), garments, shop towels, mats, mops, table linen, barber and beauty towels,and restaurant bar towels to industrial or commercial users. Uniforms are at the upper-end of the market with service station and beer uniform accounts being the best. However, market pressures have cut the cost of a uniform from $1.60 to $1.20 currently. Customers served include vehicle maintenance shops, metal fabrication machine

shops, printers, printed circuit board manufacturers, aerospace, furniture manufacturers, agricultural businesses, and restaurants.
Plants which handle light soils usually don't process shop towels. A "middle-of-the-road" operation launders medium soils while heavy soil operations process shop towels and inkies. The plants operated on similar schedules and production shifts as follows:

- 5 days per work week with 82 employees on 2 shifts (39 per shift);
- 5 days per work week with 36 employees on 1 shift;
- 5 days per work week with 170 employees on 1 production shift (2:00 am - 12:30 pm);
- 4 days per work week (closed Wednesday) with 96 employees on 10-hour shift (midnight - 2:30 pm); and
- 5 days per work week with 100 total employees on 1 shift, from 5:00 am - 2:30 pm.

The total production poundage laundered weekly at the assessed laundries was:

- 61,000 pounds (Approximately 46,000 pounds/week are processed by water washing with 15,000 pounds/week processed by dry cleaning);
- 100,000 pounds (Shirts and pants accounting for 50,000 pounds/week);
- 175,000 pounds (Shop towels accounting for 25% of the volume or approximately 44,000 pounds);
- 134,800 pounds; and
- 83,000 pounds (Approximately 70,000 pounds/week are processed by water washing with 13,000 pounds/week processed by dry cleaning).

Soiled materials are received and sorted according to soil type, fabric type, garment type, ownership, and color. The soiled textiles are sorted into loads for processing by washers of different sizes. Different wash formulas are used depending on soil characteristics. In-coming shop towels with heavy soil may be soaked overnight. A 10 - 20 minute treatment operation prior to the break is used for heavy soil loading and it is best to drain the operation before the break. For shop towels, temperatures of 165 - 170 degrees F or a terpene cleaner are used to remove heavy, oily soils.

Mats are washed in cold water and dirty dust mops are washed in hot water. A dust suppressant is added to both mats and mops. One plant quit applying it and the customers have not noticed the change. Finishing includes a steam tunnel and sheets and table clothes go through pressing machines.

One facility processed shop towels until recently when discharge limitations could no longer be met and the shop towels were sent to a job-shop plant for laundering. The shop towels are sorted at the plant and trucks pick up the soiled ones and deliver clean ones for the customers. Another facility processed shop towels until mid-1992

when discharge limitations could no longer be met and the shop towels were sent to another company-owned plant for laundering. After pickup, shop towels are sorted at the plant and once-a-day a flatbed truck picks up the soiled ones and delivers clean ones for the customers.

Dry-to-dry and wet-to-dry cleaning machines are used for longer life of pants and overalls (which cost $80/pair for a refinery). Two dry cleaning machines are used at one plant to process 16% of the total weekly production poundage, mostly pants. The two machines have 170 pound capacities each per load. Approximately 7 or 8 loads are processed in each daily. Therefore, approximately 2,600 pounds per day or 13,000 pounds/week are dry cleaned. At another plant, two 180 pound capacity machines process 15,000 pounds/week. Solvent recovery by distillation and a water/oil separator is in-place at both locations. A flow diagram of the dry cleaning processes can be found in Appendix G.

PRETREATMENT PROCESSES

Several different types of pretreatment systems are used on the wash water discharged from laundering ranging from sophisticated and costly to simple and more affordable. Diagrams generalizing the flow of materials through the laundering, dry cleaning, and treatment processes were developed and can be found in Appendix G. The waste streams identified during the assessment are also noted in the flow diagrams.

At one plant, wash water is discharged through a shaker screen to an equalization basin. A three chamber, primary separator is used next for pH adjustment and a coagulant is added. Air flotation is used in 2 chambers in combination with an oil skimmer which generates a hazardous waste tramp oil. The bottoms from the sludge tank are metered to the rotary drum which generates 8.5 tons/month of filter cake that is 55% solids.

At another plant, wash water from non-oily textiles is discharged to a clarifier where an oil skimmer generates small amounts of hazardous waste oil. The shop towels' wash water is sent through a complete, on-site treatment system. The batch treatment plant is used on the wash water discharged from laundering shop towels. Acid cracking is used to break or float the oil and soils from shop towels. Lime is added in the batch treatment process for floccing. After settling, the sludge passes through a filter press which produces a sludge cake. The cost to operate the system is $3.00 per gallon. The sludge cake is stored in roll-off bins located on the site. For economies-of-scale, two roll-offs are hauled at one time.

At another plant, sulfuric acid cracking (pH 2 - 3) is used to break or float the oil and soils from shop towels. It passes through an oil/water separator which generates 3,000 gallons of oil every 2 - 3 months. This would be a rate of approximately 50 - 60

gallons per day. Ferrous sulfate and a 6% lime slurry are added in the rapid mix tank for floccing. This process pulls out more oil. The next step in the treatment process is aeration and addition of an anionic polymer in the slow mix tank. After settling to 1 - 2% solids, the sludge passes into a sludge holding tank (5% solids) and finally, through a filter press which produces a filter cake (60% solids). Two loads per day are generated and 6 loads fill a 20 cubic yard container. The filter cake is stored in the roll-off bins located on-site. For economies-of-scale, two roll-offs are hauled at one time resulting in loads of 18 - 20 tons every 6 - 8 days. Water passes through a neutralization tank where sulfuric acid ensures a pH of 11 before being discharged to the POTW whose limit is pH 12.

At another plant, wash water is discharged to a series of two pits where acid is added in the first pit if needed. It then passes through a shaker screen into a third pit. From this pit, the water passes through a heat exchanger/reclaimer on the shaker screen for heating in-coming water before discharging into a fourth pit. From pit #4 the water goes to a holding tank with an oil skimmer. Finally, the water passes through a settling pit before going to the sewer. A nonhazardous sludge is pumped out of the settling pit once-a-month.

At another plant, a small treatment system is used on the wash water discharged from laundering. Wash water is discharged to a collection basin and then passes through a shaker screen to a two chamber baffle basin. An oil skimmer had been used in the past which generated a hazardous waste tramp oil. This facility processed shop towels until mid-1992 when discharge limitations could no longer be met. The County limit for petroleum oil and grease is 100 ppm.

Plants should continue looking for ways to get more oil out during the treatment process prior to the filter operation. At one plant assessed, they might consider an ozone injector in the treatment process to lower the TTOs from shop towels. A VOC Stripper or centrifuge can significantly reduce solvents entering the wash and treatment processes. They can be expensive and options for reuse of the recovered solvents need to be developed which satisfy all regulations. These and other liquid removal options should be considered if technically and economically feasible for industrial laundries and their customers. This option is discussed later in the Waste Reduction Opportunities section.

RESOURCE CONSERVATION PROGRAMS

Instituting a comprehensive conservation program can save money and valuable resources. For instance:

- Using the latest technology or new equipment may require less energy, water and chemicals to operate properly and cycle times may be reduced.

For example, plant management should consider automatic, liquid injection wash systems or retrofitting where economically and technically possible. They reduce cycle time and result in precise measurement of formulas as a better operating procedure. All laundry processes were automated with liquid injection of the laundry chemicals at one plant assessed. The liquid soaps are more expensive, however, the automatic loading of the chemicals saved 0.8 hours per day per machine. The automated system saved raw materials and reduced handling of chemicals which had previously been added by hand (40 - 50 pounds/load) as additional benefits. The liquid detergents and chemicals come in drums and are received on pallets.

- Monitoring your water, gas and electric meters routinely is necessary. Identify peaks and valleys for usage during the day and week and what measures might reduce usage. Determine if there are activities that consume water, gas and electricity that could be curtailed during non-production hours.

Utility and water consumption are tracked at most plants. In-process recycling on-site should be considered for heat energy at industrial laundries. The following questions should be asked:

- Is there a heat reclamation system in use and where is it located?
- Where is the reclaimed heat used?
- Can the efficiency of the existing system be improved?

Energy

It does appear that heat and energy recovery is practiced widely by industrial laundries. The most efficient energy reclamation measures and technologies should be put into place at all existing and new facilities.

At one facility visited during the assessments, a heat exchanger is used for energy conservation by heating in-coming city water at 72 degrees F with the 150 degree F discharge water to a temperature of 100 - 110 degrees F. At another plant, a heat exchanger is used for resource conservation by heating in-coming water with the 150 degree F discharge water to a temperature of 80 - 100 degrees F before going into the boiler. A heat exchanger on the shaker screen is used at yet another plant for resource conservation by heating city water. And finally at a fourth plant assessed, discharge water passes from one pit through a heat exchanger and reclaimer on a shaker screen for heating in-coming water before being discharged into another pit of the treatment system. There is also a flue gas recirculator at this facility to heat in-coming water as an energy recovery measure.

Water is heated to final wash temperatures with gas boilers. Gas is also used in dryers and steam tunnels. The monthly costs for gas at the plants are:

- $4,500 ($54,000 annually;
- $4,600 ($55,200 annually);
- $9,500 ($114,000 annually); and
- $10,000 ($120,000 annually -- It is estimated that the gas boiler at this plant represents about 50% of the costs).

Monthly electric usage costs at the plants are:

- $3,880 ($46,550 annually);
- $5,350 ($64,200 annually);
- $4,500 ($54,000 annually -- These rates are based on 10 hours per day in production during the "out-of-peak" time period -- 2:00 am - 12:30 pm); and
- $11,000 ($132,000 annually).

Water

These average amounts of water were used by the plants to process the volume (poundage) laundered weekly:

- 110,000 gallons/week to process 46,000 pounds (2.4 gallons/pound);
- 140,000 gallons/week to process 70,000 pounds (2 gallons per pound);
- 242,000 gallons/week to process 100,000 pounds (2.4 gallons/pound);
- 258,000 gallons/week to process 135,000 pounds (1.9 gallons per pound); and
- 350,000 gallons/week to process 175,000 pounds (2 gallons per pound).

The annual costs for water usage and discharge to the sewer are:

- $39,000 (Assuming water at $11,400 and sewer at $27,600);
- $55,000 (Assuming water at $31,200 and surcharges are assessed at $6,000 per quarter for waste water discharges);
- $284,000 (Assuming water at $126,000 and annual sewer fees are $66,000 based on a monthly average of $5,500. The plant also pays a "Significant Users Fee" of $23,000 per quarter or $92,000 annually. This is fee is going up to $25,000 per quarter soon. Seventy percent of the sewer fee is a surcharge on total suspended solids (TSS) because the 205 ppm limit cannot be met); and
- > $21,600 (Water usage currently is 28,000 gallons per day but cost was

not determined during the assessment. Annual sewer charges are $21,600 based on a flat fee of $5,400 per quarter with surcharges for BOD, TSS, and volume).

In-process recycling or reuse on-site should be considered for water at industrial laundries. The following questions about water conservation need to be answered:

- What percentage of all laundries, small and large, are currently using water conservation measures?
- Does one washer or method of washing use more water than others?
- How is the liquid removed from the vessel when the cycle is complete (ie. gravity, pump, vacuum, etc.)?
- Can the various cycle discharges be separated?
- Is there a water reclamation/reuse system in operation?
- On what laundry process stream is the reclamation associated?
- What water reuse systems can be benchmarked as the best-of-best and be incorporated by other laundries?

Although there is much talk by laundry representatives about what is being done in water conservation, the assessors didn't find this to be the norm at large laundry plants or "the cream-of-the-crop." More management commitment and effort needs to be focused on the water reuse issue to achieve the highest percent technically and economically feasible. The following observations were made during these assessments.

One plant is plumbed for clean rinse water reuse in flush cycles for heavy soiled textiles. Currently, 10 - 20% of the clean rinse water are reused on heavy soiled loads. A goal of 80% clean rinse water reuse has been set for accomplishment in the next two years. Another plant was also plumbed for clean rinse water reuse in flush cycles for heavy soiled textiles. The percent of water reused currently is __%. Technical and economic feasibility should be determined with the help of laundry associations, local/state/federal P2 and regulatory staff, and consultants.

Water softeners are used on incoming water and brine is produced which is discharged to the POTW. This brine waste stream can be costly and harder to manage if the local POTW does not accept brine, as is the case in San Bernardino County. At one plant assessed, material recovery and reuse is accomplished by diverting calcium that is displaced during the water softening process to the equalization tank in the

treatment process. The calcium replaces lime in the morning until production levels require addition of lime throughout the shift. Plant management should investigate this potential for reducing treatment chemical costs and brine disposal impacts on the POTW.

HAZARDOUS WASTES GENERATED

The hazardous wastes generated by laundry and treatment processes are:

- filter cake:
  - RCRA hazardous;
  - California List; and
  - Non-hazardous;
- waste oil;
- still bottoms from the distillation of perc;
- Recovered solvents;
- Vehicle maintenance wastes; and
- Lint from a shaker screen (which was generated at a rate of 1 drum per week and is shipped as a hazardous waste with the filter cake).

Total annual costs of hazardous waste management were not determined during the assessments for all plants, however one facility spent more than $141,000 annually. The following descriptions of hazardous waste streams generated at the various plants do include costs where they were available.

At one plant that used dry cleaning, two machines generated 400 pounds per month of still bottoms. Two machines at another dry cleaning facility generated four or five 16 gallon drums per month which weighed approximately 535 - 665 pounds. The cost for waste management by Safety Kleen is approximately $5,000 annually for this service.

