Paint Product Stewardship

A Background Report for the National Dialogue on Paint Product Stewardship

Product Stewardship Institute
University of Massachusetts/Lowell
Kitson Hall, Room 210
One University Avenue
Lowell, MA 01854
www.productstewardship.us

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Authors: Tim Greiner and Vesela Veleva of Greiner Environmental, Inc. and Alan Phipps of the Product Stewardship Institute.

Editor: Scott Cassel of the Product Stewardship Institute.

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1. EXECUTIVE SUMMARY

Look in most home basements, garages, tool sheds and storage buildings and you will find a common item – leftover paint. Citizens have no further need for it, trash haulers often won't accept it, and local governments are left with trying to come up with an answer when asked, "What should I do with my leftover paint?" End-of-life management of leftover paint has become an increasingly costly line item in local government budgets in a time of shrinking state revenues. Dissatisfied with the current lack of cost-effective solutions, many of those involved in paint management have expressed interest in working together to jointly solve this problem.

PSI drafted this report as an overview of the architectural coatings (paint) industry with a focus on product stewardship and the end-of-life management for leftover paint. Its purpose is to lay the technical foundation for a national dialogue convened by the Product Stewardship Institute that started in December of 2003. This technical report provides basic information to enable representatives from government, the painting industry, and other interested groups to more effectively participate in the dialogue.

This report is accompanied by a separate document by the Product Stewardship Institute entitled, *Product Stewardship Action Plan for Leftover Paint*, that outlines the key issues and potential solutions related to leftover paint management. The Action Plan is the result of nearly 40 interviews with a range of potential dialogue participants, including government officials, paint manufacturers, retailers, painting contractors, recyclers, and other key parties. Expressed in these interviews was a spectrum of views regarding how to manage leftover paint:

Opportunity View	*"Leftover paint contains valuable resources. The private and public sectors have the opportunity to build markets for these materials, create jobs, and reduce unnecessary paint disposal and its accompanying environmental impacts. Leftover paint potentially represents an inexpensive source of raw materials for paint manufacturers."*
Problem View	*"Leftover paint costs state and local governments millions of dollars annually to manage. Both latex and oil-based paints pose environmental threats when disposed of improperly. Collection and proper management of these products is important for environmental protection."*
No-Problem View	*"Latex paint is innocuous and there are few environmental risks associated with it. It is the consumer's responsibility to use up or dry up leftover latex paint prior to disposal. Yes, oil-based paint is hazardous and it is up to consumers and government agencies to ensure it is properly disposed of."*

These views contain important insights into the complexity of managing leftover paint and the potential for creative solutions to lessen the impacts of leftover paint on the environment and on government budgets.

ENVIRONMENTAL ISSUES

The paint industry has succeeded over the last 30 years in dramatically reducing environmental impacts by eliminating mercury, and reducing lead and the volatile organic compounds (VOCs) in paints. Significant improvements in the performance of latex paints have also contributed to the

increase in market share of these environmentally preferable paints over oil-based paints. In addition to reducing the hazards of paint, many retailers and manufacturers provide consumers with guidance on how to purchase the right amount of product for a job in an effort to minimize the volume of leftover paint.

Nevertheless, there are still significant volumes of leftover paint generated by household consumers and painting contractors, and this paint is an environmental concern when improperly disposed. Oil-based paints are combustible, contain organic solvents, and are classified as hazardous waste when disposed. While latex paint does not typically exhibit characteristics of a hazardous material, some latex paints contain solvents, biocides, and other materials of concern. Liquid paints are often banned from landfills because they can contribute to leachate. Improperly disposed paint can contaminate groundwater, and harm fish and other aquatic life. From a life-cycle standpoint, the use of leftover paint as a substitute for raw materials in the paint production process, or other beneficial uses, can result in significant reductions in the environmental impacts associated with the material extraction, processing, and end-of-life management life-cycle phases. Increasing the recycling rates of steel and plastic paint containers represents another opportunity to reduce the life-cycle impacts of paint.

PRODUCT STEWARDSHIP

Product stewardship is a principle that directs all participants involved in the life cycle of a product to take responsibility for the impacts to human health and the natural environment that result from the production, use, and disposal of the product. The primary participants in the life cycle of a product typically include manufacturers, retailers, consumers, and government. Many of these participants are already engaged in product stewardship efforts. Several paint manufacturers are using leftover feedstock to manufacture recycled paint. Retailers are also participating in stewardship efforts. For example, a few states and municipalities have collaborated with retailers to develop programs that encourage consumers to return leftover paint to retail stores for recycling or disposal. These efforts represent just a few of the many initiatives taking place across the country, yet serious challenges remain to implementing widespread recovery of leftover paint and reduction of environmental impacts. PSI recognizes that the product stewardship activities in the paint industry are broader than those detailed in this report. For example, the stewardship activities of many firms include ensuring containers are child proof, protecting the health and safety of workers in paint manufacturing facilities, and staffing 24-hour emergency hot lines with personal that have

Leftover Paint Facts

Paint is a top concern based on its high volume in the waste stream, subsequent costs to manage, and high potential for increased recovery, reuse, and recycling.

In 2000 about 637 million gallons of paint were sold in the United States, equal to approximately 2.3 gallons per person. Of that amount, ***34 million gallons*** are estimated to become leftover, or "surplus," paint annually (see page 16).

Of all hazardous household products (HHP), paint represents the largest cost for local governments to collect and manage and could cost up to *$275 million per year* if all leftover paint were managed properly (see page 20).

Manufacturers and retailers engaged in paint product stewardship programs are finding increased customer loyalty, cost reduction, and publicity benefits with their efforts to recycle leftover paint.

transportation and health expertise. In this report, PSI has focused on the leftover paint portion of the entire spectrum of possible paint product stewardship activities.

BARRIERS TO RECYCLING LEFTOVER PAINT

State and local governments, as well as other entities, spend millions of dollars to manage leftover paint. Unfortunately, the markets for this leftover paint are under-developed. Some recycled-content paint manufacturers find that they cannot sell non-white paint, leaving them with an inventory of non-saleable color paint in their warehouses. The low demand for recycled-content paint has driven those that manage leftover paint to find other ways of extracting value from leftover paint, such as using it as a cement additive. In addition, many municipalities, faced with limited budgets, have started to encourage consumers to dry out and dispose of latex paint in favor of higher priority products.

Market barriers to recycled paint include a perception among some homeowners and painting contractors that recycled paint is of poor quality. In some cases, the lack of available colors and the difficulty in matching colors work against recycled paint sales. Some manufacturers have expressed concern regarding contamination of recycled paint from heavy metals and bacteria. However, data from recycled paint manufacturers have shown that, with proper paint sorting after collection, these concerns can be effectively addressed.

Many paint manufacturers are also concerned that recycled paint could steal market share from more profitable virgin products. Profit and growth pressures facing the industry, along with a global economic slow down and the increased use of vinyl and other exterior surfaces that do not require paint, compound the issue.

Finally, laws governing VOCs and the collection, storage, and transport of waste paint sometimes create significant barriers to recycling leftover paint. While federal regulations exclude household wastes from being classified as hazardous waste, a few states (e.g., MA and CA) have stricter regulations that regulate household waste, including leftover paint, as hazardous waste once it is collected. These rules make it difficult for entities, such as retailers, to get involved in waste paint collection and recycling since doing so can make them "hazardous waste generators" and liable for the "waste."

OPPORTUNITIES TO INCREASE PAINT STEWARDSHIP

There have been numerous efforts by manufacturers, retailers, and all levels of government to expand paint stewardship opportunities. Several manufacturers are using leftover paint as a low-cost source of raw materials for their mid-grade products. Others are successfully marketing reblended and recycled paint to contractors, consumers, non-profits, and government agencies. Leftover paint is also incorporated into other products, including use as a cement additive. Most oil-based paint is fuel-blended for recovery of the paint's energy value.

The national dialogue on leftover paint management provides all participants with an opportunity to further identify barriers and develop solutions that create viable recycled paint sales and expanded regional and national markets.

2. INTRODUCTION

The purpose of this report is to present background information for a national stakeholder dialogue on architectural coatings (paint) management. The dialogue, which is being convened by the Product Stewardship Institute (PSI), aims to bring together representatives from the paint industry, industry associations, retailers, state and local government, environmental/consumer advocates, paint recyclers, and others, to jointly develop a strategy for solving problems related to leftover paint management.

