WASTE MINIMIZATION

OPTIMIZATION

IN JEWELRY MANUFACTURING

by

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ABSTRACT

The jewelry manufacturing industry can no longer ignore the growing financial burden and liabilities associated with its hazardous waste generating practices;

Nor can management overlook the routine tasks of time consuming requirements of constant monitoring, record keeping, laboratory testing, reporting, numerous inspection procedures and special employee training for hazardous waste handling.

While regulations are constantly increasing and becoming tougher from year to year, the jewelry industry is faced with multifaceted rules and regulations from federal, state and local authorities.

Fines in the thousands of dollars for non-compliance or violations are being assessed, even to the smallest of firms, including jail sentences for company officers. Imprisonment plus fines is not an unusual occurrence in today's array of rules and regulations. Regulations are often complex, written in legal terms unfamiliar to the majority of the business community, and are frequently overlapping due to a multitude of regulating agencies, targeted efforts by environmental interest groups, opportunities for citizen suits and whistleblowers.

As the constant changes and newly promulgated regulations are on the rise, so are the lists of regulated substances and materials which industry historically used in the daily manufacturing process.

At the same time the news media has created a general sense of fear and distrust towards industry, resulting in the well known "NIMBY" (Not in my backyard) syndrome. This fear has raised strong public opposition to any siting of waste treatment, recycling or disposal facilities within easy access to most industrial facilities.

Industry, academia and regulators alike have realized that the hazardous waste issues of today have to be addressed objectively by instituting new technologies combined with changes of standard practices by industry of end of pipe treatment.

Waste minimization, recovery, recycling and pollution prevention have successfully emerged as the general trend for addressing the hazardous waste issues of the nineties. Pollution prevention initiatives by industry have not only proven to be environmentally sound, but also have shown definite economic advantages.

Not only can industry reduce the volume and toxicity of its waste, but conserve on valuable resources while reducing the overall cost for hazardous waste management and future liabilities.

The speaker will address waste minimization and pollution prevention trends specific to the jewelry manufacturing industry including some statistical data based on the general sic code.

"Waste reduction succeeds when it is part of the everyday consciousness of all workers and managers involved with production - where the waste reduction opportunities are - rather than when it is a job only of those responsible for complying with environmental regulations.
A few people with end-of-pipe, pollution control jobs are not in a position to reduce waste by themselves;
Such efforts must involve upstream workers and facilities."

The Office of Technology Assessment (OTA) September 1986
The OTA is an analytical arm of the U.S. Congress whose basic function is to help legislators anticipate and plan for the positive and negative impacts of technological changes.

According to the OTA there are five (5) distinct approaches that industry can take to reduce hazardous waste:

1) Change the raw materials of production.
2) Change production technology and equipment.
3) Improve production operations and procedures.
4) Recycle waste within the plant.
5) Redesign or reformulate end-products.

Among the opportunities that exist for common processes and wastes are:
Waste minimization, waste reduction, recycling, recovery and waste control, the buzzwords of the 80's have become pollution prevention for the 90's.

The conventional approach in the past to improve environmental protection by imposing more regulations and enforcing them more firmly has been overall disappointing to say the least.

The federal government in the past has devoted over 99 percent of its resources to telling industry how to control wastes and pollutants after they are generated.

Annually several thousand pages of new environmental regulations are published in the federal register, while millions of dollars are spent on record keeping and reporting requirements, and billions of dollars are allocated for remedial action and Superfund clean ups. Large proportions of the hazardous waste have been merely shifted from one media to another or transported from one type of landfill to another type of landfill,
practices which result in lengthy and costly litigations, while all the time the pollution of natural resources continues.

Approximately 70 billion dollars was the level of national spending for pollution control during the mid eighties; two-thirds of this amount was spent by industry. While during the same period only one percent was spent to reduce the generation of hazardous waste.