At one plant, the oil is decanted at a rate of 300 gallons per day. The oil is stored in a 2,400 gallon tank and is hauled as a hazardous waste. The oil is "probably fuel blended." Initially, the cost for hauling and recycling was $1.10 per gallon but now is at $0.80 per gallon. Assuming 21 working days in a month, the amount generated would be 6,300 gallons and would cost about $5,000. This results in an annual generation rate of 75,000 gallons and a disposal cost of $60,000.

The oil from the oil/water separator is stored and handled as a hazardous waste at another plant. The oil is fuel blended by a company. The cost for hauling and fuel blending is $1.00 - $4.00 per gallon and is determined by the BTU value and the solids content. Assuming 3,000 gallons are generated quarterly, the amount generated annually would be 12,000 gallons and would cost about $24,000 at an average of $2.00 per gallon.

At one plant, the oil skimmer on a holding tank removes 1/4 - 1/2 drum per day of tramp oil from discharge waters. This would be 2 drums per week or 8 drums per month. Costs for managing the waste oil were not determined during the assessment.

An oil skimmer had been used in the past at one plant which generated a hazardous waste tramp oil. Amounts and costs for managing the waste oil in the past were not determined during the assessment. The limits for petroleum oil and grease are 100 ppm in the County where the laundry is located. If fats, oil and grease (FOG) become a problem, an oil skimmer may be necessary again in the future.

At one plant, the filter cake is landfilled at a cost of $60/ton and a haul fee of $350. As a hazardous waste, state taxes of $26/ton are levied which costs $221/month. The management cost for this hazardous waste is $1,081/month or $13,000 annually.

At one plant, the total estimated cost of filter cake (120 tons) disposal for the first ten months of operating a batch treatment was $11,500 or approximately $13,800 annually. Each haul of 40 tons would be approximately $3,850. Disposal of the filter cake costs $65.00 per ton. The flat rate transportation cost is $748.00 for the doubles. Bin liners are $15.00 each or $30.00 per haul. And finally, the bin rental fee is $3.50 per day per bin or $147 per month for the two bins. Since placed in operation 10 months ago, bin rental has cost $1,470 (or $490 per haul).

At one plant, the filter cake (60% solids) is a hazardous waste because it fails the aquatic toxicity test because of trace solvents and oils. Disposal costs for the filter cake and lint are $135.00 per ton with the transport fee included. It is estimated that the total cost of filter cake disposal , generator fees, and taxes is $75,000 annually.

There is a potential long-term liability associated with this type of disposal and some industrial laundries are working with cement manufacturers to explore using the 50% silica filter cake (from rotary vacuum drum) in its process.

At one plant, solvents recovery from shop towels generates 2000 gallons per month of hazardous waste. The recovered solvents are sent for fuel blending at a cost of $1.75 per gallon including the transport fee. The monthly costs for management of this hazardous waste stream are $3,500 or $42,000 annually.

One plant provides fleet vehicle maintenance for 33 trucks with 3 or 4 mechanics. They are responsible for the proper handling and disposal of all used oils, filters and wastes. Used oil filters are stored in a drum; every 3 months it is picked up for crushing and reclamation of the oil filters at a cost of $40.00 per drum. Every six months, 5 drums of used oil are generated. No disposal costs were given for this waste stream during the assessment. Antifreeze is sent through the plant's treatment system. The mechanics use recovered solvents as needed for cleaning.

At another laundry, fleet vehicle maintenance is performed at a central garage facility. Oil changes are carried out at this facility with the used oil and filters being sent to the central garage for proper disposal. They are responsible for the proper handling and disposal of all used oils, filters and vehicle maintenance wastes. The central garage facility also has a paint booth which probably generates paint and solvent clean up wastes. No disposal costs were given for these waste streams during the assessment.

Fleet vehicle maintenance is performed at one plant on 28 trucks. Safety Kleen services 3 solvent wash stations every two months. The cost for this service is $150 per month or $1,800 annually. Oil changes generate 55 gallons per month of used oil which is handled by a company along with the tramp oil from skimming in the treatment system. The oil filters are taken by Safety Kleen who picks up every 2 months at a cost of $109 or $650 annually. Another plant used a contract service for vehicle maintenance.

No plant visited had underground storage tanks (USTs).

NON-HAZARDOUS SOLID WASTES GENERATED

The non-hazardous wastes which are generated at laundry plants consist mostly of miscellaneous shipping and packaging materials such as cardboard, plastic bags, pallets, and fiber and steel drums. Chemicals come in bags and drums on pallets. At one plant, the dumpsters were estimated to be "80% cardboard and paper" along with lint. Other solid wastes include lint from shaker screens on discharge waters and lint collectors for the dryers. The dryer lint collector at one plant is cleaned once-a-day and put in the 6 cubic yard, solid waste dumpster.

A sludge which is pumped from a settling pit is disposed as a solid waste at one plant. The settling pit generates 4,500 gallons per month of sludge at a cost of $1,500 or $18,000 annually. Another solid waste stream generated at industrial laundries are old uniforms and textiles taken out-of-service. One facility assessed sends the old uniforms for rag manufacturing and the laundry receives $0.05 per pound. If an industrial laundry is not currently recycling these solid wastes, the options available should be reviewed and implemented.

The solid wastes are put in dumpsters which are emptied periodically. The solid waste management costs determined were:

- $400/month ($4,800/year);
- $205/month ($2,460/year – dumpster is emptied daily);
- $800/month ($9,600/year); and
- Costs were not determined during the assessment at one plant but two, 4 cubic yard dumpsters are emptied every 2 days.

The following responses were given by plant staff when ask about solid waste management practices:

- "The company that handles our solid waste sorts for recycling."
- At one plant, "some of the cardboard boxes are broken down and sent back to the supplier for reuse." "Some cardboard boxes are hauled for recycling."
- Steel drums "are picked up by the suppliers." The treatment chemical supplier "picks up their drums." The chemical supplier "takes the drums back."
- Pallets "are taken by someone." Some pallets are "sold and the hanger supplier picks their pallets up." Pallets are "sent back to the supplier or trashed out." Pallets "are reclaimed by another company."
- "Hangers are recycled" at most facilities.
- "Boiler maintenance is performed once a year. All of the waste generated is hauled off by the Contractor. "

WASTE REDUCTION OPPORTUNITIES

The following is a list of the opportunities for meaningful waste reduction which the assessments identified. For each opportunity, further discussion and brainstorming with employees should produce a list of options to be considered for implementation. Selected sources of information relevant to the pollution prevention options will be found in the appendices.

1. Separate and Maintain Strict Control of the RCRA and California List Hazardous Waste Streams.

During the plant visits, the writer observed that an environmental management system is being used by industrial laundries to implement and assure compliance with all existing regulations in the handling, storage and disposal of the wastes. Employee awareness and training programs about hazardous wastes should be expanded to include identification of waste reduction opportunities.

Management should identify and separate pollutant sources, if possible, to determine potential problems from your waste streams and to maximize pretreatment efficiency. Waste stream separation according to toxicity, type of contaminant, and/or physical form can help achieve waste reduction during materials handling, transfer, storage, and treatment.

2. Establish a Continuing Waste Reduction Program

Opportunities for waste reduction are present in every operation, unless **ALL** waste streams are eliminated or have been reduced to the lowest levels technically and economically achievable. The way to take advantage of the opportunities is to establish a program to identify and capitalize on them. Powerful incentives for a continuing waste reduction program exist, but often are not recognized. Their number will increase as business expands, regulatory pressures increase, landfills are filled, current disposal practices are prohibited, and labor and materials costs rise.

A continuing waste reduction program should be fully implemented at all industrial laundries. When shipping hazardous wastes with a required RCRA manifest, the generator certifies a program is in-place to reduce waste streams where technically and economically feasible. California has a hazardous waste reduction planning law. Industrial laundries should develop a plan to meet all state/federal requirements. The essential elements of an effective company-wide program can be found in Appendix A.

Some of the more significant incentives for implementing a program are:

- CONSERVE RESOURCES AND PROTECT THE ENVIRONMENT
- SUBSTANTIAL ECONOMIC RETURN
- REDUCED LIABILITY
- EASE OF REGULATORY COMPLIANCE
- GOOD PUBLIC IMAGE AND MARKETING TOOL

3. Best Management Practices (BMPs)

These assessments pointed out the need for an increased focus on best management practices by both laundries and their customers in chemical usage, handling and storage of soiled textiles, and ensuring that no free-liquids are transported and processed in the laundries. Good operational control for waste reduction is defined as a **procedure or policy** within an organization that reduces the generation of multi-media wastes. Better standard procedures usually relate to production (organizational structure, housekeeping improvements, initiatives, operations planning and control) rather than raw materials and design factors.

Initial policy deployment by management should provide information on BMPs and monitoring and incentives for the professional sales staff and route salespeople (and Teamsters). The sales staff and route salespeople serve exclusive areas on commission base-pay and interface with the customers trying to maximize sales within their area. They understand the customer's needs and include requests for special handling during washing for the heavy soiled loads they identify. Any time not spent actually servicing customers is spent finding new customers. They will need positive benefits for the customer to help in marketing and will need a guide of "tips for better

serving customers," especially those with solvent soiled textiles. Marketing incentives used by sales staff and route salespeople should also include activities already implemented in water and energy conservation which will also improve the company's image.

Since they work on commission, they have very limited interest in monitoring the condition of the customers' soiled textiles and uniforms. Route salespeople are most interested in making their service calls as quickly as possible. Management needs to consider a bonus program for preventing pollution and protecting the laundry facility from pollutants of concern.

Route salespeople understand the customer's needs but may need help and instructions on what to look for. Sales staff and route salespeople need to know when and why they can take shop towels. There are BMPs for customers and treatment and disposal concerns at the laundry which should be covered by management. If these conditions are met, route salespeople can take shop towels. A checklist should be designed for the route salespeople that would clearly describe what they should be doing at each stop to appropriately screen the materials that they're picking up. Some larger laundries have staff trained and assigned to marketing services and screening clients for soil types.

Route salespeoples' training should begin with identifying and targeting soil types and pollutants of concern and the probable sources of these contaminants. The training should focus on verifying that best management practices (BMPs) are being employed by the customer to ensure that no free-liquids are transported back to the laundry. Route salespeople need to have answers for materials handling and transport questions such as:

- What type of management commitment and support is there for requiring implementation of pollution prevention and best management practices (BMPs) by the customers?
- Are there proper collection systems or liquid extraction equipment at the customer's facility?
- Have there been any instances or problems with liquids in transit from the customer to the laundry?
- Can a list (or MSDSs) of chemicals used by the customer be provided before the initial pick up of soiled textiles and where should that list reside?

- What trigger mechanisms are in-place at the laundry to ensure that target pollutants in soiled textiles are reviewed by management and environmental/safety staff prior to contracting with a potential client?

- What steps are involved in getting the soiled textiles to the loading bay?

- What steps are taken once at the loading bay involving sorting and counting the pieces?

Guidelines and material information for the route salespeople and the customers should include BMPs that help reduce the toxicity of chemicals used and eliminate free-liquids in the soiled textiles. An effort to educate customers about best management practices via guidance manuals, fact sheets, and a general awareness may have an impact in reducing contaminants before the soiled textiles are picked up for cleaning. Daily/weekly sales meetings should be used for no free-liquids training and better chemical usage awareness. A bibliography of manuals, fact sheets, and checklists has been developed for "risky" clients, which have been identified in an Institute of Industrial Launderer's (IIL) study. This pollution prevention bibliography can be found in Appendix B.

Best management practices (BMPs) by the customer and laundries for shop towels have been summarized from: (1) Washington State Dept. of Ecology, July 1992 Focus handout; (2) Minnesota Pollution Control Agency, October 1989 memo; and (3) the Institute of Industrial Launderers and Textile Rental Services Association 1992 brochure entitled, "Management Practices for Soiled Reusable Textile Handling." This summary can be found in Appendix C.

Contracting office staff should also be aware of and involved in ascertaining acceptability of what's being taken in for processing. If there were a list (or MSDSs) of chemicals provided by the customers, the safety programs at both facilities would be involved and become aware of each other and potential safety, health, and environmental concerns. This type of supplier partnership will be of benefit to both parties in the long-term.

4. Better Standard Operating Procedures

A business's first step in a waste reduction program can be to change procedures. Improving operating procedures reduces accidental and material losses while maintaining or increasing productivity. Improved procedures can range from a change in management approach to a change in waste handling procedures. Proper procedures to reduce waste must be a part of the overall operating plan for a business.

Purchasing (Substitute) Raw Materials and Inventory Control

Instituting a comprehensive chemical review and purchasing program can save money and valuable resources and reduce toxics and waste. For instance:

- Identifying all process and treatment materials that you use in your facility and evaluating how much is going into the different processes and what residuals are exiting to all media -- land, air and water -- is an important element of a waste reduction plan.

Material safety data sheets (MSDSs) were obtained for Factor Plus, Promote Plus, FB Counterpunch, Economy Sour, Sentinal Sour, Silver-Wyte, and Digress a powdered, chlorinated laundry bleach. Factor Plus, a laundry detergent is incompatible with strong oxidizers. Promote Plus, an industrial shop towel laundry detergent, is incompatible with strong oxidizers. Silver-Wyte, a laundry bleach, is a strong oxidizer with the potential for release of chlorine. FB Counterpunch is a liquid, industrial, dry cleaning detergent which is incompatible with oxidizing agents and chlorinated cleaners. Laundry bleachs (Silver-Wyte and Digress) are strong oxidizers with the potential for release of chlorine when mixed with acids, ammonia, oil, and liquid organic materials. Economy Sour and Sentinal Sour are incompatible with strong alkalies or chlorinated cleaners which may also be present in laundry operations. A nonbenzene-based, powdered dye is manually added when needed for the last 10 minutes of the wash cycle at most plants. Chemical oxygen demand (COD) could be added to the waste water by this dye. Some surfactants used contain ethylene glycol.