PSI coordinates with its 26 state government members and 23 local government members, to reduce the health and environmental impacts from consumer products. PSI works closely with manufacturers, retailers, environmental groups, and other stakeholders to develop agreements to reach common goals. Current PSI projects involve product stewardship for electronics, paint, pressurized gas cylinders, tires, beverage containers, industrial radioactive devices (e.g., nuclear gauges and exit signs), and mercury thermostats.

State and local government officials asked PSI to address this issue. Paint is a top concern based on its high volume in the waste stream, subsequent costs to manage, and high potential for increased recovery, reuse, and recycling. Paint also can contain volatile organic compounds, fungicides and, in some cases, heavy metals.

This report primarily addresses latex and oil-based architectural coatings (also known as water-based and solvent-based paints). Latex and solvent paint comprise the vast majority of paint-related products collected by state and local government programs. Throughout this report, we use the term "paint" to refer to these two types of architectural coatings. We also include exterior solvent and water-based stains in this category. Their composition usually similar to that of exterior paint products and can be managed, for the most part, exactly like exterior house paint categories. Other paint products that are commonly collected at household hazardous waste collection sites, but not addressed in the report, are specialty paint products (e.g., marine, automotive, and artist waste paint) and other paint products (e.g., wood furniture stains, thinners, strippers).

Report Terminology

Latex Paint
: Refers to water-borne or water-based paints. Manufacturers no longer use latex in waterborne paints. Beginning in the 1950's, plastic (vinyl and acrylic) resins began replacing latex from rubber trees.

Water-base and Waterborne
: These are equivalent terms, describing paints formulated with water, thinned with water, and cleaned up with water. See Latex Paint.

Oil-based Paint
: Refers to solvent-based paints. The term derives from natural oils that were originally used as binders. The oils were replaced by plant-derived and later synthetically-derived alkyds. These paints are soluble in hydrocarbon and oxygenated solvents but not water.

Leftover Paint
: Refers primarily to unused post-consumer paint. For some municipalities, the term includes unused painting contractor waste. Related terms include waste paint (which implies the material has little value) and surplus paint (which implies retailer miss-tints or discontinued products).

Recycling
: Refers to the blending, remanufacture, consolidation or recycling of post consumer paint. For the purpose of this report, recycling does not refer to in-plant recycling of pre-consumer paint (i.e., formulation errors, mistints, or other mixing/ manufacturing miscues.

This report does not focus on paint reformulation to reduce life cycle impacts. Responding to regulations, cost considerations, and customer preference, the industry has reduced VOCs, heavy metals, and overall paint hazards over the past few decades.

3. THE ENVIRONMENTAL AND HUMAN HEALTH HAZARDS OF LEFTOVER PAINT

Since the 1970's, government regulation and the efforts of the paint industry have dramatically reduced the environmental impacts of paint. Compared with 20 years ago, the majority of today's architectural coatings have few VOCs, little lead, and no mercury. Environmentally preferable latex paint has taken market share away from oil-based paints, increasing from 30-35% of architectural coating sales in the 1970's to over 80% currently. Despite these successes, paint still poses an environmental concern. Leftover paints are liquid wastes and are difficult for consumers to dispose of properly. Oil-based products contain combustible solvents and, in some cases, hazardous air pollutants. Latex products fail fish bioassay tests and, in some cases, contain small amounts of formaldehyde (CA DFG 1990). Older leftover paint still coming to collection programs may contain lead, mercury, and other heavy metals.

Aside from use and disposal, there are other environmental problems and opportunities associated with paint. The sustainability goals increasingly articulated by the paint industry, government and non-governmental organizations (NGOs), call for reducing the life-cycle impacts of products. The environmental impacts of extracting/producing virgin raw materials that go into the manufacture of paint are far greater than those associated with the actual manufacturing process and product transportation to market (Häkkinen et. al.) [1]. If leftover paint were used as a substitute for virgin raw materials in the production of new product, it would greatly reduce the environmental impacts associated with paint manufacture.

3.1 Oil-based Paint

The presence of hydrocarbon and oxygenated solvents, such as toluene and glycol ethers, render oil-based paints combustible and present an environmental and human health hazard. If used in poorly ventilated areas, solvent vapors can irritate eyes, skin, and lungs, and contribute to respiratory problems, muscle weakness, and liver and kidney damage. While leftover oil-based paint generated from households is exempt from being classified as a hazardous waste, the fact that it exhibits hazardous characteristics has prompted states and municipalities to discourage households from disposing of leftover liquid oil-based paint in municipal trash. The National Paint and Coatings Association (NPCA) recommends that liquid solvent-based paint not be discarded with normal trash. Consumers are also discouraged from trying to dry oil-based paint for disposal since the evaporating solvents can increase risk of fire, contribute to indoor air pollution, and present an inhalation hazard to humans. Oil-based paint should never be poured down a drain, or dumped into sanitary or storm sewers – doing so could cause problems at wastewater treatment facilities or pollute groundwater, rivers and streams. Instead, the NPCA recommends that consumers save it for

[1] This life-cycle study reviews three recent paint LCI studies and assesses the environmental impact of coated exterior wooden cladding.

a special paint collection program or hazardous household waste (HHW) program in their community.

Other than the hydrocarbon and oxygenated solvents, Life Cycle Inventory (LCI) studies show that titanium dioxide (TiO_2) and certain binders carry the majority of paint environmental burden (Häkkinen et. al.). For example, for an alkyd semi-gloss paint, the alkyd resin and TiO_2 were the most important factors for energy consumption, carbon dioxide (CO_2) emissions, sulfur dioxide (SO_2) emissions, nitrogen oxides (NOx) emissions, and chemical oxygen demand (COD). In coatings where the content of titanium dioxide or zinc oxide pigments is 10-30%, the environmental burdens of the paint are significant based on these pigments (with environmental burdens of TiO_2 being significantly higher than zinc oxide). In addition to these air, water, and waste impacts, the manufacture of titanium dioxide using the chloride process produces large amounts of dioxin-contaminated wastes. LCI impacts of other paint ingredients, such as calcium carbonate or talc fillers, iron oxides, and ferric sulfphate additives, are minor when compared to alkyd resins and TiO_2 (see Section 5.2 for a detailed description of paint ingredients).

3.2 Latex Paint

Generally speaking, the human health and environmental hazards of latex paints are far lower than those of solvent-based paints since they contain from 50% - 90% water. Improper disposal into water bodies is one environmental issue associated with latex paint. In addition, water-based paints contain some solvents (e.g., ethylene glycol and glycol ethers) and, in some cases, small amounts of formaldehyde-containing bactericides which, when used in poorly ventilated spaces, could pose hazards to human health.

The primary environmental toxicity of latex paint is to fish and aquatic life with the route of exposure being a spill or dumping of waste paint into a storm drain. Tests done by the California Department of Fish and Game modeling a "spill" showed overwhelming evidence of such toxicity (CA DFG 1990). According to DFG, " latex paints, having both toxic constituents as well as high concentrations of pigments with increased turbidity can be extremely deleterious to fish and aquatic life and must not be allowed to enter waters of the State or be placed at a location where it can enter such waters." Tests were also performed on wash water from latex rollers and brushes with similar results. DFG also notes in its analysis that,

> *"…Our investigations have shown that most people, painters included, know that oil-based paints and thinners are either toxic or deleterious to aquatic life and should not be discarded in streams or the environment in general; but because water is the solvent for latex paints, and water is not usually toxic, they believe that disposal to a storm drain or stream is acceptable." (CA DFG 1990)*

While disposal of dried latex solids into a sanitary landfill does not pose an environmental threat, the time and effort required to dry and solidify excess latex paint may be a deterrent for some consumers, according to state and local solid waste officials. During the drying process, the paint must be sheltered from rainwater and secured from children, pets, and wildlife. If there is a significant amount of paint left in the can, the drying process requires that the paint be poured in a thin layer onto cardboard and/or that absorbent material, such as cat box filler, is added to the paint. Furthermore, consumers often cannot distinguish between leftover latex and oil based paints, and

oil-based paints should not be solidified through evaporation (although dry oil paint is not considered hazardous).

From a life-cycle perspective, the paint constituents with the biggest impacts are similar to oil-based paints (solvents aside). The polymer system (e.g., styrene acrylate) and TiO_2 have the greatest environmental burden, while the impacts from intermediate agents and other pigments are rather low. It is worth noting that the higher quality paints (latex or oil-based) usually contain appreciable amounts of titanium dioxide since it allows better hiding. However, one cannot assert that higher-grade paint products also have greater life-cycle environmental burdens since higher-grade paint often lasts longer andhas fewer performance/application issues, both of which translate into a decreased need for repainting. Simply put, lower quality paint may require additional application coats and, therefore, may have a greater potential for increased paint waste, including containers and ancillary products (e.g., rollers, drop cloths, tape, brushes, tray liners, etc.). This paint also might result in greater VOC emissions and liquid wastes associated with cleanup.