"POLLUTION PREVENTION"

In October of last year, U.S. Congress passed the Pollution Prevention Act of 1990.
Pollution prevention, for the first time, has become the national objective.
"Pollution prevention has become the preferred approach to address a world-wide problem."

The 1988 Toxic Release Inventory Data under Sara Title III, Section 313 -shows that reporting facilities released 4.57 billion pounds of toxic materials directly into the environment.

This amount does not include pollution from non-point sources for which little or no data is available.

U.S. E.P.A. is conducting and sponsoring a variety of initiatives with emphasis in research and development programs while encouraging industry's participation in waste minimization assessments through E.P.A.'s "Waste Reduction Innovative Technology Evaluation Program (WRITE) and Waste Reduction Assessment Program (WRAP).

A number of demonstration projects in different sectors of industry will feature creative and innovative approaches to pollution prevention which can be applied to other situations eventually to be shared with various segments of waste generating industries.

Many publications have come on the market in recent months describing technologies, methodologies and successful case studies on pollution prevention.

Profit from Pollution Prevention, A Guide to Industrial Waste Reduction & Recycling, published by The Pollution Probe Foundation, 12 Madison Avenue, Toronto, Ontario, Canada, M5R 2S1 and *Prosperity without Pollution, The Prevention Strategy for Industry and Consumers*, by Dr. Joel S. Hirschhorn and Kirsten U. Oldenburg, published by Van Nostrand Reinhold, 115 Fifth Avenue, New York, N.Y. 10003, demonstrate a variety of approaches to waste reduction projects, their strategies and end results for a number of industries in the U.S. and Canada.

More and more organizations, technical societies and business groups conduct seminars, workshops, round table conferences and symposiums with pollution prevention as their major topic.

Large corporations already have felt the impact of the general public's demand for products from "green" companies, that is items which are manufactured by firms which are or have implemented environmentally sound manufacturing processes, an environmentally acceptable end product including their packaging.

This worldwide trend is finding acceptance not only by environmental interest groups, but also by the general public where awareness has become a much greater part of a better educated and environmentally attuned consumer.

A strong movement by interest groups to legislate requirements for identification and labeling of all consumer products and packaging as a "green" product has been in the wings for some time and is moving closer to reality.

The jewelry manufacturing industry in fact whould be well advised to address this issue in its future marketing concept. Not only would it promote domestic products, manufactured under the "green" label but also could influence the buyer to choose such products over imports from foreign countries which are not "environmentally oriented" and which produce jewelry items with little or no restriction or regard toward the environment.

As we scrutinize our past practices and look toward the future, it becomes very obvious that many of the so called wastes our industry has generated and disposed of represented valuable resources which were discharged, often randomly, only to be re-purchased as raw materials to replace them.

Some statistics published in recent papers will identify this fact very well, others will call our attention to everyday practices we have taken for granted with little or no regard to the economic impact on our firm's manufacturing cost or its bottom line.

It becomes therefore extremely important that we look at this information objectively and scrutinize such data in order to be able to relate back to our own manufacturing process. The information available today is virtually endless. The tools are available and new tools are emerging every day to address these issues; many jewelry manufacturing processes cannot only be accomplished with

environmentally sound practices, but also can be achieved with the economic advantages such practices can provide.

As this symposium appropriately advocated jewelry manufacturing technology, it is of importance that we focus our interests not only on technology, but equally as important on methodology that is environmentally acceptable to us and to future generations.

THE IMPACT OF HAZARDOUS WASTE

Section 104(c)(9) of the comprehensive Environmental Response, Compensation and Liability Act, as amended, requires as a condition for providing remedial actions, that states assure the availability of treatment, storage and disposal facilities (TSD'S) that have the capacity to treat, destroy, or securely dispose of the wastes generated within their borders for the next twenty years.

The Capacity Assurance Plan (CAP) must also provide arrangements with other states to agree on acceptance of hazardous wastes which cannot be processed or facilitated or where the state is unable to handle the types of waste generated by its industry.