Technical information on Regenerate II, a terpene liquid laundry additive used at one plant, claims it is an environmentally safe detergent-solvent formulation designed for removing ink, paint, grease, and oil from cotton, polyester, and polyester/cotton blends. It is designed to be used in combination with other complete detergents and a break operation should follow the treatment. Compatibility testing is suggested prior to using this terpene cleaner on mats since it may soften or damage natural and synthetic rubbers. An MSDS was not obtained on this terpene cleaner but it should be noted that some terpenes contain volatile organic compounds (VOCs) and may contain an ingredient from the SARA Title III Section 313 chemical list. This could be a source of solvent contamination in the wash water.

Safety meetings should focus on proper handling and storage of all process chemicals to avoid health hazards and the generation of waste from spills and cleanup. The automatic, liquid injection systems that are available do reduce the handling of approximately 40 - 50 pounds of laundry chemicals per load which improves worker safety.

Consider replacing your current raw materials with others that reduce the amount or toxicity of the waste that you generate. Toxics use reduction in all process and

treatment chemicals should be reviewed periodically with your suppliers and vendors. Management, environmental/safety staff, and suppliers need to continue asking why are these chemicals used and how can their hazards and toxicity be reduced for the laundries and their customers. At one plant assessed, management made the decision to quit applying oil to dust mops and customers have not noticed the change. You should always take into consideration the cost of treatment and disposal when you are deciding what raw materials to purchase and use in laundering.

Standard procedures for inventory controls should be implemented or improved to ensure review of all chemical usage in the plant. Material and waste tracking systems including good inventory controls seemed to be in-place at the facilities assessed. Laundry process and treatment chemical usage at the laundries visited was well documented including MSDSs and amounts of chemicals used over periods of time. Laundries should use just-in-time inventory controls where possible with usage of chemicals on a first-in, first-out basis to prevent storage of products beyond their shelf life which creates waste.

Procedures for inventory control implemented should ensure review of all chemical usage in aerosol cans throughout the plant. Aerosol cans offer industry a wide variety of products in a very convenient package. Currently, many landfill authorities are beginning to address aerosol cans that they manage. The following are waste reduction recommendations:

- Order aerosol products according to demand. Expired shelf life may require excess inventories to be disposed.

- Control inventories by dispensing aerosol cans through one person in one location to prevent unnecessary usage.

- Keep aerosols away from moisture, sunlight, and extreme heat and cold to increase shelf-life.

- Keep protective caps on containers when not in use to prevent contamination, rusting of the container top, and nozzle damage.

- Purchase alternative aerosol products that do not contain CFCs.

Vendor/supplier certification and procurement procedures should include considerations and requirements for reducing solid waste from shipping and packaging materials. Better specifications in contracting can save money in reduced solid waste costs and ensure the reuse, recyclability, and high post-consumer content of all shipping and packaging materials received.

Good Housekeeping

Good housekeeping measures can greatly decrease the amount of wastes that are generated. To reduce excess waste production:

- Keep tight fitting lids and bungs on containers to prevent loss of chemicals through evaporation or spillage. Keeping lids on containers also prevents contamination with water, dirt or other materials.

- Use spigots and pumps when dispensing new materials and funnels when transferring wastes to storage containers to reduce the possibility of spills.

- Inspect spigots routinely to reduce leaking and clean up time. If adsorbents are used, a waste is being generated and raw materials are lost.

- Store products in locations that will preserve their shelf life.
- Accumulate wastes indoors or in a covered area to prevent moisture from seeping in.

- Never mix different types of waste together. Mixing wastes may make recycling impossible, or make waste disposal much more expensive.

- Make sure that personnel are well trained and aware of operating practices that reduce waste generation.

Large amounts of solid and/or hazardous waste may be generated through spills and leaks, improper storage practices, inefficient production start-up or shut-down, scheduling problems, lack of emergency procedures and preventive maintenance, or poorly calibrated devices for pollution control processes. New manuals of standard procedures and routine training and retraining can eliminate this problem. These procedures may significantly reduce waste at the source.

If you are using adsorbents, select adsorbents that are wringable and can be reused more than once to reduce raw materials loss, disposal costs, and clean up time. Some adsorbents have been used as much as 17 times. Consider adsorbents such as special formulated peat moss that will not easily leach in landfills. Adsorbents have been developed from sawdust, wood fibers, and corn cobs. Sand and clay have been used in the past but new concerns about them leaching absorbed materials should be considered carefully. Check with your landfill authorities to determine if they will accept certain adsorbents containing chemicals. Some restrictions may apply.

Maintenance and Preventative Maintenance

The laundries visited during these assessments had major maintenance operations for laundry and dry cleaning equipment, treatment processes, boilers, and fleet vehicles. More effort should be focused on the waste streams generated by these activities. The solvents, oils and greases generated during these procedures should be separated and handled properly. They don't need to go through on-site waste treatment systems where lint, sludges, and waste water will be impacted.

Reducing wastes through good operating practices can be achieved by using maintenance and preventative maintenance to reduce incidents of equipment breakdowns, inefficiency, or process fluid and chemical leakage. Liquid and laundry chemical leaks can be eliminated by conducting a regular maintenance program including:

- Periodically replacing the seals on the washers and the door gasket.
- Checking hose connections and couplings.
- Cleaning lint screens to avoid clogging.

Corrective maintenance, such as resetting control valves or adjusting process temperatures, will increase efficiency and prevent raw material and energy loss through waste streams. At one facility visited, maintenance costs for a 5 week period were approximately $5,000. The production manager, plant engineer and general manager track major equipment and/or recurring problems. Preventive maintenance helps reduce down-time and wastes produced during the procedure.

Another waste stream generated by maintenance activities are aerosol cans. Paints, cleaners, greases, silicones, etc. are used and empty aerosol cans are disposed of in the solid waste dumpsters. Standard procedures for inventory controls and reduction of waste from aerosol products have been mentioned earlier.

5. Reduce the Number of Empty Cans, Bags, Drums and Pallets

It was observed that practically all of the laundry, treatment and dry cleaning chemicals, etc. are received in bags, cardboard boxes and all types of drums. The quantity is great enough that alternate packaging in larger containers would cause a large reduction in the amount of solid waste being landfilled and empty containers to be handled. A chemical use report on daily usage figures was provided by one of the plants assessed. If all of these chemicals came in 55 gallon drums, there would be an equivalent of 9 empty drums generated as solid waste per week (although some chemicals come in bags and smaller fiber drums).

Determine the number of drums generated and track their handling and storage procedures and costs. Negotiate with your supplier to use returnable drums or bulk containers to ship materials. The concept of bulk or semi-bulk packaging bears exploration, even if some changes in the procedures used to distribute to the point of use or to dispense for use are necessary. Returnable "tote bins" may be impractical because of current equipment and accessibility, but if the current package is a standard steel drum, the number of empty containers generated could be reduced significantly, potentially 90%. The number of incoming disposable pallets would also be considerably reduced. Automated, liquid injection systems may also allow the use of reusable, bulk containers - totes - which reduce solid waste after chemical usage (by 6 - 7 drums).

For reusing and recycling 55 gallon drums, businesses usually return empty drums to the chemical supplier or deal with a cooperage company who reconditions and sells them. If your supplier will not accept empty drums, determine if a drum reclamation company will recondition your drums for resale. Drum reconditioners recycle steel drums which contain residues of organic materials by burning them out before straightening and repainting. Investigate drum recycling sites to ensure that your drums are managed responsibly and lawfully according to all local, state, and federal regulations.

If drum disposal is necessary, consider sending empty containers to scrap metal vendors. Visit your local scrap metal vendors to note how scrap is handled. Tour the company to monitor how the containers are managed. Ask questions on how your scrap should be stored and transported and how it is received and processed.

You may want to consider crushing or cutting the drums and other metal containers to ensure that they are not being reused for storing or transporting others materials. If you generate large numbers of drums the supplier will not take, you should determine the feasibility of purchasing a drum crusher. Before cutting or crushing drums, determine if the drum contained flammable materials. These drums may contain an explosive mixture of air and vapor. Drums should be thoroughly purged before cutting or crushing.

When asked about pallets during the assessments, most replied, "they are taken by someone except the damaged ones which go to the dumpster." More focus should be placed on this waste stream by contacting suppliers about pallet reuse or elimination altogether. Pallets are a candidate for advertising in Waste Exchanges. The amounts, sizes and frequency can be advertised as an available material for reuse at a reasonable cost.

6. Inaugurate a Comprehensive Paper and Paper Products Recycling Program

Recycling paper products can reduce disposal costs. In almost every landfill, paper products represent the largest volume of waste present. As landfill space becomes more valuable, recycling paper products has great potential to extend the life of landfills. Recycling paper has not always been encouraged by paper mills, largely because they lacked capacity to handle the recycled material. This is no longer the case. Most will now buy corrugated board and some 35 grades of paper. High grade, office paper should be used on both-sides and then be separated and recycled.

Reuse of cardboard boxes can be accomplished by purchasing contracts which encourage the reuse of raw material shipping containers. Reuse of corrugated packaging has been accomplished by many suppliers to all types of industry. Some may require liners to enhance reuse but this option should be pursued with your suppliers.

Some facilities that generate large amounts of cardboard have found it economically feasible to bale and sell their cardboard. Businesses with small amounts of cardboard usually give it away to a business or charity willing to pick it up. We suggest you contact your current or local recycler about the feasibility of upgrading the present recycling program or initiating one. For a directory of industrial recyclers call Cal EPA's Department of Toxic Substance Control (DTSC) at 916/322-3670.

7. Utilize Waste Exchanges.

There is a growing interest in services known as Waste Exchanges. Basically, a waste exchange distributes information among subscribers about waste materials available, or waste materials wanted. Often, a waste for one company is a useful raw material for another. The waste exchange allows you to find someone who can make good use of materials which would otherwise be discarded. Many companies have found that pallets can be exchanged locally to reduce solid wastes to the landfill.

Another example are companies who sell used lubricating oil to a fuel blender for a few cents a gallon. Space heaters which burn untreated, used oil are now available, and some companies who once paid for waste oil disposal are now seeking to acquire or purchase additional used oil through the waste exchanges.

Appendix D contains names and addresses of local and out-of-state Waste Exchanges and reuse programs. Calmax would be your closest contact and specific information on their purpose has been provided. Also included are agencies and groups which provide resource assistance.

8. Reduce, Recover and Reuse Solvent from the Dry cleaning Process.

Industrial laundries which also are dry cleaners are prime candidates for waste reduction. Typical wastes generated by dry cleaners include spent perchloroethylene (perc), still bottoms from distillation of solvents, spent filter cartridges, cooked powder residue and water contaminated with perc. These hazardous wastes must be managed and disposed of legally.

In approximately 10% of industrial laundries, dry cleaning with perchloroethylene (or perc) or other solvents is used on garments, shirts and pants. There were both dry-to-dry and regular transfer machines which had capacities of 170 - 180 pounds per load. The dirty solvent mixture passes through a solvent/water separator and generates 50 - 60 gallons/day of water and soluble materials which are recycled back into the laundry water wash cycle for reuse. Laundries should determine if this practice could be impacting oil and TTOs in the waste water. The solvent from the separator passes through a distillation unit before reuse.

By 1994, regulations will probably require ventless systems and dry-to-dry technology or transfer enclosures. Some laundries will retrofit their dry cleaning machines to meet the new standards, while many will have to buy new equipment or discontinue dry cleaning. It is the writer's understanding that new Maximum Achievable Control Technologies (MACTs) will be published in the Code of Federal Register on July 17, 1993 (but we all know how that goes).

Establishments who use perc and solvents should review use of all containers including sewer lines and septic tanks which may contain or may have contained perc. Special attention should be paid to perc-contaminated condensates and prior or current disposal of still bottoms to ensure that contamination is not continuing. Cracked sewer lines which leaked heavier-than-water perc have caused groundwater contamination. All tanks and piping systems should be checked after earthquakes and heavy freezing.

There are a variety of ways that laundries with dry cleaning can reduce the amount of waste that you generate and in turn reduce your operating costs. These waste reduction techniques for dry cleaners include:

Good Housekeeping

Good housekeeping measures can greatly decrease the amount of wastes that are generated. To reduce excess waste production:

- Keep tight fitting lids and bungs on containers to prevent loss of chemicals through evaporation or spillage. Keeping lids on containers also prevents

contamination with water, dirt or other materials.

- Use spigots and pumps when dispensing new materials and funnels when transferring wastes to storage containers to reduce the possibility of spills.

- Inspect spigots routinely to reduce leaking and clean up time. If adsorbents are used, a waste is being generated and raw materials are lost.

- Provide secondary containment in areas where perc and perc wastes are stored.

- Store products in locations that will preserve their shelf life. Use just-in-time inventory controls where possible and usage of chemicals should be on first-in, first-out basis to prevent storage products beyond shelf life.

- Accumulate wastes indoors or in a covered area to prevent moisture from seeping in.

- Never mix different types of waste together. Mixing wastes may make recycling impossible, or make waste disposal much more expensive.

- Make sure that personnel are well trained and aware of operating practices that reduce waste generation.

Maintenance and Preventative Maintenance

Reducing wastes through good operating practices can be achieved by using maintenance and preventative maintenance to reduce incidents of equipment breakdowns, inefficiency, or process fluid and chemical leakage. Corrective maintenance, such as resetting control valves or adjusting process temperatures, will increase efficiency and prevent raw material loss through waste streams. In dry cleaning, both liquid and vapor leaks can be eliminated by conducting a regular maintenance program including:

- Periodically replacing the seals on the dryer deodorizer and aeration valves, the door gasket on the button trap, and the gasket on the cleaning machine door.

- Repairing holes in air and exhaust ducts.

- Checking hose connections and couplings.

- Cleaning lint screens to avoid clogging fans and condensers.