3.3 Containers

Roughly 90% of architectural paint products are sold in steel cans. Most steel cans contain a minimum of 25% recycled steel. The maximum recycled content in steel cans is 30-35% due to the technical limits of basic oxygen furnaces used in steel manufacturing. Our research finds that, even though the Steel Recycling Institute promotes paint can recycling, recycling of steel paint containers across the country is inconsistent. Only about half of the communities surveyed reported some steel paint can recycling.

Plastic cans have become more price-competitive in recent years and are increasing in market share. The plastic cans are typically made from polypropylene with a conventional steel rim and top. The cans are lighter weight and more resistant to rust and dents than steel cans. Behr, a major Home Depot supplier, uses plastic/steel hybrid cans for the 30 million gallons of paint it sells annually. Plastic and plastic/steel hybrid containers can be made from 100% post consumer materials. Two of the major plastic/metal hybrid can manufacturers (KW Plastics and U.S. Can Corporation) are already doing this. While the manufacturers state that the plastic/metal hybrid cans are easily recycled, none of the communities we spoke with had systems in place to recycle the hybrid cans collected at paint collection facilities and events.

The choice of containers and their ultimate fate (recycling or disposal) can have varying environmental impacts. Containers create a significant environmental burden; the material extraction and manufacturing processes for both steel and plastic cans are energy intensive and result in significant environmental impacts. Studies examining packaging materials in other industries have identified "win-win" opportunities to reduce supply chain costs and environmental impacts by optimizing packing weight, design, and materials selection.[2] We know of no studies examining the life-cycle environmental burdens of paint containers and, therefore, recommend future research in this area.

[2] Keoleian, Gregory A., Spitzley, David V., Guidance for Improving Life Cycle Design and Management of Milk Packaging, Journal of Industrial Ecology, 1999 Volume 3, Number 1.

4. PAINT PRODUCT STEWARDSHIP

Product stewardship is a principle that directs all actors involved in the life cycle of a product to take responsibility for the impacts to human health and the environment that result from the production, use, and disposal of the product. The primary actors in the life cycle of a product typically include resource extractors, primary ingredient manufacturers (e.g. resins or binders), paint formulators, retailers, government agencies, and consumers.

Product stewardship became an important issue in the United States in the late 1990's because of the dramatic increase in the amount of waste sent to landfills, incinerators, and wastewater treatment plants in the past twenty years. Increased waste means increased recycling and disposal costs, usually borne by local communities. Costs further escalated from the need to keep a growing number of toxic products out of solid waste disposal facilities. As these costs became too great a financial burden for local communities, local agencies turned to the states for assistance. State and local agencies are now looking to product manufacturers, retailers, and other potential partners to become part of the solution and to alleviate the burden created by what some local governments call an "unfunded industry mandate."

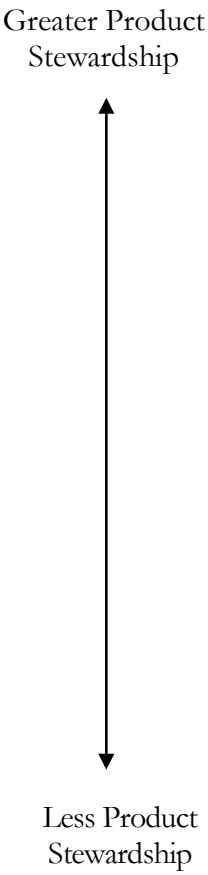
Over the past five years, federal, state, and local governments have initiated product stewardship activities on a number of products. Efforts are underway for electronics, carpet, pressurized gas cylinders, beverage containers, mercury-containing products, radioactive materials, and paint. In each of these efforts, the goal is to reduce the life-cycle impacts of the product and find cost-effective ways to capture the value left in the product at the end of its useful life and integrate the materials back into new products.

4.1 Paint Product Stewardship

There are a host of paint-related product stewardship initiatives across the United States involving retailers, manufacturers, local governments, and state governments. These programs generally focus on latex paint rather than oil-based paint because of the hazardous characteristics of oil-based paint. These efforts include product reformulation, paint collections, or reblending leftover paint into new paint for resale in the United States or abroad. Figure 1 below presents a range of paint product stewardship methods. Section 8 of the report describes many of the current product stewardship programs in detail.

Figure 1: Paint Product Stewardship Efforts

1. Product reformulation to reduce toxicity and other life-cycle impacts
2. Consumer education to prevent over purchase, promote proper paint storage, and encourage the public to use up paint rather than disposing of it
3. Giving or swapping paint with neighbors or others to use up
4. Return to retailer
   - 4.1. On-site mixing to sell or give to charity
   - 4.2. Original manufacturer take back and mix into product
   - 4.3. Reblended off-site by recycler (not original manufacturer) and resold
5. Collection site/event reuse/recycling
   - 5.1. Organized "Swap" programs for residents or charity
   - 5.2. On-site blending of paint for sale or charity
   - 5.3. Manufacturer pick up for reblending into product
6. Post collection reblending/recycling
   - 6.1. Paint sent for offsite recycling and returned to municipality for sale or charity
   - 6.2. Paint sent offsite to processor (public or private) for recycling
     - 6.2.1. Paint recycled into new paint products
     - 6.2.2. Paint recycled into other products such as cement
   - 6.3. Paint sent off site for disposal
     - 6.3.1. Paint is used as alternative daily cover for landfill
     - 6.3.2. Paint is fuel blended
7. Direct Consumer Disposal
   - 7.1. Dry and dispose of in municipal trash



To illustrate paint product stewardship examples more clearly, the text below presents suggested activities for retailers, consumers, contractors, government officials, and manufacturers. Undoubtedly, these activities will be a central part of the stakeholder dialogue, and are provided only to stimulate discussion and not to be prescriptive. Note that there are no single best product stewardship methods in all cases. Local conditions, such as the existence of recyclers, interested retailers, or manufacturing plants within the immediate area often dictate the types of stewardship options employed.

What Can Retailers Do?	• Educate consumers on how to purchase the right amount for the job, proper storage techniques, and local collection opportunities for leftover paint. • Provide homeowners and contractors with convenient leftover paint collection locations. • Sell recycled content paint. • Sell paint with reduced toxicity including zero and low VOC paint.
What Can Homeowners and	• Purchase only the amount required for the job and use it up.

Contractors Do?	• Participate in paint swap programs. • Purchase recycled content paint. • Purchase paint that has reduced toxicity including zero VOC paint. • Recycle leftover paint. • Properly dispose of latex paint at the end of its useful life, but only as a last resort if no available recycling opportunities exist.
What Can Manufacturers Do?	• Sponsor the development of national standards for recycled paint. • Reduce paint toxicity and other life-cycle impacts. • Promote standard criteria for use of recycled paint for design professionals and contractors. • Take back own brand of paint and incorporate it into existing products. • Package paint in containers designed to reduce the lifecycle environmental burdens (e.g., containers produced using recycled materials, and that are easily recyclable). • Produce paint that contains recycled content and market it to consumers for appropriate applications. • Sponsor and participate in collection programs to recover leftover paint.
What Can Government Do?	• Purchase recycled content paint for agency uses. • Develop procurement contracts designed to encourage the purchase and use of paint with recycled content and/or reduced toxicity. • Set standards for what constitutes recycled or re-blended paint. • Collect leftover paint. • Assist manufacturers of recycled-content paint in market studies and obtaining capital or low interest loans for facility construction or improvements. • Reduce regulatory barriers to leftover oil-based paint collection and transportation. • Educate consumers and contractors on purchase and disposal.

5. PAINT PRODUCTION

This section reviews the amounts and types of paint manufactured in the United States. The primary focus is on architectural coatings, and includes the two main types: latex and oil-based paints. This section also includes a short review of two other paint products that are part of the national dialogue -- specialty paints and other paint products. Key materials used in paint and their functions are outlined, as well as the application and market share for each type of paint.

5.1 U.S. Paint Production

Approximately 25.6 million metric tons of paints and coatings, valued at about $60 billion, were produced worldwide in 2000. Of this, United States manufacturers were responsible for 5.82 million metric tons (12.8 billion pounds) or approximately one-quarter of the world's paints and coatings. The paint industry is a mature one, with expansion and contraction generally correlating with the health of the economy, especially the housing and construction market, and transportation sector. Throughout North America (and in Europe), there is a strong trend toward consolidation. The ten largest producers accounted for about 45% of the business worldwide in 2000 (CEH 2002).