Rhode Island, for example, has made arrangements with other northeast states comprised of: Connecticut, Maine, Massachusetts, New Hampshire, Vermont and the states of Delaware, Maryland, New Jersey, Pennsylvania, West Virginia, Virginia, and the District of Columbia. Such requirements may be required to be reassessed every two years.

According to Rhode Island's cap with information based on 1987 statistics, 26,700 tons of hazardous waste were generated by R.I. industry, while 12,700 tons were identified as RCRA wastes (federal hazardous waste) and 14,000 tons were identified and defined as R.I. or state hazardous waste.

The Federal RCRA wastes are wastes which require the Capacity Assurance Plan (CAP), while the state wastes consisted primarily of oils and PCB's.

Waste characteristics for the RCRA wastes were as follows:

1) Metal bearing, inorganic wastes in the form of liquids, solids and sludges.
2) Solvents (primarily non-halogenated).

The majority of the waste volume was generated by the jewelry and electroplating industries. The report pointed out, however, that some significant generation occurs in almost all sectors of the economy.

In 1987 R.I. reported 1,190 actual recurrent generators, of which only 127 were classified as large-quantity generators: that is generators which ship more than 1,000 kilograms per month of hazardous waste.

In addition, during the same period, 1,126 one-time events were listed which required the use of a temporary hazardous waste generator identification number.

One time shipments of hazardous waste consisted mostly of waste oil, solvents and PCB contaminated waste.
To be exact:
75% waste oil
20% waste halogenated solvents
5% PCB contaminated waste.

From the re-occurring generators, 120 generators fell into the SIC Code 39 which includes mostly jewelry and allied industries.

The total waste generated was 768,167 kg or 846.7 tons. Eight hundred forty-six and seven-tenths tons represent 15% of all the

toxic waste generated. Five hundred and eighteen tons or 73% were wastes from electroplaters and solvents.

Breakdown of hazardous wastes:

4,663 lbs D006	Cadium bearing wastes
1,942 lbs D007	Chromium bearing wastes
12,824 lbs D008	Lead bearing wastes
105,648 lbs F001 (Degr)	Halogenated solvents
38,876 lbs F002	Spent solvents with 10% plus of halogenated solvents.
524,624 lbs F006	Waste water treatment sludge metal hydroxide.
33,112 lbs F007	Spent cyanide plating baths
5,230 lbs F009	Spent stripping solutions containing cyanide
36,111 lbs All Others	Misc. wastes

This information does include several thousand tons of heavy metals discharged into the sewers by this industry or does it include several thousand tons of pollutants such as solvents discharged into the air during the same period.

Unfortunately, there has been no accurate economic value assessed to these losses.

THE POLLUTION PREVENTION ACT OF 1990

The U.S. E.P.A. has been advocating pollution prevention strategies with industry for several months. In the February 26, 1991 issues of the *Federal Register* the agency clearly indicated its specific pollution prevention strategy in its statement. In this new philosophy E.P.A.

under the direction of U.S. Congress will direct industry to change its aspect of waste management and its focus on:

Pollution prevention, source reduction, recycling of wastes that cannot be prevented, environmentally safe treatment of wastes that cannot be prevented or recycled: and environmentally safe disposal of wastes that cannot be eliminated.

The President's statement endorsed the new initiative with the following statement:

> Environmental programs that focus on the end of the pipe or the top of the stack, or cleaning up after the damage has already been done, are no longer adequate... . We need new policies, technologies, and processes that prevent or minimize pollution - that stop it from being created in the first place.

The E.P.A. has recently asked about 600 U.S. companies to make voluntary reductions in their emission of 17 toxic chemicals - the agency calls this program the Industrial Toxics Project (ITP). The project covers emissions to all media; air, land and water, as well as the use of chemicals in consumer products. Just as specific pollutants are targeted for major reduction under the Clear Air Act Amendments (CAA) where major reductions or the elimination of such air pollutants as: chlorofluorocarbons (Cfc's, sulphur dioxide (SO_2)), carbon monoxide (CO), nitrogen oxide (NO) and hydrocarbons, E.P.A. has targeted 17 high priority toxic chemicals for sustained reduction by setting a nationwide goal of voluntary reduction of one-third in total releases or off-site transfer of these chemicals by 1992, and a 50% reduction by 1995 with 1988 as the base year.