- Checking baffle assembly in cleaning machine.

- Checking air relief valves for proper closure.

- Monitoring for vapor losses with solvent leak detectors.

- Checking to see that your water/solvent separator is working correctly. If there is an unusually large amount of perc in your collection bucket, it is not working correctly.

Substitute Raw Materials

Consider replacing your current raw materials with others that reduce the amount or toxicity of the waste that you generate. For example, if you use a solvent other than perc, use one which is not considered ignitable with a flash point of 140 degrees F. Check with your supplier/vendor for more information. You should always take into consideration the cost of disposal when your are deciding what raw materials to purchase.

Modify or Replace Your Dry cleaning Process

In wet-to-dry units you lose solvents in the transfer process. Several other technologies which have been developed recently to control perc emissions during transfer are termed transfer enclosures. A transfer enclosure captures or collects perc emissions during clothing transfer at dry cleaning facilities using transfer machines. Transfer enclosures have been subclassified into two types, hamper enclosures and room enclosures. If you are currently using a wet-to-dry cleaning unit, consider replacing it with a dry-to-dry unit which eliminates the need for clothing transfer.

A fact sheet on "National Emission Standards for Hazardous Air Pollutants from Dry cleaning Facilities" can be found in Appendix F. It includes the recommended standards for pollution prevention practices, operational and maintenance practices, and reporting and recordkeeping. As mentioned earlier, MACT standards will be published on July 17, 1993 in the Code of Federal Register.

Reduce, Recover and Reuse Solvent from the Waste Stream

There are several methods you can use to reclaim perc from your system. Perc and other cleaning solvents are expensive, so the more of it you can recover and reuse, the more money you will save. Recycling methods include:

- Distilling your spent perc in a distillation unit.

- Capturing the perc vapors which are vented from your machine, and passing them through an activated carbon filter. The perc is then reclaimed by passing steam, in reverse, through the carbon filter.

- Using "sniffers" to draw in the perc vapors from the shop or transfer enclosures, and then using the same carbon filter process to reclaim the perc.

9. Solvents Recovery With VOC Stripper and Centrifuge

During these assessments, the issue of handling and laundering shop towels was discussed with laundry personnel. Two methods for solvent recovery prior to water washing are centrifuging and Volatile Organic Compound (VOC) stripping. A VOC Stripper, the first of it's kind in full operation, was observed. The "bugs of doing 4 or 5 daily loads were being worked out." Operating procedures and sling loading of the 800 - 1000 pounds of shop towels had been modified to improve the cycle times.

The VOC Stripper processes the soiled shop towels by injecting live steam at controlled temperatures to release the solvents from the fabric. The steam and VOC vapors are drawn off through a condenser to a separator where the VOCs are recovered. A cold water rinse cycle quickly lowers the temperature of the shop towels for unloading. The recovered solvents are stored in tanks.

After installing the VOC Stripper, an impact on washing efficiency was observed. In general, there has been an increase in wash cycle time, temperature, and chemicals needed to clean the shop towels in the absence of the solvents. Shop towels (heavy soil) require a flush cycle while the shirts (light soil) go directly to the break cycle. For shop towels, wash temperatures of 180 degrees F are used to remove heavy, oily soils. Normal wash temperatures are 140 - 150 degrees F. The shop towels also require longer rinsing cycles, sometimes for 2 hours while normal soil rinsing cycles are less than an hour.

If solvents recovery is implemented, marketing/sales staff, route salespeople, and environmental/safety staff should investigate the option of returning recovered VOCs to the customer/generator for reuse at their facility. Local, state, and federal regulators should provide guidance for solvent materials reuse in cleaning and other processes and toxics use reduction by the customers. EPA's Design for The Environment Printing Project's "Case Study 1: Managing Solvents and Wipes" can be found in Appendix E. This is a model example of a supplier/customer partnership which resulted in solvents recovery using a centrifuge and continuous improvement of processes at both facilities. It is the goal of this P2 Industrial Laundry Workgroup to help facilitate adaption of these types of pollution prevention and waste reduction successes.

INDUSTRIAL LAUNDRIES WITH VEHICLE MAINTENANCE

It is apparent from the assessments that fleet maintenance is performed on-site and that typical vehicle maintenance waste streams are generated. These wastes are generated at this plant and a central garage facility. Many state and federal pollution prevention programs have developed vehicle maintenance manuals, fact sheets, and checklists for reducing toxic materials use and wastes. These are being included in the pollution prevention bibliography found in Appendix B. These should be used for educating laundry customers in this business sector who use shop towels, but also should be used by the laundries themselves.

Training for mechanics is necessary to ensure proper handling, storage, reduction, and disposal of these wastes. Pollution prevention manuals for vehicle maintenance can be found in the bibliography in Appendix B. Vehicle maintenance waste streams are identified and discussed in these manuals and waste reduction recommendations are offered.

APPENDICES

APPENDIX A

Waste Reduction Planning Program

The essential elements of an effective company-wide program are:

- TOP **MANAGEMENT COMMITMENT** AND SUPPORT
- EXPLICITLY **DEFINED PROGRAM** AND OBJECTIVES
- ACCURATE **ACCOUNTING OF WASTE STREAMS** AND THEIR TRUE COSTS
- A PERVASIVE **WASTE REDUCTION ETHIC**
- **INFORMATION AND TECHNOLOGY** SOURCES
- PERIODIC **PROGRAM EVALUATION AND REASSESSMENT** OF WASTE REDUCTION OPPORTUNITIES

None of the elements is measurably more important than another, and a program will rarely be more than partially effective unless all those listed are present.

The program must have a set of GOALS which should be:

- **ACCEPTABLE** to those who will work to achieve them.
- **FLEXIBLE** to adapt to changing requirements.
- **MEASURABLE** over time.
- **SUITABLE** to the overall corporate goals.
- **UNDERSTANDABLE.**
- **ACHIEVABLE** with a practical level of effort.

Top management commitment can best be communicated by a formal policy statement from the C.E.O. or from the Directors. An example is:

CORPORATE ENVIRONMENTAL POLICY

[Corporate Name]
_____ is committed to continued excellence, leadership and stewardship in protecting the environment. Environmental protection is a primary management responsibility, as well as the responsibility of every employee.

In keeping with this policy, our objective as a company is to reduce waste and achieve minimal adverse impact upon the air, water and land through excellence in environmental control.

The Environmental Guidelines include the following points:

_Environmental protection is a line responsibility and an important measure of employee performance. In addition, every employee is responsible for environmental protection in the same manner as he or she is for safety.

_Minimizing or eliminating the generation of waste has been and continues to be a prime consideration in research, process design, and plant operation; and management considers it as important as safety, yield, and quality.

_Reuse and recycling of materials has been and will be given first consideration prior to classification as waste for treatment and disposal.

[Corporate Official]
Signed:_____

Defining a waste reduction program ideally involves a company-wide assessment of waste generation by as diverse a "TASK FORCE" of employees as can be assembled. The task force should determine:

- **What wastes** are generated;
- **What operations** or processes generate them;
- **Quantity and cost** of each waste stream; and
- **Corporate priority** for attacking reduction efforts, according to the stated goals.

Each opportunity must be individually evaluated to determine the action to be taken. As a result of the assessment, a number of OPPORTUNITIES similar to those listed in this report will have been identified. Once identified, evaluation by smaller teams of persons most familiar with the operation involved usually reveals several options for dealing with each opportunity. An evaluation team can then judge the options according to such criteria as cost to implement, disruption of normal operations, technical difficulty, etc. and recommend an implementation plan.

Sources of technical information are many, but include, among others, State Technical Assistance Programs such as: Cal EPA's Department of Toxic Substance Control (DTSC); EPA Region 9's information services and publications; equipment, chemical and environmental services vendors and suppliers; and consulting firms.

The final element of a successful waste reduction program is continuing evaluation and updating. To plan future pollution prevention and waste reduction efforts, companies must establish a means of documenting and evaluating current and past efforts. Such analyses should consider:

- The program's actual costs and savings compared with initial program estimates.

- The impact of waste reduction efforts on:

  »The composition of the waste streams;

  »The quantities of the waste streams;

  »The cost of waste management;

  »Production capacity and product quality;

  »Production costs, including raw materials;

  »Utility and maintenance costs;

  »Health and safety exposure of workers and community; and

  »Corporate environmental, health and safety liability.

APPENDIX B

Pollution Prevention Bibliography

POLLUTION PREVENTION RESOURCE DOCUMENT LIST

Industry	Title	Type	Prepared By
Auto Repair	Waste Minimization for Automotive Repair Shops	Fact Sheet	Cal-EPA DTSC
	Automotive Maintenance Industry: Basic Environmental & Business Requirements	Fact Sheet	L.A. City HTM
	Radiator Repair Industry: Basic Environmental & Business Requirements	Fact Sheet	L.A. City HTM
	Hazardous Waste Reduction Assessment for Automotive Repair Shops	Handbook	Cal-EPA DTSC
	Used Oil: Handling, Storage & Transport for Recycling	Fact Sheet	Cal-EPA DTSC
	Used Oil Filters: Handling, Storage & Transport for Recycling	Fact Sheet	Cal-EPA DTSC
Printers	Waste Minimization for Commercial Printing Industry	Fact Sheet	Cal-EPA DTSC
	Mangaging Solvents & Wipes	Case Study	U.S. EPA DfE Project
	Printing: Pollution Prevention Opportunities Checklist	Factsheet	L.A. County San. Districts
	Commercial Printing: Pollution Prevention Opportunities Guidelines	Guidelines	Orange County San. Districts
Metal Finishers	Waste Minimization for Metal Finishers	Fact Sheet	Cal-EPA DTSC
	What Should I Do With My Electroplating Sludge?	Fact Sheet	L.A. City HTM
	Plating with Trivalent Chrome	Fact Sheet	L.A. City HTM
	Decorative Plating with Tri-valent Chrome	Fact Sheet	Cal-EPA DTSC
	Metal Finishers: Pollution Prevention Opportunities Checklist	Factsheet	L.A. County San. Districts

Metal Finishers (con't)	Metal Finishing: Pollution Prevention Opportunities Guidelines	Guidelines	Orange County San. Districts
	Hazardous Waste Reduction Checklist & Assessment Manual for the Metal Finishing Industry	Handbook & Checklist	Cal-EPA DTSC
	Waste Minimization Opportunity Assessments: East L.A. Enterprise Zone Metal Plating Facilities	Case Studies	Cal-EPA DTSC/L.A. City HTM
Metal Fabricators	Metal Fabricators: Pollution Prevention Opportunities Guidelines	Guidelines	Orange County San. Districts
	Metal Fabricators: Pollution Prevention Opportunities Checklist	Factsheet	L.A. County San. Districts
Aerospace	Waste Minimization for Aerospace Industry	Fact Sheet	Cal-EPA DTSC
Printed Circuit Boards	Waste Minimization for Printed Circuit Board Manufacturers	Fact Sheet	Cal-EPA DTSC
	Printed Circuit Board Manufacturing: Pollution Prevention Opportunities Guidelines	Guidelines	Orange County San. Districts
	Printed Circuit Board Manufacturing: Pollution Prevention Opportunities Checklist	Factsheet	Orange County San. Districts
Furniture Refinishers	Furniture Refinishers– Regulatory Requirements	Fact Sheet	L.A. City HTM
	Waste Minimization Assessment for a Manufacturer of Military Furniture	Case Study	U.S EPA RREL
Jewelry	Jewelry Manufacturers: Basic Environmental & Business Requirements	Fact Sheet	L.A. City HTM
Paint	Waste Minimization for Paint Formulators	Fact Sheet	Cal-EPA DTSC
	Paint Collection Facilities for Businesses	Directory	L.A. City HTM

Paint (con't)	Waste Minimization for Auto Paint Shops	Fact Sheet	Cal-EPA DTSC
	Formulators (Paint, Pesticides, Aerosols): Pollution Prevention Opportunities Guidelines	Guidelines	Orange County San. Districts
	Formulators (Paint & Pesticides) Pollution Prevention Opportunities Checklist	Factsheet	L.A. County San. Districts
Pesticides	Waste Minimization for Pesticide Formulating Industry	Fact Sheet	Cal-EPA DTSC
	Formulators (Paint, Pesticides, Aerosols): Pollution Prevention Opportunities Guidelines	Guidelines	Orange County San. Districts
	Formulators (Paint & Pesticides) Pollution Prevention Opportunities Checklist	Factsheet	L.A. County San. Districts

The publications on this list are available to the public free of charge. To order, call or write:

Cal-EPA
DTSC

California Environmental Protection Agency
Department of Toxic Substances Control
Pollution Prevention & Regulatory Assistance Division
Technology Clearinghouse
P.O. Box 806
Sacramento, CA 95812-0806

(916) 322- 3670

L.A. City
HTM

City of Los Angeles
Hazardous and Toxic Materials Office
Board of Public Works
200 N. Spring Street, Room 353
Los Angeles, CA 90012

(213) 237-1209 *(213) 237-1445 (FAX)*

L.A. County
San. Districts

Los Angeles County *contact: Theresa Dodge*
Sanitation Districts
P.O. Box 498
1955 Workman Mill Road
Whittier, CA 90607

(310) 699-7411 *(310) 692-5103 (FAX)*

Orange County
San. Districts

Orange County *contact: Adriana Renescu*
Sanitation Districts
P.O. Box 8127
10844 Ellis Avenue
Fountain Valley, CA 92728-8127

(714) 962-2411 *(714) 962-6957 (FAX)*

U.S. EPA
DfE Project

U.S. Environmental Protection Agency
Design for the Environment Project
Pollution Prevention Information Clearinghouse

(202) 260-1023 *(202) 260-0178 (FAX)*

APPENDIX C

Summary: Best Management Practices (BMPs) for Soiled Textiles

Best Management Practices (BMPs) for Shop Towels[1]

BMPs for the Customer

DO:

- o Use non-hazardous cleaning solvents whenever possible
- o Use cloth or other durable material shop towels
- o Wring out soiled towels before placing in collection drums
- o Use centrifuge or mechnical ringer, if appropriate
- o Make sure no towels bearing free liquids are placed in drums
- o Make sure liner system (nylon or mesh bag) is in good working order and hangs at correct height
- o If excess liquid collects at bottom of drum, decant into waste solvent collection drum; manage the liquid appropriately
- o If collected liquid meets RCRA criteria (listed, characteristic, etc.), manage as a hazardous solvent waste
- o Always collect, store, and transport in closed containers
- o Manage containers holding flammable materials according to all local fire department standards
- o Share your Material Safety Data Sheets with route salespeople

☞ **NEVER:**

- o Air dry soiled shop towels
- o Pick up spills of hazardous liquids with towels
- o Dispose of excess chemicals by pouring onto towels
- o Put towels with free liquids in collection system
- o Allow towels in drum to contact excess liquid (liner should always hang high enough to prevent this)
- o Pre-wash or launder shop towels on your own

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[1] BMPs summarized (in shortened form) from Washington State Dept. of Ecology (DOE) July 1992 Focus handout; Minnesota Pollution Control Agency (MPCA) Oct. 1989 memo; and Institute of Industrial Launderers (IIL) and Textile Rental Services Association (TRSA) 1992 brochure "Management Practices for Soiled Reusable Textile Handling."