The major changes in the industry over the past 20 years relate to the adoption of low-VOC and waterborne (latex) paints. Driven by environmental regulations, economics, and consumer demand, most companies shifted from manufacturing conventional, solvent-based formulations to waterborne (latex) paints. For example, in 1970 latex paints used in architectural applications accounted for 30-35% of the total; in 1990 this number grew to 70-80%. Additional factors for the shift included rising energy and solvent costs and manufacturing safety and environmental considerations.

Paint and coatings provide two primary functions – decoration and protection. There are three main types of paints and coatings (CEH 2002):

a) **Architectural coatings** (45% of [global coatings) are interior and exterior coatings used to decorate and protect new construction as well as to maintain existing structures, including residential homes and apartments, public buildings, offices, institutions, and factories;

b) **Industrial and Original Equipment Manufacturer (OEM) finishes** (40% of global coatings) are coatings that are applied to manufactured goods as part of the production process, for the purpose of protection or decoration;

c) **Special purpose coatings** (15% of global coatings) are used for miscellaneous applications such as traffic paints, automotive refinishing, high-performance coatings for industrial plants and equipment and protection of marine structures and vessels.

U.S. paint exports exceeded imports by a factor of three in the year 2000 (see Table 1). However, exports were only about 6% of U.S. production by volume, and imports less than 2% by volume.

Table 1: U.S. 2000 Imports and Exports of Paints and Coatings (million of gallons),

	Solvent-based	Water-based	Total
Imports	17.2	6.1	23.3
Exports	38.7	34.1	72.8

Source: SRI International, Chemical Economics Handbook 2002, Surface Coatings 592.5100 Y

5.2 Paint Ingredients

The main paint ingredients include binders, solvents, pigments, extenders and additives, and antimicrobials. Figure 2 depicts the formulation of a typical opaque latex acrylic topcoat and a typical opaque oil-based alkyd topcoat.

Binders or resins are nonvolatile film formers that bind the pigment particles together. They can be synthetic resins, drying oils, or natural resins. Currently, 95% of all film formers are synthetic resins. Acrylics are the predominant type, followed by alkyds and vinyls; other common coating resins include urethanes, polyesters, epoxies, amines, and cellulosics. Resins made from 100% natural ingredients amounted to 0.2% of all film formers in 2000, compared to approximately 50% prior to World War II. However, alkyds are made with natural renewable oils, such as linseed, soya, castor, and other oils, up to 75% of their solid content.

Pigments are finely ground, insoluble, dispersed particles that provide a coating formulation with color and opacity. They also can function as fillers, reinforcements and property modifiers. Pigments can be either natural or synthetic and inorganic or organic.

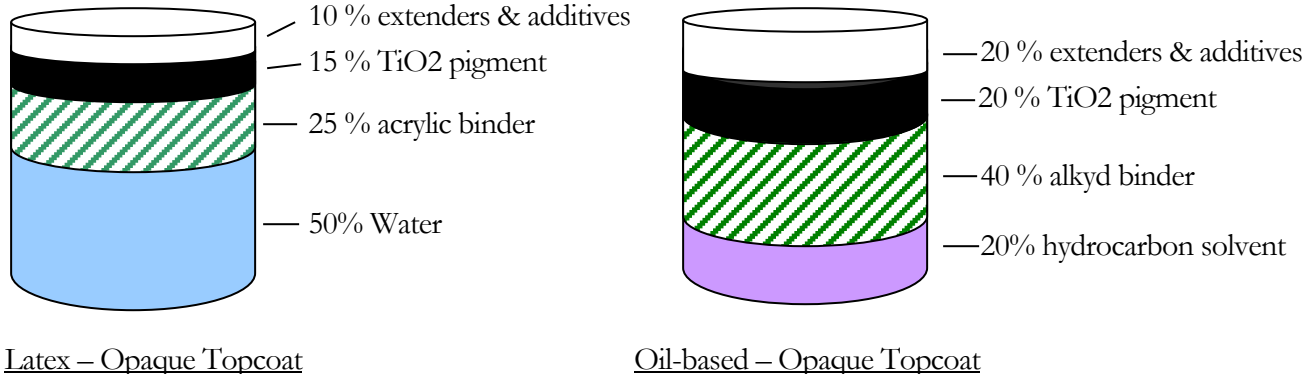
Solvents are volatile liquids used to dissolve or disperse the film-forming constituents. Paint solvents are either organic liquids or water. Organic solvents are primarily hydrocarbons and oxygenated solvents but their use has declined more than 25% since 1973 due to increasingly stringent environmental requirements and consumer preference.

- Hydrocarbons are the most common solvents used in paint and are divided into two categories; aliphatic and aromatic. The most commonly used aliphatic solvent is mineral spirits. Aromatic solvents provide stronger solvency, but with a greater odor. The most common are toluene, xylene, and naphthas.
- Oxygenated solvents include ketones, esters, glycol esters, and alcohols and are widely used with synthetic binders. Ketones are characterized by their strong odor, range of water solubility and evaporation rate. Esters provide solvency nearly equal to ketones but with more pleasing odors. Glycol ethers, used in low levels in water-borne paints, are milder in odor and display water miscibility, strong solvency, and slow evaporation.

Extenders and additives facilitate the production, application, and performance properties of paint. Plasticizers, which are added to increase flexibility, account for almost one-quarter of the additives. Surface-active agents function as emulsifiers, pigment suspension aids and wetting agents. Other additives include thickeners (such as cellulose ethers), dryers, anti-skinning agents, anti-flooding agents, marproofing aids, sanding aids, ultraviolet light (UV) absorbers, and corrosion inhibitors.

Antimicrobials (bactericides, fungicides, and algaecides) are used in both oil-based and latex-based paints, and are required more in regions with high humidity. In 1990 the EPA banned the use of mercurial compounds as antimicrobials in paint, though some old paint still contains mercury. There are two main types of paint antimicrobials used today: in-can preservatives and dry-film preservatives. In-can preservatives, which keep the paint from spoiling, include isothiazolinone and amine adduct. Dry-film preservatives, which fight fungi and algae once the paint is applied, include chlorothalonil, n-octyl isothiazolin and iodoproynylbutyl carbamate (IPBC), and zinc pyrithione (Desaritz 1999).

Figure 2: Typical Paint Formulation (percent by volume)



Latex – Opaque Topcoat

Oil-based – Opaque Topcoat

5.3 Latex and Oil-based Paints

In 2001, U.S. paint manufacturers shipped 617 million gallons of architectural coatings, of which almost two-thirds (386 million gallons) were for interior application, and just over one-third (224 million gallons) for exterior applications (see Figure 3). In 2001, 81.2% of architectural coating shipments were latex, compared to 79.9% in 2000. Latex or water-based paints represented 89% of all interior paints and 71% of exterior coatings. The value of U.S. shipments of architectural coatings in 2001 was $6.73 billion, an average of $10.91 per gallon. Oil or solvent-based paints had higher costs than latex paints, with oil-based interior paints averaging $12.64 per gallon compared to an average of $10.36 per gallon for interior latex paint. See Appendix A: Shipments of Paint and Allied Products (2001) for detailed information about the quantity and value of shipments of paint products in the U.S. (U.S. Census Bureau, 2002).