E.P.A. has designated the Title III Heavy Weights based on their relatively high emission volumes according to Form R reporting the toxicity threat they present to human health and the environment.

Their relatively high production volumes;

The pollution-prevention potential that each of the chemicals represents based on successful pollution prevention programs by certain companies.

E.P.A. has listed them as 17 plus 1

1. Cadmium
2. Chromium
3. Lead
4. Mercury
5. Nickel
6. Benzene
7. Carbon Tetrachloride
8. Chloroform (Trichloromethane)
9. Cyanides
10. Methylene Chloride (Dichloromethane)
11. Methyl Ethyl Ketone (MEK)
12. Methyl Isobutyl Ketone
13. Trichloroethylene (TCE)
14. Tetrachloroethylene (PERC)
15. 1,1,1 Trichloromethane
16. Toluene
17. Xylene

Dioxins

In order for industry to be successful in its attempt to practice or implement pollution prevention or waste minimization, several factors must be considered in the early planning stages.

A company must assess its resources and capabilities and establish the fact: "Can we or can we not do our own assessment?

Do we have the time?

Do we have the manpower?

Do we know what the regulations are?

a) Local
b) State
c) Federal

Do we know what the regulated materials are?"

If management must answer any of the questions with a "no," it would be appropriate to ask for help.

Help can be found by:

- Checking with a qualified consultant
- By checking with your trade organization
- By checking with other companies in your industry
- Literature search
- State technical assistance programs.

If you have chosen to proceed on your own, one of the first steps that you will have to initiate is an environmental self-audit.

Self-audits must be well planned and accurate. The information collected must be precise and based on documentation. Estimations and assumptions are in virtually every instance insufficient to meet today's regulatory requirements for proper reporting.

In order to conduct one's own audit, one must have complete records of the following:

- Hazardous waste manifests - hazardous materials tracking reports
- Purchases of chemicals & materials
- Chemical inventory - beginning and end of year, including storage areas
- Outside drum storage, in-ground tanks, above-ground tanks, boilers, smoke stacks, vents, baghouses, scrap bins and dumpsters.

Every aspect and possibility of usage of listed materials within the premises including additional buildings or storage areas of chemicals and materials, even if they are no longer in use, must be identified and examined.

Obviously, this is a tall order, but absolutely necessary if preparing for today's environmental reporting.

Present regulations do not provide amnesty for ignorance of the laws, nor are they forgiving for oversights and miscalculations.

Not only do regulations change, but so do the very same substances and materials listed on a variety of lists encompassing a wide array of regulations from an equally diverse array of regulatory agencies.

Good communications and interface with your trade organizations and technical societies including seminars and workshops organized by the regulating agencies in your community are an essential task in today's world. To keep abreast with the constantly changing system has become a challenge even for the most astute environmental manager and consultant.

Since regulators historically do not alert the regulated community as to new regulations and/or changes, the burden of knowing the what and when of environmental compliance lies with the regulated industry and its management.

Subscribing to advisory bulletins, the *Federal Register* and other prominent government and private sector communications will assist greatly in the overall federal requirements but seldom will they cover specific local regulations which are addressed in your community, city or state.

Public hearings advertised in the local newspaper which refer to specific regulatory processes are often overlooked by industry or in most cases ignored as is indicated by the poor turnout in such hearings.

Unfortunately, once the regulations are passed, even the strongest objections by industry are usually in vain or can only be contested through a long, drawn out and costly legal process.