Best Management Practices (BMPs) for Shop Towels[2]

BMPs for the Laundries

DO:

- o Let your customers know that you cannot accept shop towels bearing free liquids
- o Work with customers to outline acceptable and non-acceptable practices to minimize free liquids on towels (start with the summary of customer BMPs provided)
- o Educate route salespeople on both customer and laundry BMPs; set minimum standards for them to accept or refuse pickup
- o If refusal notice is given, have follow-up discussion with the customer so they know how to avoid future refusals
- o Establish in-house procedures for the safe receipt, handling, and processing of soiled shop towels
- o Make sure all activities associated with transporting and handling industrial textiles comply with applicable EPA, OSHA, DOT, and other federal, state, and local regulations
- o Incorporate BMP instruction into training of all laundry employees

ALSO CONSIDER:

- o Telling your customers about state and local pollution prevention programs that could help them minimize their wastes
- o Handing out free industry-specific pollution prevention brochures that have been developed by state and local agencies

☞ **NEVER:**

- o Accept free liquid bearing towels
- o Transport or store soiled shop towels in open containers
- o Allow mis-management of solvent which collects in drum (e.g., do not pour down drain)

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[2] BMPs summarized (in shortened form) from Washington State Dept. of Ecology (DOE) July 1992 Focus handout; Minnesota Pollution Control Agency (MPCA) Oct. 1989 memo; and Institute of Industrial Launderers (IIL) and Textile Rental Services Association (TRSA) 1992 brochure "Management Practices for Soiled Reusable textile Handling."

APPENDIX D

Waste Exchange Information: Calmax

CALMAX UPDATE

Joyce Mason
CALMAX Coordinator

CALMAX First-Year Totals Soar. Your eyes are not deceiving you! Since the last Update, reports on the amount of waste diverted during the first year of publication of the CALMAX catalog skyrocketed, from an estimated 6400 tons to nearly 112,000! (See Match of the Catalog, September/ October 1992, for details.)

That's the good news. The "bad" (or at least limiting) news is that since neither the California Integrated Waste Management Board (Board) nor the Local Government Commission (LGC) is directly involved in the business-to-business exchanges CALMAX helps bring about, we will probably never know all the numbers.

111,816 Tons!

The LGC is a nonprofit, nonpartisan membership organization of local elected officials. As you may know, the LGC jointly operates CALMAX under contract with the Board and is directly involved in many day-to-day CALMAX program operations, including receipt of your Successful Exchange Forms. After your listings run two catalogs, an LGC/CALMAX staff member will call you to find out if you want to continue your listing—and whether or not you have made any successful exchanges that you have not yet reported to us.

But in a busy world with finite resources, we have limited call-back capabilities on those participants not reached in the first few tries. Fred Wetzel's successful transactions, connections made through CALMAX, illustrate what a difference just one participant's report can make. Your reports are absolutely essential to us to keep this program going and growing. We hope it s a small price to pay for our free resource matchmaking service. Thanks for keeping us informed.

User Survey. We have had few, but very positive responses so far on the survey printed in the last catalog. We will follow up with a telephone survey to a representative sample of our subscriber list in the near future. Thanks for taking a few minutes to talk to us when we call.

User Group. One of our subscribers recently suggested we start a CALMAX user group. A possible way to begin might be with semiannual meetings in Northern and Southern California, focused on how to maximize trades through the catalog and other ways to reduce, reuse, and recycle. If you are interested in this concept or have ideas to add, please call me at (916) 255-2369.

Conferences and Events. We brought the CALMAX booth to Eco Expo in LA, March 12-14. I'll be speaking and chairing a reuse panel at the Pacific Recycler's Expo in San Jose, April 8. If you haven't seen the CALMAX slide show or information table, stop in and meet us. I'm also on the agenda for the May 21 California Resource Recovery Association (CRRA) luncheon in Fremont, "Working with Reuse Industries." For information on any of these events, call us at CALMAX: (916) 255-2369.

This month's catalog ushers in the Spring Season, that wonderful time of year for clean-up and new beginnings. It's the perfect time to find new materials to list in the CALMAX catalog. Plant a seed for reuse and watch it grow!

cal MAX California Materials Exchange

916-255-2369 • 800-553-2962

MATERIALS LISTING/CONTACT FORM

NAME OF NONHAZARDOUS MATERIAL: _____

☐ AVAILABLE OR ☐ WANTED IN: _____
City/Region

IF AVAILABLE, IS MATERIAL ☐ FREE OR ☐ FOR CHARGE: _____
Price or Charges

AMOUNT: _____
Include weight, volume or container size

☐ ONE TIME ONLY OR ☐ RECURRING: _____
If recurring, how often

DESCRIBE YOUR MATERIAL BELOW:

_____

_____

_____

Check the appropriate category for this material or product: check one box only

☐ CONSTRUCTION	☐ METAL	☐ PLASTIC
☐ CONTAINERS	☐ ORGANICS	☐ RUBBER
☐ DURABLE GOODS	☐ PAINT/WAX	☐ TEXTILE
☐ ELECTRONIC	☐ PALLETS	☐ WOOD
☐ GLASS	☐ PAPER	☐ MISCELLANEOUS

The CALMAX Catalog advertises listings by region and by material type. Please check the appropriate region where your material is available or wanted:

☐ BAKERSFIELD/FRESNO	☐ MONTEREY/SANTA CRUZ	☐ SANTA BARBARA/VENTURA
☐ BISHOP/LONE PINE/VICTORVILLE	☐ REDDING	SAN LUIS OBISPO
PALMDALE/BARSTOW	☐ SACRAMENTO/STOCKTON	☐ SUSANVILLE/ALTURAS
☐ EL CENTRO/INDIO	☐ SAN BERNARDINO/RIVERSIDE	☐ TAHOE/RENO
☐ EUREKA/CRESCENT CITY	☐ SAN FRANCISCO/SAN JOSE	☐ OUT OF STATE
☐ LOS ANGELES/LONG BEACH/ANAHEIM	SANTA ROSA/OAKLAND	☐ ALL OF CALIFORNIA

☐ DO NOT RELEASE MY LISTING INFORMATION ON NATIONWIDE COMPUTERIZED BULLETTIN BOARD

CONTACT NAME: _____ TITLE/POSITION: _____

NAME OF BUSINESS: _____ TYPE OF BUSINESS: _____

ADDRESS: _____

CITY: _____ STATE: _____ ZIP: _____

CA COUNTY: _____ COUNTRY: _____

PHONE: ( ) _____ FAX: _____ SIGNATURE: _____

MAIL OR FAX THIS FORM TO:

CALMAX-CIWMB
c/o Local Government Commission
909 12th Street, Suite 205
Sacramento, CA 95814
(916) 448-1198 • FAX (916) 448-8246

CALMAX reserves the right to not list a material, or to edit information provided by the listing party.

LISTING DEADLINES:

Issue:	Received by:
MAY/JUNE	4/21/93
JULY/AUG	6/23/93
SEPT/OCT	8/25/93
NOV/DEC	10/20/93

HOW TO USE THIS CATALOG

Listings are divided into three main sections.

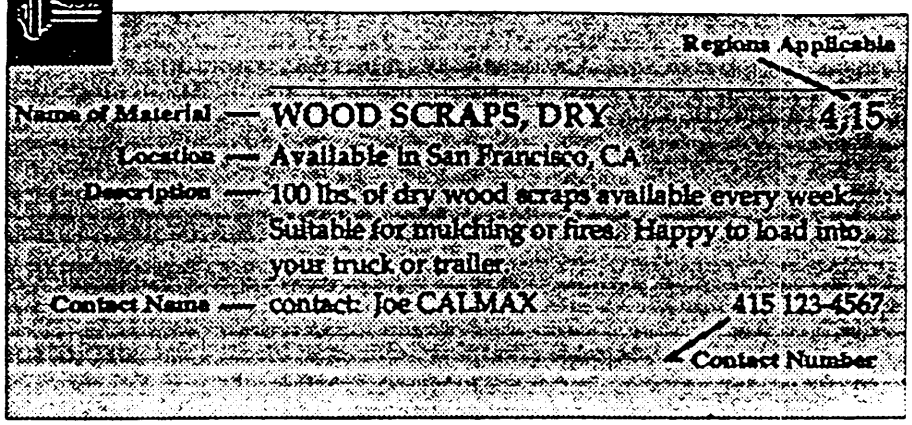
- ★ **Available listings**
- ★ **Wanted listings**
- ★ **Regional listings** — abbreviated versions of all listings from the first two sections organized into the regions shown on the next page.

Within the three sections, listings are grouped into the 15 Material Categories below.

Material Categories

CONSTRUCTION
CONTAINERS
DURABLE GOODS
(furniture, appliances, machinery etc...)
ELECTRONIC
GLASS
METAL
ORGANICS
PAINT/WAX
PALLETS
PAPER
PLASTIC
RUBBER
TEXTILE
WOOD
MISCELLANEOUS

KEY TO LISTINGS



To Place a Listing with CALMAX

If you are looking for, or want to get rid of a nonhazardous material, and would like to advertise with CALMAX, use the Listing/Contact Form on the last page of this catalog.

Making an Exchange

All arrangements are worked out between the interested parties. Any costs, charges, prices, etc. are negotiab between the parties. For instance a material may be offered for free, for hauling costs or for a price. *Please refer to the disclaimer on page 2.*

LIST OF THE MONTH

SMALL BUSINESS DEVELOPMENT CENTERS OF CALIFORNIA

The Office of Small Business of the California Department of Commerce provides management and technical assistance to small businesses, primarily through the numerous **Small Business Development Centers** located throughout the State. Information and resources covering initial start-up requirements, financing options, marketing, and manufacturing as well as other forms of assistance are available through the **Centers**. Contact your local Center, listed below, for more information and assistance.

Central Coast
Small Business Development Center
6500 Soquel Drive
Aptos, CA 95003 (408) 479-6136

East Bay
Small Development Center
2201 Broadway, Suite 814
Oakland, CA 94612 (510) 893-4114

East Los Angeles
Small Business Development Center
363 S. Park Avenue, Suite 105
Pomona, CA 91766 (714) 629-2247

Gavilan College
Small Business Development Center
5055 Santa Teresa Boulevard
Gilroy, CA 95020 (408) 847-0373

Greater Sacramento
Small Business Development Center
1787 Tribute Road, Suite A
Sacramento, CA 95815 (916) 920-7949

Lake and Mendocino County
The Business Development Center of Lake and Mendocino Counties
341 North Main Street
Lakeport, CA 95453 (707) 263-0630

Merced/Modesto
Small Business Development Center
1012 Eleventh Street, Suite 300
Modesto, CA 95354 (209) 521-6177

Napa Valley College
Small Business Center
100 Coombs Street
Napa, CA 94559 (707) 253-3210

North Coast
Small Business Resource Center
882 H Street
Crescent City, CA 95531 (707) 464-2168

San Diego
Small Business Development Center
402 W. Broadway, Suite 1000
San Diego, CA 92101 (619) 544-1350

San Joaquin
Small Business Development Center
5151 Pacific Avenue
Stockton, CA 95207 (209) 474-5089

Sierra
Small Business Development Center
550 High Street, Suite 3
Auburn, CA 95603 (916) 885-5488

Solano County
Small Business Development Center
320 Campus Lane
Suisun, CA 94585 (707) 864-3382

Southwestern College
Small Business and International Trade Center
7101 Siempre Viva Road, Suite 200
Otay Mesa, CA 92173 (619) 661-1135

Tri-County
Small Business Assistance Center
260 Cohassett Avenue
Chico, CA 95926 (916) 895-9017

Weill Institute
Small Business Development Center
2101 K Street Mall
Bakersfield, CA 93301 (805) 395-4148

APPENDIX E

EPA's Design for The Environment Printing Project's "Case Study 1: Managing Solvents and Wipes"

A Cooperative Project between the U.S. Environmental Protection Agency and the Printing Trade Associations Nationwide

design FOR THE ENVIRONMENT

PRINTING PROJECT

CASE STUDY 1

MANAGING SOLVENTS AND WIPES

Being responsive to the environment means learning new procedures and using new tools to do the same job with less hazard. Decisions about the purchase of equipment and chemicals for pressrooms or other production processes depend not only on cost, availability, and performance, but also on whether environmental requirements can be met. Meeting environmental requirements means understanding the comparative human and ecological risks of the alternatives being considered.