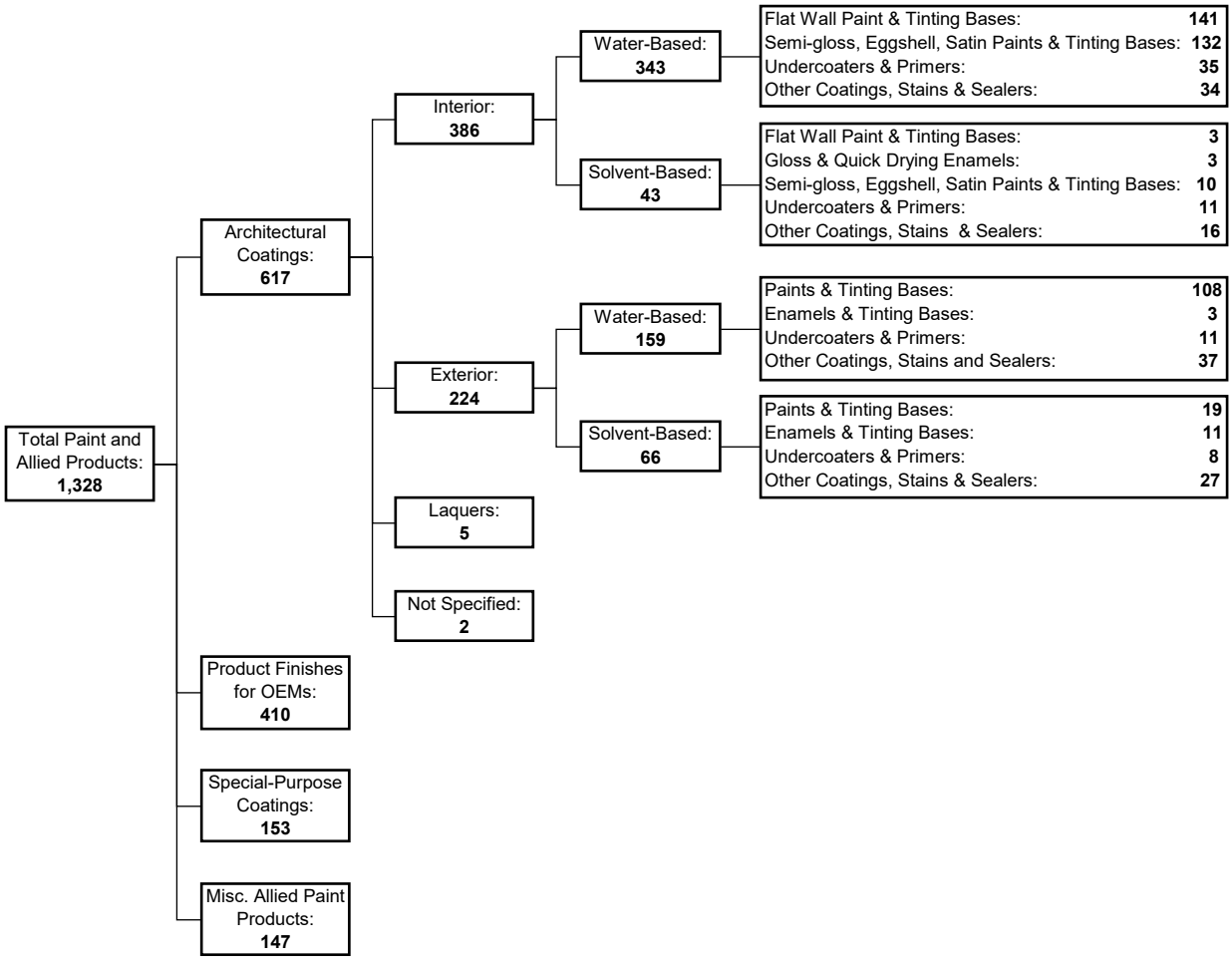
Table 2: U.S. 2000 Consumption of Paint (million gals)

	Interior	Exterior	Total
Architectural coatings	394	243	637
Water-borne	343	168	511
Oil-based	51	75	126

In the low-gloss or flat coatings market, which holds a major share of architectural coatings (about 50-55%), waterborne formulations have an even more dominant position, with over 95% for interior flat paints and over 85% of exterior flat house paints (CEH 2002, 592.5100 Z). Higher-gloss paints, including semi-

gloss and gloss enamels, account for about 30-35% of the architectural coatings sales (see Table 2). Consumption of high-gloss paints has decreased, as consumers are tending to use more semi-gloss paints. Solvent-borne alkyd enamels still dominate this high-gloss market, with about 75% of the interior market share and nearly 100% the exterior market share. However, the latex share is expected to grow because of intensifying environmental regulations and the improved performance of these paints.

Figure 3: U.S. Shipments of Paints and Allied Products in 2001 (millions of gallons)



5.4 Specialty Paints

Specialty paints are formulated for specific applications and/or application conditions, such as extreme temperatures or marine environments. Solvent-based formulations still are predominant but a shift has been observed toward increased use of waterborne formulations due to more stringent VOC regulations.

5.5 Other Paint Products

Other paint products include varnishes, stains, thinners, cleaning solvents, and strippers. Varnishes, for example, differ from conventional coatings in that they are solutions of film formers in organic solvents and do not contain pigments. Their function is merely to protect the surface. Stains are a hybrid of paints and varnishes since they contain some coloring material but are generally transparent (Latex stains are more highly pigmented than solvent-based stains). As with specialty paints, these other paint products make up a minor share of the leftover materials collected by HHW programs. There is little information on volumes or specific product types since most collection programs do not track this category separately.

5.6 Architectural Coatings Manufacturing Cost Structure

Paint production is not a capital-intensive manufacturing process. As illustrated in Table 3, nearly half the production costs are in the cost of raw materials. Labor and overhead costs are roughly 13% of production costs and gross margin averages are estimated to be 30-35%. Because of the differences in the way companies market their products, Selling, General and Administrative expenses (SG&A) vary significantly company by company. Earnings before interest and taxes average roughly 7-12%.

Table 3: Average U.S. Coating Companies Cost Structure, 1998–2001

Income	**100%**
Cost of Goods Sold	
Raw Materials	50-55%
Labor	5%
Energy	1%
Overhead, Taxes, Insurance, Depreciation	7%
Total	**65-70%**
Gross Margin on Sales	**30-35%**
Sales, General, and Administrative Expenses	
Salaries	5-10%
Other	20-30%
Income Before Taxes	**7-12%**

Source: CEH 2002, 592.5100 K

6. LEFTOVER PAINT VOLUME AND COST

Leftover paint is generated by Do-It-Yourself (DIY) consumers, by contractors who may leave paint behind with their customers, and by retailers due to customer returns, miss-tints, and shrinkage[3]. Although paint purchases by contactors and DIYs are well understood, the amount of unwanted paint generated by households each year is not well understood. Municipal and state agencies consistently reported to PSI that leftover paint represents between 40% and 60% (by weight) of all material collected at HHW collection facilities or events. Using data from California and Washington, PSI has developed an estimate of the annual generation rate for leftover DIY consumer paint. These states were selected because they have comprehensive leftover paint collection data and, together, they represent 13 percent of U.S. households. PSI also used data from several municipal collection programs in states besides CA and WA to estimate the average cost to manage a gallon of leftover paint. It is important to note that a significant percentage of U.S. households do not have access to a drop off center, collection event, or other avenue to dispose of their leftover paint, although little definitive data exist.

6.1 Quantity Of Leftover Consumer Paint

Estimating the volume of leftover paint for the entire U.S. is difficult, but using data from the two states with the most comprehensive programs (California and Washington), PSI estimates the annual national generation of leftover consumer paint to be from **16 to 35 million gallons** (See Table 4), or 2.5% to 5% of sales. Note that the estimates above do not include volumes generated by contractors (unless paint is left behind for the consumer), dealer miss-tints, paint manufacturers, private business (corporations), and public agencies (e.g., schools or public works departments). These estimates are described in greater detail in sections 6.1.1 and 6.1.2.

Table 4: Estimate of Leftover Consumer Paint in U.S.

State	(A) Number of Households in State	(B) Percent of U.S. Households [1]	(C) Percent of Households with Local HHW Program	(D) Actual Paint Collected in 2000 (gal) [2]	(E) Estimate of Potential Leftover Paint (gal.) [3]	(F) Estimate Leftover Paint in U.S. based on Actual Collection (gal./year) [4]	(G) Estimate Leftover Paint in U.S. based on Estimated Collection (gal./year) [5]
California	11,500,000	11.0%	90%	1,718,000	3,817,778	17,428,986	34,857,971
Washington	2,300,000	2.2%	95%	330,000	694,737	15,858,124	31,716,247

Notes:
1. Based on 105 million households in U.S. according to U.S. 2000 Census
2. Assumes the average weight of a gallon of paint is 10 pounds.
3. Assumes estimates represent half of the leftover paint generated by the served households
4. National estimate based on actual state data assuming 100% of households are covered: [(D) / (C)] * 105,000,000 / (A)
5. National estimate based on estimated state data assuming 100% of households are covered: (E) / (A) * 105,000,000

In addition to the estimate based on California and Washington collection data, PSI also reviewed data from three additional sources:

[3] Retailers also generate paint waste due to from customer returns, mistints, spills, and other shrinkage.

- The National Paint and Coatings Association (NPCA) survey of 1,000 households;
- Paint collection data from Metro Regional Government in Oregon, which operates a successful paint recycling project; and
- An estimate based on HHW collection data across the country
- An estimate based on data collected by Product Care in Canada.