It is therefore prudent for your firm to stay informed and for management to take an active part in the environmental issues for your company. Small, owner operated companies are finding themselves in the most difficult position. Since limited resources and time constraints are major obstacles for such companies, not only to stay informed but to operate within the confines of the regulatory system, it would be advisable to engage the services of a qualified consultant who is familiar with the industry and has the expertise to deal and communicate with the regulators on your behalf if there should be or is a problem at your firm with the regulatory requirements.

As we look at the pollution prevention trends and applied techniques by a variety of industries based on a questionnaire mailed to a large group of subscribers to an environmental newsletter, the information collected has revealed that industry in general has either been engaged in or is in the process of addressing pollution prevention.

Recycling or re-use	14%
Material substitution	18%
Process modification	15%
Source reduction	9%
Worker training and education	7%
Procurement/Inventory control	4%
Product changes	3%
Waste compaction/Water removal	3%
Outside vendors	3%
Top management support	2%
Waste exchange	1%

Industry has adopted some basic approaches to hazardous waste reduction which can be implemented by any industry with various degrees of effort and expenditures.

Change the raw materials of production
Change production technology and equipment
Improve production operations and procedures
Recycle within the plant
Redesign or reformulate end-product.

Since the methodology often varies greatly from company to company, it is impossible to address each and every process, but let us attempt to address pollution prevention opportunities in your facility in a generic way by identifying a particular source or operation common to our industry to which you will be able to relate as we describe them in this presentation.

Keep in mind that you may have already taken certain steps or implemented certain changes which have helped your company to reduce the generation of hazardous waste or even eliminated a hazardous waste stream entirely.

The examples we address here are practices which have been implemented successfully in large, medium and small jewelry manufacturing companies and apply to precious metals jewelry as well as custom jewelry.

It should be pointed out at this time that the use of certain types of equipment, such as evaporators (atmospheric), may be construed as "waste treatment" equipment and may be therefore regulated under RCRA if so interpreted by your local or state agency. In this case one would require a part "B" permit which is a lengthy process and is issued only by your control agency, that is an authorized state agency such as D.E.M., D.E.P., etc. Where the state has been

granted authority by U.S. E.P.A., otherwise by the E.P.A. headquarters of your particular region.

It is the responsibility of the generator to obtain the necessary permit and to establish a proper ruling in every case where hazardous waste is being treated, altered, or reduced.

Let us take a walk through a typical jewelry manufacturing plant, and let us look where a company can address waste minimization, often with simple changes in chemicals, by recycling or reusing materials, which are normally discarded as waste, minor process modifications, worker education, purchasing habits and inventory control, waste compaction, by utilizing outside vendors, some product changes, and source reduction.

While many of the changes may require little effort and cost, others may result in equipment modifications or additions which demand expenditures beyond the financial resources of a company.

Many states do have a variety of grant programs for its industry to accomplish such changes, as long as they are directed towards waste reduction. Every opportunity should be explored through existing technical assistance programs, research and development initiatives, economic development agencies and academia. Often partnerships have been formed between state agencies and academia to initiate and manage such programs for a specific industry.

Sometimes trade organizations and technical societies are involved in conducting granted programs which are to be documented, and the information is compiled into a report made available to the rest of the industry. Sometimes workshops and seminars are sponsored by the Chamber of Commerce or other business group where such information is shared with the local industry.

These resources are available to the local industry at little or no cost other than a luncheon. Unfortunately, small companies do not have the opportunity to attend such meetings, since many owner/operators cannot spare the time away from the business.

Historically, these are the companies who can benefit the most from such technically oriented meetings, whereby much of the information can be incorporated immediately and produce an instant payback. While virtually any company can realize such cost benefits, others can actually remove themselves from the regulatory system entirely by working prudently to achieve pollution prevention.

In any case our industry should look particularly at the economic benefits realized through pollution prevention, reduction of waste hauling, a primary motivator since the cost of an average 55 gallon drum is well over $200.00 and escalating for disposal cost, coverage for environmental liability, if available, and last but not least the ongoing liabilities associated with hazardous waste activities.