This case study is brought to you by the U.S. Environmental Protection Agency's (EPA's) Design for the Environment (DfE) program. Through the DfE program, government and industry are working together to identify alternative products and processes that are safer for the environment.

This is the first in a series of case studies that EPA is developing to illustrate the DfE theme. This study describes a successful pollution reduction program at the John Roberts Company in Minneapolis, Minnesota. Although the company did not have access to risk and impact information, the way in which it searched out safer alternatives illustrates how printers can achieve significant environmental results.

In particular, this case study illustrates:

- How a self-audit of solvents used in printing operations led to the substitution of more environmentally appropriate solvents.
- How the use of a centrifuge to extract solvents from industrial wipers prior to laundering resulted in reduced solvent in the laundry's wastewater.
- How this company saved money through its efforts to use safer solvents and reduce waste.

The story of this company's experience, and the steps it followed, show how problems can become opportunities and how environmental planning can be good for business.

Background

The John Roberts Company is a commercial printer of annual reports, brochures, catalogs, forms, limited edition fine art prints, and direct mail pieces using both sheet-fed offset and web offset printing processes. The company began to really understand its solvent use practices as a result of a problem encountered by the industrial laundry that washes the company's press wipers. The effluent from the laundry had become a concern to the local regulatory agency that oversees the sanitary sewer system in the Minneapolis metropolitan area.

Understand The Problem

The John Roberts Company uses leased towels as wipers for press cleanup. The company was sending its leased towels

Printing donated by Custom Print, Inc.

to an industrial laundry for cleaning, and with them went a great deal of ink and "spent" solvents. The presence of these solvents in the wipers was creating a problem for the laundry and for the local sanitary sewer system that handles the effluent from the laundry. The two major concerns were volatility and flammability.

The local regulatory agency approached the industrial laundry because too much solvent was being washed out of the towels, causing the vapors from the laundry's effluent to exceed the lower explosive limit (LEL).

The laundry, in turn, asked its major printer customers and a trade association, the Printing Industry of Minnesota, Inc. (PIM), to work out a solution. There were incentives for both parties: the laundry would be able to retain its business, and the printers would be able to continue using leased towels.

Consider Possible Solutions

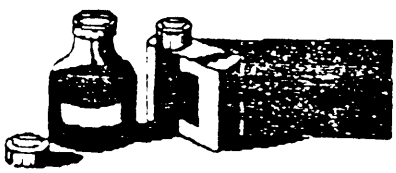
The John Roberts Company decided to concentrate on two main objectives: (1) to change the *nature* of the solvent that was left in the towels from cleaning presses, and (2) to reduce the *volume* of solvent left in the towels.

Change The Nature Of The Solvents

Finding An Alternative

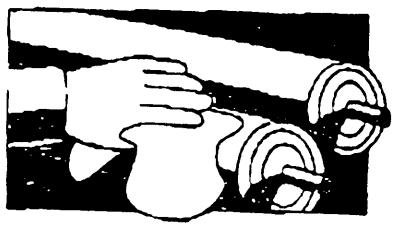
The first step was to examine the nature of the solvents used to clean the presses to see if a less volatile substitute could be used. More information was needed about the tasks solvents must accomplish and the conditions under which these solvents perform.

As a result of thorough discussion with everyone involved in the process, the company prepared a list of necessary solvent criteria:



- For washing press blankets, a solvent must work quickly to cut ink, leave the blanket free of any oily residue, and dry almost immediately. Time and the ability to get back up to color quickly is critical during a press run.
- For cleaning the metal parts of a press, a slower-working solvent would be suitable as a general press wash.
- For cleaning the chain of ink rollers, a solvent that is slow to evaporate is needed. This solvent must not flash off before it has gone through the entire sequence of rollers or it will fail to clean them adequately.
- On a limited basis, a very aggressive solvent is needed for removing hardened ink that sometimes collects on the press.

In light of these criteria, the company's first task was to find a blanket wash that balanced these production needs with the environmental needs of less volatility and flammability.



Press operators prefer solvents that flash off quickly and do not require a lot of wiping or leave behind an oily film. Unfortunately, most solvents with these desirable properties also create problems for industrial laundries by exceeding the LEL level. When the John Roberts Company audited its operations, it discovered that press operators had been using a highly volatile solvent called type wash as a general, all-purpose solvent, including for blanket cleaning. This product was a blend of acetone, toluene, methyl ethyl ketone (MEK), and isopropyl alcohol and contributes not only to in-plant volatile organic compounds (VOCs) in the air, but also to problems with the laundry's effluent.

This solvent was never intended for all-purpose use, but using the solvent had become a habit that was hard to break. Because it flashed off so readily, no time was lost by press personnel. It was easy to see why the solvent was so popular.

As the company analyzed the product's properties further, however, it found that almost one-half the total volume of the solvent was wasted. It simply evaporated before

...ne work could be performed! The ...oal was to find a substitute solvent ...nat was better matched to the tasks ...t was to perform and that did not ...ubstantially affect work procedures ...r productivity.

Work Together To Implement Changes

It is important to recognize that it was not sufficient to simply look for a technical solution to the problem. For success to be possible, the support of upper management was vital, as well as the cooperation and understanding of press personnel. Management gave its support by assuring plant personnel that learning to work with new solvents might involve some procedural changes that could affect productivity slightly, but that small losses would not reflect negatively on overall performance evaluations. Input was sought from each press person and floor helper. The reasons why it was necessary to change solvents and how the change was to be accomplished were explained to them.

The raising of awareness in the effort to find a substitute resulted in a reduction in the misuse of the type wash solvent. Type wash usage was reduced from 152 to 5 fifty-five-gallon drums in the first year. The company still uses type wash, but only where its use can be justified. A new replacement solvent, an ultra-fast blanket wash, was blended especially for the company and performed well with respect to speed and lack of an oily film.

Only 38 fifty-five-gallon drums of this new blanket wash were purchased in the first year. Even after including the purchase of the replacement solvent, the John Roberts Company realized a savings of more than $18,000 in the first year by changing solvents and using them more prudently. More importantly, by selecting a replacement solvent blend with a lower evaporation rate and by strictly limiting the use of type wash, the contribution of vapors from the John Roberts Company to the laundry's effluent no longer exceeded the LEL and was no longer a concern.

Make Additional Improvements

There were, however, some lingering concerns with the new solvent. One ingredient in the new blanket wash was 1,1,1 trichloroethane (TCA), which gave the blend some of its performance characteristics, but is being phased out because it is an ozone depleter and a suspected health hazard. TCA will soon be banned by the Montreal Protocol, an international treaty to eliminate the manufacture of ozone depleters.

The company therefore continued its investigation of alternatives, this time with an emphasis on reduction of fugitive VOC emissions. It reformulated its blanket wash to a less volatile press wash that contains no TCA. The company approached its search for a substitute with reduced VOC emissions with the realization that vapor pressure plays an important role. A solvent with a lower vapor pressure will evaporate less readily and will release less VOC emissions to the air. Therefore, when the goal is reduction of fugitive VOC emissions, volatility should be considered.

Early results from this change show that because considerably less solvent is lost to the air through evaporation, the company is purchasing four fewer drums of solvent each month. However, four more drums of spent solvent are removed from the rags and sent offsite for fuel blending. In spite of the costs to manifest and ship this solvent, the company still saves $100 per month. In addition, the John Roberts Company has lower fugitive emissions and a healthier workplace.

During trials for new solvent blends, the company's management came to a critical realization: the way in which a product is used is key to its performance. The company found that testing the same product on different presses using different crews produced widely varying results. The success of the solvent changes the company made was due largely to the development of a very specific procedure for solvent use, which was developed by the press operators themselves.

Reduce The Volume Of Solvent

The second objective was to reduce the volume of solvents left in the towels. With the help of its trade association, the Printing Industry of Minnesota, Inc. (PIM), the company began to explore ways to "wring out" the wipers.

The first step was to make sure efforts to train employees not to dump excess solvent in the pile of used wipers had not eroded. Confident that training had assured that the rags put in the used rag container retained the "minimum" amount of solvent, the company explored the use of a commercial grade laundry centrifuge to separate out any remaining solvent. The company was surprised to learn that the "minimum" amount of solvent retained in the wipers was much more than originally thought.

Now, before wipers are sent to the laundry, they are spun in a safe, explosion-proof centrifuge, which extracts between $2^1/_2$ and $3^1/_2$ gallons of "spent" solvent for every load of approximately 220 wipers. This amounts to quite a lot of solvent over time. The recovered solvent is now reused throughout the plant in a series of parts washers to clean press ink trays, instead of going out with the laundry, and the spent solvent is then sent to a fuel blender. Reuse of this solvent eliminated the purchase of more than one drum a week of virgin solvent for use in parts washers throughout the plant. The centrifuge recovery program has saved the company more than $34,000 in the first year alone, resulting in a quick payback on the $15,000 centrifuge. The centrifuge has also resulted in a sizeable reduction in the volume of solvent sent to the sewer system. Using a centrifuge for this purpose might not be allowed in all states, but other options could be available.

The Design For The Environment Approach

This case study described how a company systematically assessed a problem, applied knowledge acquired through that assessment (along with the assistance of its trade association), and dealt with the problem in its context.

The result is a methodology that is affordable, effective, readily adaptable, and can be transferred to other printers. Environmental benefits demonstrated in this case study include reduced fugitive air emissions, less solvent discharged to the water system, and decreased toxic chemical purchases. Waste solvent is being used for energy recovery. In addition, the company has completely eliminated its use of TCA, and the safety of its work environment was greatly improved.

The methodical evaluation of a problem, leading to solutions aimed at reducing the creation of pollutants at their source, is what EPA's Design for the Environment program is seeking to encourage. While this story illustrates a method for evaluating alternatives, the company did not have access to important risk information. The DfE Printing Project seeks to provide information to industries and companies (often through their trade associations) on the comparative risk and performance of alternative chemicals, processes, and technologies, so that printers are able to make more informed decisions. EPA will make this information available in the form of a "Substitutes Assessment" later in 1993.

The search for alternative chemicals and new technologies begins with today's success. Assisting in the search for and evaluation of alternatives is the goal of EPA's DfE program. With this case study and others like it, we hope to illustrate the application of this goal and the pursuit of continuous improvement.

If you would like more information about the John Roberts Company's experience, contact:

Jeff Adrian
John Roberts Company
9687 East River Road
Minneapolis, MN 55433
Telephone: 612-755-5500
Fax: 612-755-0394

If you have a success story to share, and would like us to help you publicize it
or
if you would like more information about the Design for the Environment program, contact:

The Pollution Prevention Information Clearinghouse
at the U.S. EPA
Phone: 202-260-1023
Fax: 202-260-0178

APPENDIX F

A Fact Sheet on "National Emission Standards for Hazardous Air Pollutants from Dry Cleaning Facilities"

NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS FROM DRY CLEANING FACILITIES

FACT SHEET

BACKGROUND

- Under Section 111 of the Clean Air Act (CAA), a new source performance standard to limit emissions of volatile organic compounds from perchloroethylene (PCE) dry cleaners proposed on November 25, 1980 (45 FR 78174).

- Intent to list PCE as a potential toxic air pollutant for regulation under Section 112 of the CAA published on December 26, 1985 (50 FR 52880).

- Private citizen's group from Oregon, Francis P. Cook, et al., petitioned the Administrator of the EPA to regulate PCE dry cleaners.

- A Consent Decree was issued on March 16, 1990, in which the EPA Administrator agreed to sign proposed National Emission Standards for Hazardous Air Pollutants (NESHAP) under Section 112 for PCE dry cleaners within 1 year and promulgate within 2 years following enactment of the new amendments to the CAA.

- Affected sources: Dry cleaning dryers, dry-to-dry machines, transfer machine systems, and auxiliary equipment at dry cleaning facilities that use PCE as a solvent.

- Projected growth: At present, there are approximately 25,200 dry cleaning facilities. Of these, 9,700 existing commercial and industrial dry cleaning facilities are uncontrolled and would be subject to the regulation. In addition, 7,400 new dry cleaning machines (replacing those that have retired) are projected to begin operations between 1991 and 1996. Those machines purchased after 1991 will require controls and will emit fewer pollutants from process vents.

- A major source dry-to-dry machine is one that consumes 3,100 gallons per year (gal/yr) or more of PCE, and a major source transfer machine systems is one that consumes 2,000 gal/yr or more of PCE. Area sources are

those machines consuming less than these amounts of PCE annually.

RECOMMENDED STANDARDS

- Equipment standard to limit process vent emissions of PCE and pollution prevention practices to limit fugitive PCE emissions from dry cleaning facilities.

- Requires use of a carbon adsorber, refrigerated condenser, or equivalent control device (95 percent control) for both major and area source dry-to-dry machines.

- Requires use of a carbon adsorber or equivalent control device (95 percent control) for new, reconstructed, or uncontrolled major and area source transfer machines.

- Requires use of a refrigerated condenser or equivalent control device (85 percent control) for existing refrigerated-condenser controlled area source transfer machines.

- Pollution prevention practices--such as conducting weekly leak inspections, storing all PCE and PCE wastes in tightly sealed containers which are impervious to the PCE and do not react with the PCE, and minimizing door opening time--are required to control fugitive PCE emissions.

- New dry cleaning facilities must achieve compliance upon startup. Existing dry cleaning machines that are larger than 50 lb (22.7 kg) must achieve compliance within 18 months of the date of promulgation. Existing dry cleaning machines that are 50 lb (22.7 kg) or smaller must achieve compliance within 36 months of the date of promulgation.

- Exemption: Dry-to-dry machines consuming less than 220 gal/yr of PCE and transfer machines consuming less than 300 gal/yr of PCE are exempt from the requirements of the standard, except for submitting an initial consumption report to show that they qualify for exemption status.