PSI's estimate of 16 to 35 million gallons falls between the estimate of 9 million gallons using NPCA data and 40 million and 47 million using Metro's collection data and HHW collection data respectively. It is very similar to the 28 million gallon estimate based on Product Care's information. The following sections provide the methodology used for the PSI estimates.

6.1.1 California Collection-Based Estimate

The State of California and its local government entities run a comprehensive collection program that covers the majority of the State. In fiscal year 1998, California government programs operated 85 permanent HHW collection facilities, 245 temporary facilities/one day events and 107 recycle-only facilities. Roughly 50% of the state's population has access to permanent facilities where paint is collected along with other HHW. Temporary events that accept all types of HHW (including paint), along with facilities that accept only recyclable HHW such as motor oil, latex paint, and batteries, serve about 40% of the population. Only about 10% of the population (mostly in rural areas) does not have access to collection facilities or events. A limited number of California local governments do accept small business and private contractor waste for a fee.

While approximately 90% of the public has access to HHW collection options, many facilities or events are not convenient. In addition, due to budget constraints, many local governments limit their advertising and outreach efforts and the amount of time that facilities are open for collection. Thus, even where paint collection programs are present, there are gaps in service due to inconvenient locations, limited hours of operation, and a lack of general awareness of collection facilities and events (CIWMBa 2001). Many of California's permanent sites are less than five years old, and quantities are expected to increase over time. A recent study on paint management in California showed a 20% increase in paint collection from 1998 to 1999 (CIWMBa 2001). Household participation rates averaged less than 10% per year, with only 5% participating in 1998/1999.

In 2000, California collected 17.2 million pounds of leftover paint (roughly 50% latex and 50% oil-based). Although reliable data is difficult to find, it is estimated that the amount collected represents half of the leftover paint generated, with the other half being stored, dried up, or improperly disposed. Using a conservative assumption that the program serves 90% of the State's 11.5 million households (9.8% of U.S. households) and an average paint density of 10 pounds per gallon, we can project a leftover paint national estimate of ***17 to 35 million gallons***.[4] It is worth noting that the latex to oil ratio (1:1) differs from the ratio of latex and oil paint sales (roughly 4:1). PSI has not been able to determine the reason for this discrepancy. There are many possible explanations, including (a) consumers do a better job of using up, swapping, or drying up water-

[4] ((17.2 million lbs collected) / 10 (lbs/gal) * (105 million US households/10.35 million participating CA households)) ≈ 17.4 million gallons. This estimated doubles to ≈ 35 million gallons if one assumes CA collects half of leftover paint generated in the state by households.

based paints compared to oil-based paints and (b) the inventory of leftover paint stored by consumers is old and reflects an era when water and oil-based paints were sold in equal proportions.

6.1.2 WASHINGTON STATE COLLECTION-BASED ESTIMATE

Like California, the State of Washington has an extensive paint collection program. Nearly all of the residents in the State are served in some capacity, with the exception of a few rural counties. The various programs are run by different municipal government entities and include a mixture of permanent sites and one-day events where HHW such as paint, used oil, and other materials are collected. Unlike California, however, some of the local programs do accept waste from small businesses (Conditionally Exempt Small Quantity Generators – CESQGs) such as painting contractors, who pay a fee for the disposal services. This data is tracked separately. The volume collected from CESQGs was 1/7 of that collected from the general public.

Washington paint collection programs face collection barriers similar to those in California, including gaps in service due to inconvenient collection locations and hours of operation and a general lack of public awareness regarding collection facilities and events. Furthermore, returns of leftover paint are likely to dramatically increase in the future. A national study showed that paint disposal at permanent sites in that State increases by more than 600% over the first five years of a program's operation, and levels out to a steady state when the facility is roughly eight years old (Nightingale and McLain, 1997). [5]

In 2000, Washington collected 3.3 million pounds of leftover paint (roughly 46% latex and 54% oil-based) from household consumers. As in the California data, the ratio of latex to oil-based paint collected does not match the current ratio of latex and oil-based paint sales. There are many possible reasons for the mismatch, including that consumers dry up latex in greater volumes than oil and that they use up latex better than oil. Also, the paint stored by the public could reflect the ratio of latex to oil-based paints that existed more than 10 years ago. However, PSI knows of no paper or report that has studied this issue in detail.

State of Washington officials estimate that the amounts of all collected HHW will double and level off over the ten-year period 2000 to 2010 (WA DOE 2000). Using a conservative assumption that 95% of the state's 2.3 million households (2.2% of U.S. households) have access to a local HHW program and an average paint density of 10 pounds per gallon, we can project a national estimate of leftover paint ranging from ***16 to 32 million gallons***.[6]

6.1.3 NATIONAL PAINT AND COATINGS ASSOCIATION ESTIMATE

In early 1995, the National Paint and Coatings Association (NPCA) initiated a survey on leftover paint. The survey included 1,000 consumers nationwide, who were asked whether they had unwanted leftover paint stored in their homes, and to estimate the amounts. Of the 749 respondents, 29% said that they had some leftover paint that they did not want. The average amount of unwanted paint per household based on this survey was 0.375 gallons or ***roughly a third of a gallon per household***. This

[5] Although WA provides collection services to 95% of households, in any given year, only roughly 8% of households participate.
[6] ((3.3 million lbs collected) / 10 (lbs/gal) * (105 million US households/2.16 million participating WA households)) ≈ 16 million gallons. This estimate doubles to ≈ 32 million gallons if one assumes WA collects half of leftover paint generated in the state by households.

amount included paint, paint primer, stain, aerosol spray paint, polyurethane/varnish, clear sealer, and paint thinner. The survey also showed that 29% of respondents would dispose of the unwanted paint within the first 12 months after purchase, while more than 67% would keep it for more than 12 months. Other studies have shown that on average, households keep paint about 4.6 years before they throw it away (NPCA 1995).

Using the 0.375 gallons/household figure, the 105 million households in the United States (2000 Census data) would have about 40 million gallons in storage. If the leftover paint were thrown out every 4.6 years, the average annual amount of waste paint disposed would be ***9 million gallons***. Note that the NPCA estimate does not include leftover paint from small painting contractors that is sometimes collected at HHW collection sites.

6.1.4 METRO-BASED ESTIMATE

Metro Regional Government, in Oregon, has been collecting paint as part of its HHW program since 1992. About 8% of the region's households participate in the program and the average amount of leftover paint collected per household is 4.2 pounds/year (Quinn 2002). If this amount were collected nationwide, about ***44 million gallons*** would be collected *annually* (105 million households x 4.2 lbs/10 lbs/gallon).

6.1.5 TOTAL HHW-BASED ESTIMATE

The EPA estimates that each person in the United States produces an average of 4 pounds of household hazardous waste each year (EPA 1993). Based on 2000 Census data, there are, on average, 2.8 people per household, who would then generate about 11.2 pounds of HHW per household. Assuming that paint is, on average, 40% of the HHW collected, this makes about 4.5 pounds of surplus paint per household, or about ***47 million gallons per year*** for the 105 million households in U.S. (assuming paint density of 10 lbs/gallon). Gross estimates based on total HHW generation tend to be unreliable. For example, another EPA report estimates 20 pounds of HHW per average US household per year (EPA 1993). Using this figure would nearly double this estimate, yielding 84 million gallons per year.

6.1.6 BC PRODUCT CARE BASED ESTIMATE

The British Columbia Product Care Program is a mature 10-year old program that collects leftover post-consumer paint at 100 depots in the Canadian province. These depots are cited to provide the public with easy access and a consistent program. BC Product Care measures not only the leftover paint they collect, but also new paint sales since manufactures must report sales volumes when paying their eco fee. BC Product Care reports that, in 2002, 4 million people purchased 8 million gallons of paint, of which 5%, or 400,000 gallons, were returned as leftover paint for proper management. This calendar year, Product Care estimates another 6% increase in the return rate, increasing the overall return rate to 5.3% for 2003. Thus, each BC citizen purchases roughly two gallons of paint per year and disposes of 0.1 gallons.

6.2 The Cost of Managing Leftover Consumer Paint

Extrapolating these results to the entire United States, 281 million people would purchase about 563 million gallons of paint (less than the 637 million gallon sold figure by about 11.5%) and dispose of 28.1 million gals, or 5% of amount purchased. This figures is comparable with the other estimates presented in this section.

This section presents leftover paint management costs derived from various state and local programs. It is important to note that costs vary from state to state and depend on volumes, proximity to recycling and disposal facilities, types of collected paint (e.g., oil or latex), and other factors.