No matter what we call such practices, waste minimization, waste reduction, resource recovery, or pollution prevention, they all make good business sense.

POLLUTION PREVENTION OPPORTUNITIES IN YOUR FACILITY

Boiler Chemicals

Boiler chemicals often consist of toxic materials which are considered pollutants if discharged into the sewer or into waterways via boiler blow-down. Substituting with non-regulated chemicals will in most cases eliminate the need for pretreatment of boiler blow-down and may be less expensive to purchase. Shop around and check with various suppliers or vendors. Investigate their product before implementing, check the material safety data sheet (MSDS), check with other users.

Cooling Water

Especially non-contact cooling water, that is water that does not get in touch with a chemical process but merely is designed to cool a furnace, welder, soldering unit, etc. The water is then discharged into the sewer at various degrees of temperature. This water is perfectly suitable for rinsing, washing or non potable uses.

Closed loop systems where this cooling water is channeled through a chiller where it can be brought down to its original temperature may be beneficial if there is no other use for the volume of water in the facility. Even though the energy charges must be considered, remember for every gallon of freshwater purchased another fee is charged if the water is discharged into the sewer. The sewer fee is historically quite a bit higher than the freshwater charge.

Water recycling or reuse can be achieved up to 90% for process water used in our industry.

Degreasing

The use of solvents will be a major problem in the future. Provision under the Clean Air Act, ozone depletion, the Montreal protocol, surtax, permits and disposal of such solvents will be burdensome for any industry. Substitution where possible with aqueous cleaning, that is a citric acid based or alkali based cleaning solution, when heated and agitated or used in an ultrasonic unit with provisions to skim off the oil, is finding wide acceptance in our industry.

Drying

Drying solvents such as perchloroethylene find themselves high on the priority list of solvents to be phased out in the not so distant future.

Hot air drying ovens, the use of maizorb in a heated container, and centrifugal drying where possible are coming back more and more.

In other words the old drying methods before the use of solvents became popular are back.

Filing/Grinding - Metal Working

When working with metals, especially precious metals, we have learned to become very efficient in collecting dust, fines, chips and residuals to be shipped to a refiner for credit. We have learned that we increase our yield if we keep the metals segregated as much as possible and only mix them in sweepings or where there is no opportunity to separate. We must learn to be almost as cautious with our non-precious metal scrap.

By collecting the metals and keeping them separate, we increase the scrap value. We must avoid mixing regulated metals such as cadmium, nickel, lead, etc. with unregulated metals. If we neglect to do so, we may wind up with a "hazardous waste" rather than a salable material. Even if we can realize a minimal return of such "scrap," we are dealing with a product, rather than a waste.

Soldering

In soldering we are often entirely dependent on our supplier: requesting a solder materials without cadmium is now an everyday occurrence. Many products are on the market today which are cadmium free, especially in the domestic and European products. Since lead has now also become a priority metal, industry may have to spend more money on a higher quality solder, which may still be less costly than dealing with the disposal of lead bearing materials.

Electroplating

Electroplating is probably the major contributor to the industry's waste stream. Electroplating is the oldest industry regulated under the Clean Water Act. Electroplating and metal finishing are the two primary industries with categorical standards set by E.P.A. Therefore, this segment of our industry has had the most experience to deal with the regulatory system and had more opportunities to

address its needs. Much improvement has been made in the past in reducing the pollutant load primarily for economic reasons. One, to reduce the need for treatment equipment in effluent treatment, and two, to reduce the volume of treatment chemicals normally associated with heavy metal treatment.

Activating

Cyanide activators or cleaners widely used in this field can be substituted with phosphates used electrolytically at room temperature. There are proprietary products on the market which have a good life span, non-toxic and serve the purpose of activating after nickel plating or before a decorative finish is applied.

Bright Dipping (Acid)

Many firms have turned to bright annealing in an atmospheric controlled furnace. Pre-cleaning followed by vibratory finishing with a brightening agent and polishing media has also found wide acceptance in the industry.