- Operation and Maintenance/Work Practices

  - To ensure proper operation of a carbon adsorber, desorption is required at least each time the machine cleans 6.6 pounds (lb) [3 kilograms (kg)] of articles per 2.2 lb (1 kg) of activated carbon. Steam pressure must be at least 1.7 atmospheres (170 kiloPascals); air flow capacity must be at least 10.6 cubic feet per second (0.3 cubic meters

per second); and no bypass to the atmosphere is permitted.

- To ensure proper operation of a refrigerated condenser, no exhaust gases are allowed to be vented to the atmosphere or circulated through a ventless machine until the air-vapor stream temperature on the outlet side of the refrigerated condenser is less than or equal to 4.4°C (40°F).

- Before disposal, cartridge filters must be drained in their housings or in a sealed container for at least 24 hours, or must be dried in an enclosure vented to the control device.

- A weekly inspection for liquid and vapor PCE leaks is required using either visual inspection or a portable halogenated-hydrocarbon detector. The components to search are: hose connections, unions, couplings, and valves; machine door gaskets and seatings; filter head gasket and seating; pumps; solvent base tanks and solvent and waste containers; water separators; filter sludge recovery; distillation units; diverter valves; and cartridge filters.

- If any leaks are found, they must be repaired or a purchase order for repair parts must be initiated within 3 working days.

• Reporting/Recordkeeping

- Owners/operators must keep records of the amount of PCE solvent consumed, the results of weekly inspections, and dates of when repairs are made or purchase orders for repair parts initiated.

- If using a carbon absorber for compliance, the frequency and period of desorption must be recorded.

- An initial report is required from all business owners or operators, including name, address, brief description of dry cleaning machine, operating design capacity, and annual PCE solvent consumption.

- For both major and area sources, an initial statement of compliance is required stating type of control device used to achieve compliance.

- If PCE consumption level increases so that exemption status no longer applies, a compliance report must be submitted to indicate that compliance with the standard is being achieved.

IMPACTS

- Perchloroethylene emissions: reduction of 16,000 Mg (17,620 tons) from projected 1996 emission levels.
- Energy

  Total maximum national increase in electricity use of 4 gigawatt hours per year (GWh/yr) in 1996 for existing facilities and 5 GWh/yr for new facilities, which is needed to operate the control device.
- Wastewater

  Total maximum national increase of 9 Mg (10 tons) in 1996, which will be routed to and treated by a publicly owned treatment works.
- Solid Waste

  Total maximum national increase of 40 Mg (40 tons) in 1996, which will be picked up by a hazardous waste collection service.
- Noise

  No incremental impacts.
- Annualized Cost
  - Total national increase of $1 million for new dry cleaning facilities and $8 million for existing facilities in 1996, without regard to those facilities that might be exempted. Projections including those existing facilities subject to the consumption cutoff could be as low as $2 million.
  - For a typical model facility, such as a 35-lb dry-to-dry machine, increase of about $3,800/yr if installing a carbon adsorber or about $1,700/yr if installing a refrigerated condenser.
- Capital Cost
  - Total national increase of $9 million for new dry cleaning facilities and $63 million for existing dry cleaning facilities in 1996, without regard to those facilities that might be exempted.

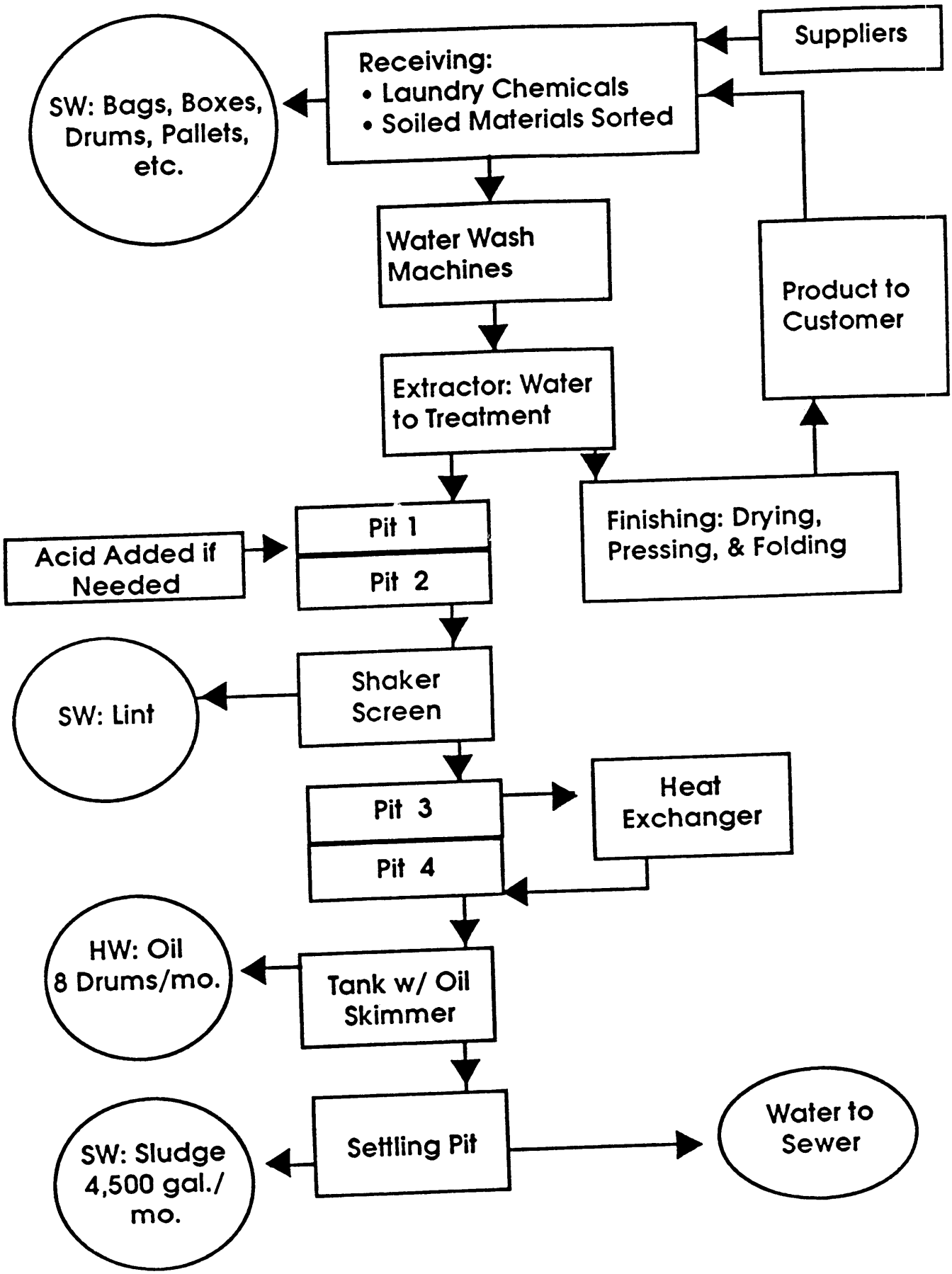
Projections including those existing facilities subject to the exemption could be as low as $26 million.

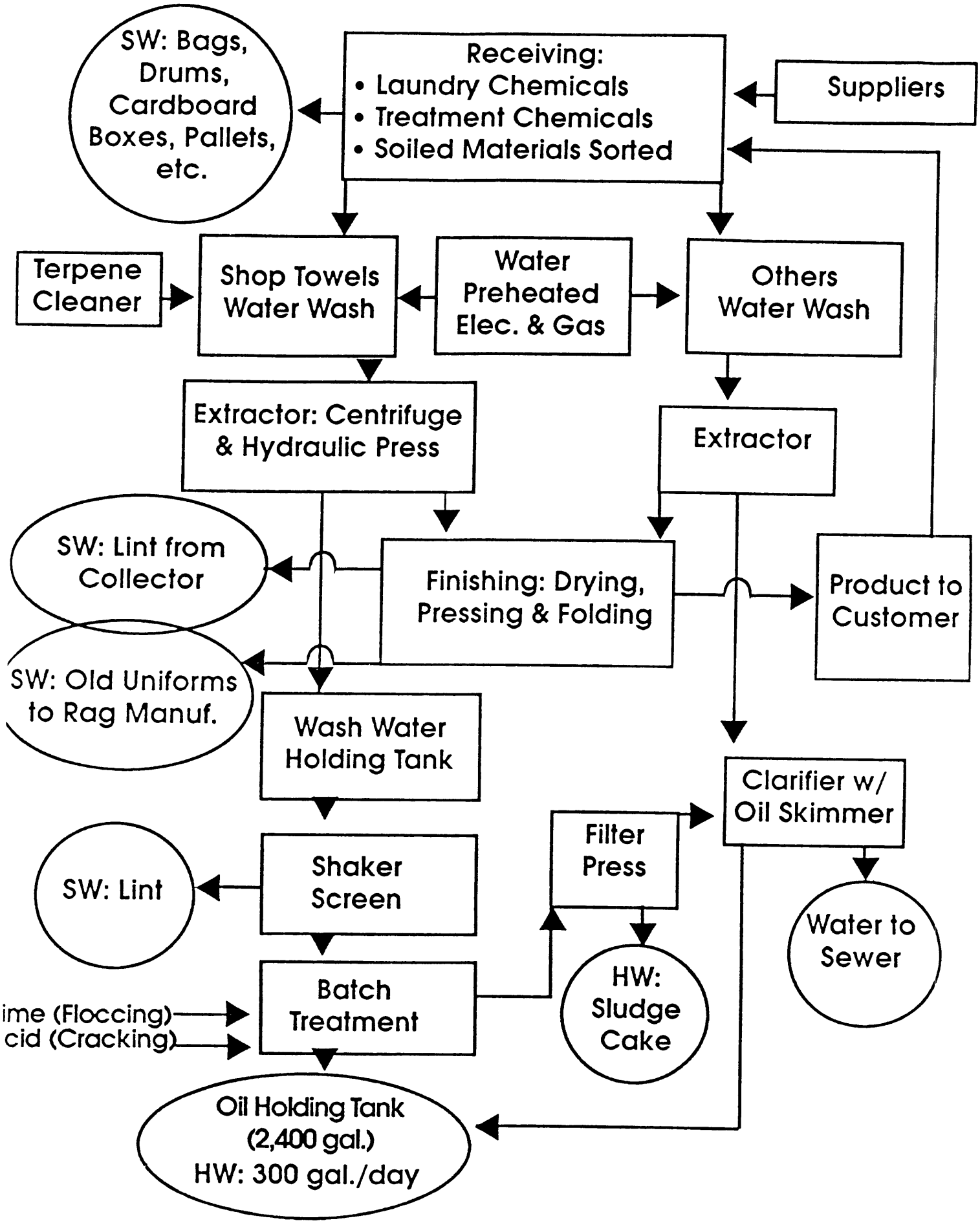
- For a typical model facility, such as a 35-lb dry-to-dry machine, capital cost would be about $6,800 if installing a carbon absorber or about $6,300 if installing a refrigerated condenser.

APPENDIX G

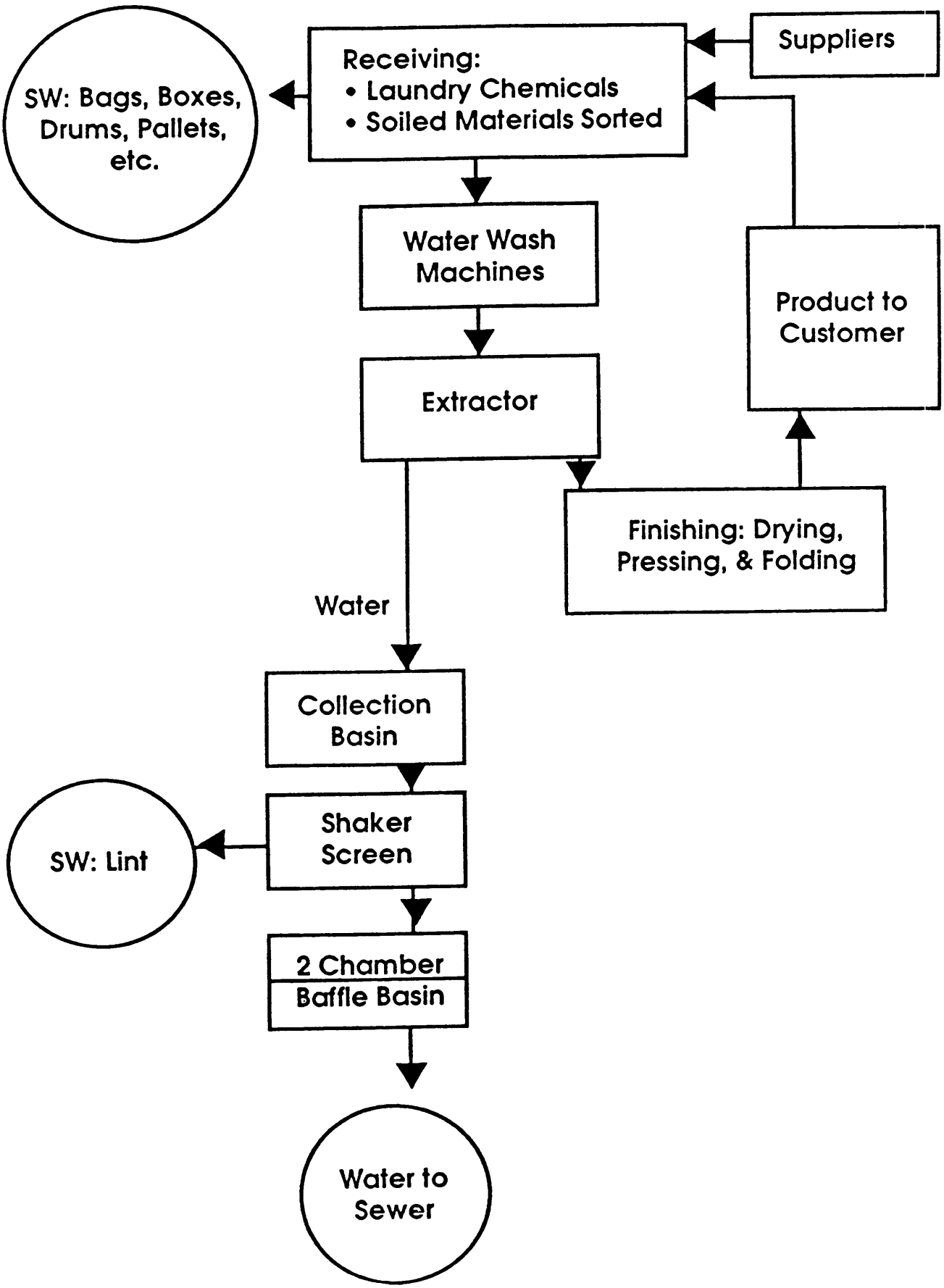
Flow Diagrams for Pretreatment and Dry Cleaning Processes