Using an average collection and management cost of $8/gallon (see section 6.2.1), and the estimate of 16 to 35 million gallons of leftover consumer paint per year, PSI estimates that if all leftover consumer paint in the U.S. was collected and managed by municipalities, the costs are estimated to be from ***$128 to $280 million*** per year.

6.2.1 Overall Program Costs

Since collection programs vary tremendously, it is difficult to accurately calculate the average cost of managing a gallon of leftover paint. Furthermore, only a few communities compile detailed cost data on their paint management programs. An analysis of data from various states, counties, and municipalities, shows that the cost to manage a gallon of leftover paint ranges from $6.00 to$13.50. Nearly all of the cost estimates are broken down into various cost categories such as collection/handling, transportation, recycling or disposal, and publicity (see Figure 4 and Table 5). To calculate an "average government cost" managing a gallon of left over paint, PSI took a rough average of the per-gallon collection costs presented in Figure 4.

Figure 4: Per Gallon Collection Program Costs

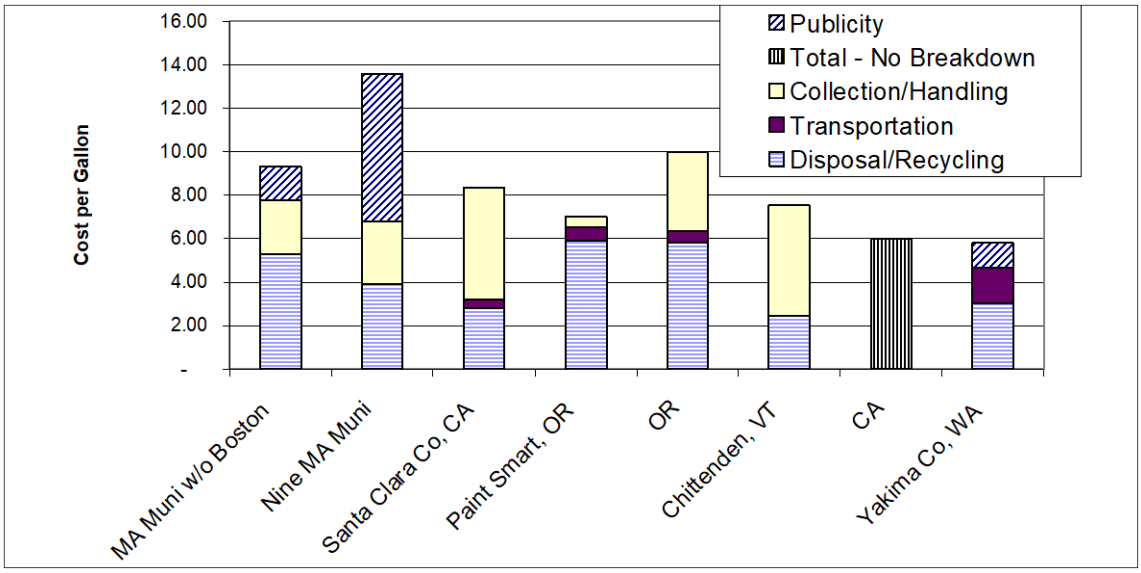


Table 5: Collection Program Cost Notes

Community	Collection Program Notes	Notes on Cost Data
Nine MA Muni	Data for 9 Massachusetts municipalities from a 2002 PSI study; Programs collect latex and oil paint	Programs run independently by each municipality.
MA w/o Boston	Data for 8 municipalities with Boston taken out.	Boston's high publicity costs ($75,000) greatly influenced the results.
Santa Clara Co, CA	Collects all types of paint, sends paint to recycler who brings back to collection center; reblended paint sold to public, permanent site and mobile unit.	Excellent cost data
Paint Smart, OR	Retailer-based initiative, all types of paint.	Very good cost data, does not include labor & storage costs for retailers
Chittenden Co, VT	Collect all types of paint, permanent site and mobile unit.	Very good cost data, no separate breakout for transportation
California	Collect all types of paint, methods vary	Estimate prepared for State Waste Management Board; no details available
Yakima Co, WA	Collect all types of paint, all paint is bulked	Estimate prepared by county, includes program administration costs

6.2.2 COST FOR SPECIFIC PAINT MANAGEMENT OPTIONS

This section presents costs for various leftover paint management methods (see Note that costs are reported by municipal programs and do not include private sector costs, such as storing or sorting paint in a retailer collection program. The overwhelming majority of oil-based paint is fuel blended across the country while latex paint is managed in many different ways.

Table 6 shows costs between different management methods and between communities and states using the same management method vary widely. For example, within the "Return to Municipality Latex Recycling" category, costs range from $3.50 to $5.50 per gallon. In these programs, paint is returned to the municipality by the recycler and either sold or given away. Note that these costs do not reflect all of the costs associated with paint management. "Latex Recycling" costs also vary widely, ranging from $1 to $6.72 per gallon. Our research indicates that having a local recycler has a significant effect on cost. Massachusetts for example, sends much of its latex for recycling to Canada.

Several latex recycling programs have very low costs. For example, Visions Recycling of California recycles latex for $1.50 per gallon. The company accepts only good quality latex paint from municipal governments, and will not take containers with small amounts of paint. Nu-Blend charges municipalities only $1 per gallon and resells its product directly to consumers and contractors and through a few retail outlets. The Paint Recycling Company in Nova Scotia, which is owned by the Canadian paint manufacturer Lauentide, takes both latex and oil based paints for $1.50 per gallon. Laurentide sells both a recycled product and reblends the recovered material with virgin paint. The efforts of Visions Recycling, Nu-Blend, and several other recyclers are in section 8.3 on page 34. Lastly, the program run by Snohomish County, WA has very low costs for consolidation of latex paint. Their program uses work-release volunteer labor to mix and give away latex paint after being consolidated on site and packaged in four-gallon tubs. Program costs are approximately $1.35 per gallon.

With the exception of the Paint Recycling Company, the costs to recycle oil-based paints are greater than fuel blending costs. This is generally true because of regulatory issues, technical issues associated with recycling oil-based paints, as well as the lack of recycling facilities located in the U.S.

Data for four paint management categories as well as programs that do not separate costs categories are presented in Table 6. The Key for Table 6 details the cost category codes used in the table. The category labeled, "**Return to Municipality Latex Recycling**," involves a contract whereby a recycler picks up paint, reblends it to a specification, and returns it to the community. The paint is either sold (typically in five-gallon pails) or given away. The category entitled, "**Latex Recycling**," presents the costs communities pay to have their latex paint recycled. In these programs, the paint is not brought back to the municipality, but instead is either reblended or recycled into other products. The "**Oil-based Recycling**" category features data that is similar to the latex data, except that the oil-based paint has been reblended into paint (and not recycled into other products). "**Fuel Blending of Oil-Paint**" data reflect costs for fuel blending of oil-based paint. "**Total Program Costs**" reflect total per gallon costs for latex and oil-based leftover paint management. Finally, there are several other pieces of cost data that do not easily fit into one of the above categories. These are highlighted in the section entitled **"Other Management Options."** This section includes information on disposal of solidified latex, hazardous waste incineration of oil-based paint, and a county paint consolidation program.

Note that the table does not include data for paint swap programs. In some programs, high quality paint is exchanged via swaps at paint collection centers and events. For example, in Washington State, some communities swap in original containers and can divert significant quantities and save the cost of material management and recycling.

Table 6: Leftover Paint Management Costs

Latex Recycle	**Metro, MN (6 counties)**	**Broward, FL**	**Sarasota Co, FL**	**Alachua, FL**	**Brevard Co, FL**	**San Joaquin Co, CA**
Return to Muni for resale/charity		$4.25	$5.50	$5.00	$4.25	$3.50
Retailer Resell or State Dispose of						
Not returned to Muni	$3.75					
Sale Price 5-gal containers ($/gal)	NA	free	some free, $5	free		$4 color, $5 white
Cost Categories		4,5	4,5	4,5	4,5	4,5
Latex Recyclers	**Visions Recyling, CA**	**Nu-Blend**	**Hotz - MA contract**	**Paint Recycling Co.**	**Metro, OR**	
Paint not returned to Municipality	$1.50	$1.00	$6.72	$1.50	$2.50	
Notes	only ?1/2 full containers	takes from local gov't	state-wide contract	resells to manuf.	charge to municalities	
Cost Categories	4,5	4,5	4,5	4,5	4,5	
Recycle Oil	**MA State Contract**	**Wake Co, NC**	**Paint Recycling Co.**			
Hotz	$6.72	$6.80	$1.50			
Notes			resells to manuf.			
Cost Categories	4,5	4,5	4,5			
Fuel Blending of Oil-Paint	**MA State Contract**	**Bellingham WA**	**Grant Co. WA**	**Wake Co, NC**	**IL State Contract**	**Snohomish Co. WA**
Cost	$5.78	$1.55	$5.50	$4.80	$3.35	$2.92
Cost Categories	4,5	4,5	4,5	4,5	4,5	4,5
Total Program Costs	**MA**	**Chittenden, VT**	**Santa Clara**	**IL Partners**	**Total CA**	**Paint Smart**
Latex and Oil	$14.20	$7.24	$8.36	$2.77	$6.00	$8.17
Latex Only						
Cost Categories	1,2,3,4,5,6	1,2,3,4,5,6	1,2,3,4,5,6	1,2,3,4,5	no detail provided	1,2,3,4,5
Other Management Options						
Option	Soldified Latex Disposal	Return to Retailer	Incineration.Haz Oil Paint	Consolidation		
Community	**Jefferson Co. WA**	**IL Partners**	**MA**	**Snohomish Co. WA**		
Cost per gal	$1.80	$3.82	$16.15	$1.34		
Cost Categories	5	1,2,3,4,5	5	1,2,4,5		