Bright Dipping (Cyanide)(Bombing)

Changes in casting techniques, mechanical finishing, and proprietary substitutes have several advantages over the peroxide-cyanide method. Safety probably should be mentioned foremost here, but also the use of cyanide in large quantities cannot be ruled out. Planned restrictions in the future warrant for the industry to investigate and implement other means to achieve like results in the brightening of precious metals.

Plating Solutions

Many plating solutions lends themselves to be recovered and reused. Make up for evaporative losses with concentrated drag-outs is a common practice in jewelry plating of precious metals. The use of stagnant rinses in succession with manual or automatic feedback to the plating tank such as for nickel has been implemented for the past ten or twelve years. Increased control for such plating baths for

contaminants is however a must. Organics from brightner systems, water softeners, and other additional agents such as wetters must be controlled along with a tendency for metal increase.

Multiple drag-out systems, equipped with metal removal via electrolytic units, ion exchange systems and evaporators where permitted lend themselves to controlled closed loop systems which are an integral part of so called zero-discharge systems. Regulatory requirements and limitations may play a major role in the implementation of such systems.

There is much written about these concepts. Unfortunately, the writers are mostly representatives from various equipment manufacturers. It will merit investigation, however, since most applications are tailored to specific needs and often unique to one's plating system.

Pickling/Cleaning

Acid pickles and alkali cleaning solutions are often discarded on a regular schedule; rather than by demand. Utilizing inexpensive test kits provided through your supplier, most acid pickles and alkali cleaners can be maintained for much longer periods by making periodic additions as needed. This practice will offset the cost for new acids or cleaners plus reduce the cost for treatment chemicals to neutralize discharged volumes which can upset the waste treatment system, and cause drastic fluctuation in the Ph neutralization tank.

Polishing

Much controversy is generated at the polishing bench, when water based polishing compounds are being mentioned. Unfortunately, with the elimination of high temperature solvents in the future which were routinely able to dissolve the binders of the compounds, the industry has little choice but to make that change to water soluble compounds. Since the abrasives used in these compounds

are pretty much the same as in the old compounds, we are dealing with a different binder which emulsifies in hot water. Utilizing an ultrasonic cleaning tank equipped with a filter to remove the solids: aqueous compounds can be effectively used in most jewelry polishing applications.

Rinsing

Many debates have arisen as to the "science" of rinsing. Time and time again modern plating and cleaning lines have demonstrated that efficient rinsing can be accomplished with water flows of 1 gallon per minute (GPM) or less if properly engineered.

The use of counterflow rinsing with air agitation is a must. Incorporating conductivity meters, flow restrictors, spray nozzles, time delay switches, foot pedals, etc. are all part of the various approaches to water conservation steps used to reduce the hydraulic loading of an industrial waste water treatment system.

Such methods combined with proper racking or positioning, changes in rinsing techniques by the operator are an important part for successful rinsing in jewelry plating or cleaning. Water conservation and pollution control are important factors which require much attention and planning in any jewelry manufacturing operation.

Stripping

Stripping is the least desirable task in any manufacturing environment since corrective actions do absolutely little for the manufacturing cost but will always be a consideration. Stripping solutions are designed to dissolve metals and hold them in solution: We consider them to be heavily chelated. In cases where the metal to be stripped is a precious metal the problem is fairly simple. The solution is manifested to a refiner or is depleted of the precious metal in-house and then neutralized for disposal in the waste water treatment system.

Stripping solutions containing non-precious metals, however, produce a special problem. As a hazardous waste one will find disposal very costly. Attempts to recover the metals often result in total destruction of the recovery equipment. Especially in situations where the stripping solution is high in cyanide, the feeding of such solutions into the waste stream combined with plating wastes results in high metal readings brought on by the chelaters.

Keeping rejects to a minimum or avoiding them altogether would be an ideal situation. Stripping solutions must be treated in different approaches. Most vendors will work with you to provide guidance as to proper disposal acceptable to your regulatory agency or sewer authority.