Water Wash (100%)

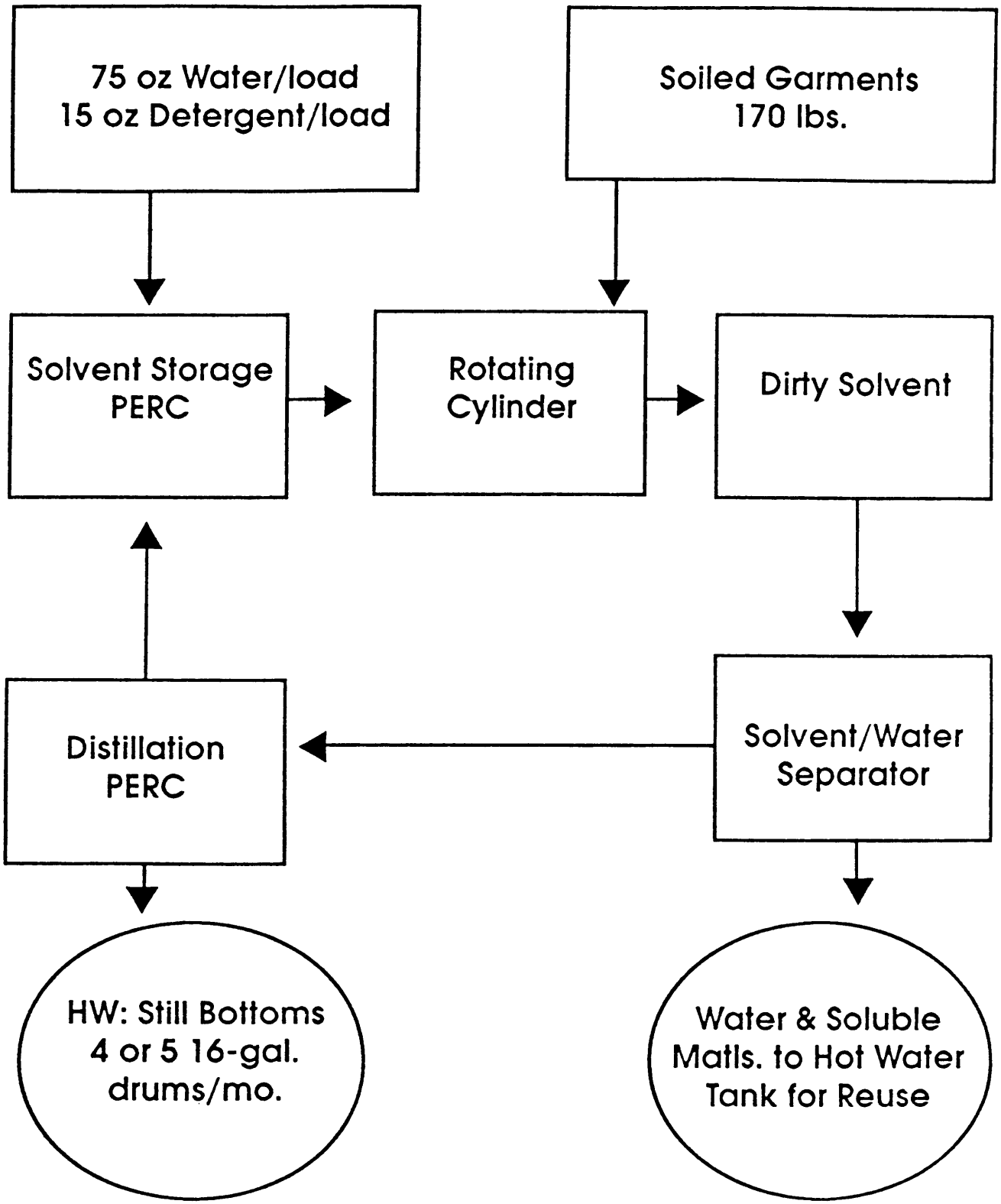



SW: Bags, Drums, Cardboard Boxes, Pallets, etc.
Receiving:
• Laundry Chemicals
• Treatment Chemicals
• Soiled Materials Sorted
Suppliers
Terpene Cleaner
Shop Towels Water Wash
Water Preheated Elec. & Gas
Others Water Wash
Extractor: Centrifuge & Hydraulic Press
Extractor
SW: Lint from Collector
Finishing: Drying, Pressing & Folding
Product to Customer
SW: Old Uniforms to Rag Manuf.
Wash Water Holding Tank
Clarifier w/ Oil Skimmer
Filter Press
SW: Lint
Shaker Screen
Water to Sewer
HW: Sludge Cake
ime (Floccing)
cid (Cracking)
Batch Treatment
Oil Holding Tank
(2,400 gal.)
HW: 300 gal./day

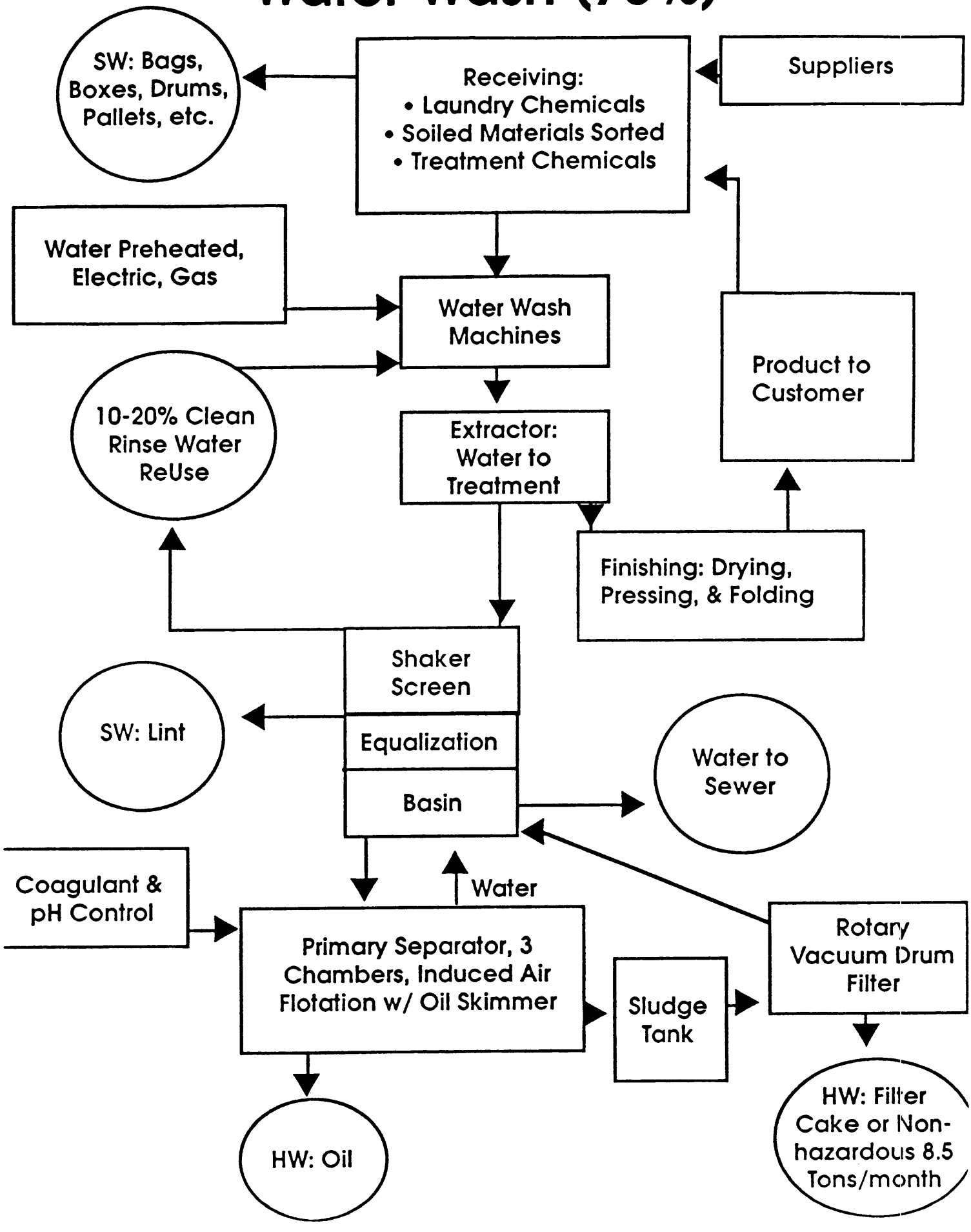
Water Wash (84%)



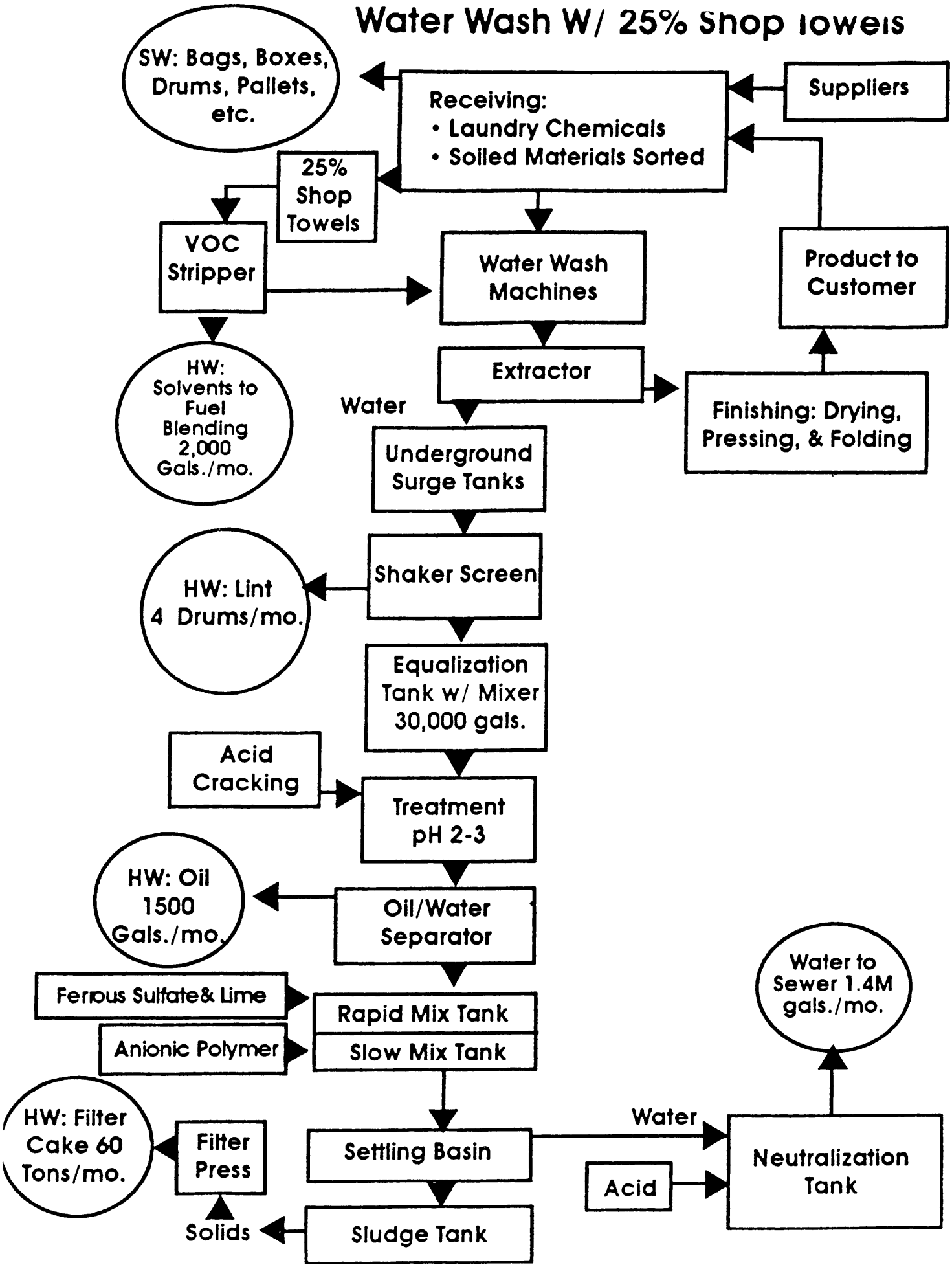
Two Dry Cleaning Units (16%)



Water Wash (75%)



Water Wash W/ 25% Shop Towels



Dry Cleaning (25%)
Two Dry-to-Dry Units