Tubbing

It is important for environmental reasons as much as for the quality of the work that tubbing media is maintained at top quality at all times. Periodic cleaning of the tubbing equipment as well as the media is a must. The use of biodegradable compounds when possible will be an added benefit. Filtering out metal fines by installing traps is a widely used practice, especially in precious metals operations. Many firms have explored the possibility to re-use or recycle the tubbing effluent with various rates of success. The critical factor is to remove virtually all of the contaminants from the water and remove all solids before flow through can be attempted. This will require filtration and organic removal consisting of a multistage treatment system.

Vibratory Finishing

The requirements in vibratory finishing are equally as important as in tubbing, removal of solids in the system which could otherwise act as an abrasive and damage the media as well as the work. Recycling of the effluent, however, has been implemented by some custom jewelry manufacturers, again with various rates of success. One of the more serious problems is caused by the use of plastic media

impregnated with aluminum oxide. The volume of sludge this material produces CNA becomes very burdensome and costly, if the waste is considered as a hazardous waste for some reason. A higher priced quartz media will usually be in the long run much more cost effective.

Overall the same principles apply as in tubbing. The possibility to recycle the effluent can be done if properly addressed.

Oils

Oils are considered a hazardous waste. Segregated oils can be manifested for recycling if the volume is sufficient. Centrifugal separators for water soluble oils are standard equipment for large users. Caution must be exercised that the water separated from this process carries less oil than permitted for discharge into the sewer. Mixed oils can usually be shipped via manifest to an incinerator as long as the metal content and PCB content is acceptable to federal and local regulators.

Solvents

Many firms routinely re-distill their solvents in-house, thereby reducing the volume normally manifested to a reclaim or disposal facility. A word of caution here; make certain that the distillation equipment is hard piped to your process or operation, otherwise a part permit may be required if federal or local inspectors interpret the operation as waste treatment under RCRA. Shipping solvents off-site via manifest to a recycling facility can be a safe way to handle this type of waste. The generator must assure compliance by the treatment facility and visually inspect and trace the process of your company's waste. Substitution of toxic solvents with a non-toxic material whenever available would be the ideal situation, or perhaps the operation could be managed with another cleaning method.

If this operation is only a small part of your production needs, shipping the work to a shop job may be sometimes an acceptable solution to a major problem.

IN CLOSING:

When making decisions in your facility as to the environmental considerations your company will face now or in the future, keep in mind that the regulations will only increase... . E.P.A. alone promulgated over 2000 regulations in the past, and new regulations such as the Clean Air Act, Stormwater Runoff and a host of others are around the corner with many more on the horizon.

Pollution control costs are predicted to rise by 85% by the end of the century.

The U.S. already spends approximately 2% of the Gross National Product on pollution control and cleanup.

Economists predict that by the year 2000 these costs will total 3% to 4%. We do not have to guess who will have to pay for this.

Pollution control costs from 1986 to 2000 are broken down as follows:

Air - from $ 27 billion in 1986 to $ 45 billion in the year 2000.
Water - from $ 37.5 billion in 1986 to $ 64 billion in the year 2000.
Land - from $ 19 billion in 1986 to $ 46 billion in the year 2000.
Chemicals - from $818 million in 1986 to $ 2.9 billion in the year 2000.

There can be very little doubt in anyone's mind that pollution prevention will be our only salvation.

firms that do not address these issues now will find that they are no longer competitive in tomorrow's market.

Pollution prevention, waste minimization, waste reduction - whatever we call it - makes good business sense.

Management often overlooks the environmental issues of today - but they have been and will continue to be a big part of conducting our daily business.

If industry had addressed these issues many years ago on their own, there would be no need for regulators, regulations, record keeping and cleanups of Superfund Sites... .

Once we learn that:

Toxic troubles begin upstream -
Not just at the end of the pipe.

We will learn to protect our resources and manage our raw materials.

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