Notes:

1. Broward, Sarasota, Alachua, and Brevard Counties in Florida send paint off site for reblending, with the paint being retuned to the county where it is either sold or given away. Several of these counties sort the paint, recycling good material and land filling the rest.
2. MN (6 counties): Some of the paint is reblended into paint while most is used as a cement additive.
3. The IL Partners program does not fit well with any of the groups above (see Section 8.5.1 for a program description). Costs exclude retailer handling and storage cost as well as fees collected by retailer. Cost for State disposal of paint that cannot be resold is included.

Key for Table 6	
Cost Category	**Number**
Collection labor	1
Storage costs	2
Program advertising	3
Transportation	4
Recycle/disposal	5
Program administration	6

7. MANAGEMENT OF LEFTOVER PAINT

7.1 Managing Left-Over Latex Paint

This section reviews various latex paint management options in greater detail. It includes subsections on swaps, consolidation, reprocessing, reblending, use in other products/applications and disposal via solidification and landfilling.

7.1.1 PAINT SWAPS

Many communities encourage consumers to donate the surplus paint to a willing neighbor, friend, or local community project. Many also provide paint exchanges or more formalized swap opportunities. For example, Massachusetts funded paint sheds for many cities and towns to store paint. The sheds include shelving for good paint to facilitate swaps.

Such an approach reduces the need to throw away or recycle leftover paint. There is little reliable data on the extent of paint exchange/reuse programs in the U.S. Paint swaps at fixed sites typically involve paint storage areas. These programs require someone to manage the material, separate out good quality paint, and (in northern climates) ensure paint is given away or stored in a location above freezing temperatures. Swaps at events typically involve sorting out good quality paint, arranging paint into oil and latex types, and setting up a table or area where the public can view it.

According to local government officials, most paint that *is* swapped is either unopened or is relatively full and in good condition. Some municipalities find swap programs to be a cost effective way to manage left over paint. However, our research found that not all the comments about swap programs were positive. Some comments indicated that swap programs were labor intensive and therefore costly. Labor tasks include actively managing the inventory of paint and providing customer service to the public. Several municipal programs commented that that more people dropped off paint than actually swapped paint. The success of these programs may hinge on variables such as population density, program design, marketing, and staff training.

In a report prepared for the Massachusetts DEP in 2002, PSI reviewed paint programs in 15 communities and found that 11 formally encouraged paint swapping -- some more actively than others. Nine communities quantified their paint collection and management approaches. PSI found that 20% of the paint collected was exchanged in swaps, 48% recycled, 23% disposed or fuel blended, and 9% unknown.

Another type of swap program is run by Habitat for Humanity. The non-profit organization runs 50 retail recycling facilities called ReStores, that sell donated, quality building materials at greatly discounted rates to all members of the general public. ReStores allow low-income homeowners the opportunity to improve their homes at bargain prices. The materials collected and funds raised increase Habitat's home-building capacity. ReStores accept building materials that are typically disposed of in landfills.

Paint and any materials that can be applied to the construction of a Habitat home are accepted and sold. Although each ReStore has its own protocol on accepting paints, the Sacramento, CA ReStore

accepts only latex paint that is no more than five years old and has either never been opened or was only opened to check color, but was not used. The Sacramento store accepts any sheen of latex paint and both interior and exterior grades. The store, which does not reblend paint, takes paint from residents, businesses, and retailers and will sell to any shopper. Store staff say that paint sells quickly.

In Ohio County, the SouthEastern Ohio Joint Solid Waste Management District has kept detailed records of its paint swap program run for the past 9 years in Washington County, Ohio. The swap is run jointly by the District, Solvay Advanced Polymers, Chevron-Phillips Chemical Co., Nova Chemical, and Kraton Polymers. The paint swap is set up on the Saturday prior to the HHW collection for a given county. Volunteers from the companies, the District, local litter prevention agency, county jail inmates, and civic organizations unload cars and trucks, and sort the materials by general color and type (oil, latex, spray, varnish, etc.) on plywood tables. Survey forms are given to everyone who either drops off or takes paint from the tables. The event lasts for approximately 7 hours, excluding set up and cleanup. Paints are offered to the public free of charge. Volunteers and staff pack unswapped paint into DOT-approved shipping containers (Gaylord boxes), which are held until the next weekend for the hazardous waste contractor, which ships them with paint and other waste collected at the HHW collection for fuel-blending. Over a nine-year period, the swap program has collected a total of 10,303 gallons of paint, swapped 32% of this paint (or 3,342 gallons), and disposed of 6,691 gallons.

PSI polled a host of state and local government programs and found no other readily available data on the economics and efficiencies of swap programs. It seems that communities simply do not track paint swaps – pointing to a possible area for future research.

7.1.2 PAINT CONSOLIDATION

Paint consolidation is the process of combining leftover paints that have similar characteristics into batches. Consolidation is done at municipal facilities following collection eventsand at a small number of retailers. The consolidation process typically involves the following steps:

1) Screening out of unusable paint
2) Sorting paint based on whether it is oil or latex paint
3) Sorting by characteristics such as color, finish, and type (e.g., interior vs. exterior);
4) Pouring the latex leftover paint from the original containers into collection drums; and
5) Mixing.

Consolidation operations also filter the paint to remove large particles and other solids. Many perform periodic testing for contaminants. The consolidated paint is often packaged in 5-gallon containers for reuse. This activity is conducted mostly by local programs in batch sizes ranging from 30 to 200 gallons.

Consolidation produces a medium grade, 100% recycled content paint that is available in limited colors and sheens. It is typically sold at a nominal cost or given away to local government agencies, charities, homeowners, and contractors. The paint is sold without warranties and it is not typically made available through retail outlets.

Advantages of paint consolidation are that it does not require expensive equipment or specially trained staff and, therefore, consolidation can easily be done at the point of collection. It is also effective in reducing storage and transportation costs since the bulked paint takes up less room than loose packed

cans. The primary disadvantage of paint consolidation is that it produces a product that has inconsistencies in color, sheen, and performance, and is therefore more suitable for applications where color matching, color choices, and sheen are not primary concerns. In some cases, paint consolidation can be used as a replacement for virgin paint with significant cost savings.

Snohomish County, WA consolidates latex paint at its "Moderate Risk Waste" (MRW) facility and gives it away free of charge to community members. A single staff person, known as the paint processor, is dedicated to the latex consolidation program and supervises the work of several work release volunteers. The volunteers bulk the collected paint in 55-gallon drums, blend it, and pour it off into plastic four-gallon buckets. Any unsalvageable paint is bulked in 55-gallon drums and sent to a treatment, storage, and disposal facility (TSDF) for solidification and then landfilled. Consolidated paint is distributed at an unstaffed, self-service store on the property. Paint is set out on shelves or on the floor and customers take what they need. The paint processor and volunteers put the paint in the store and keep the place clean. Distribution slows in the winter months but the inventory is typically reduced to zero by the end of the summer. The paint processor and other MRW facility staff answer questions and assist customers as needed.

In the first three quarters of 2003, Snohomish County managed 41,407 gallons of latex paint, consolidating and distributing 29,472 gallons while stabilizing and disposing of 11,935 gallons. Program costs include the full time paint processor's salary ($48,000 per year) and non-salvageable paint disposal ($19,500 for the first three quarters of 2003). Other staff help out but not to any significant extent. Work release volunteers are not paid. Program costs are roughly $1.34 per gallon[7]. Note that these costs do not include overhead for running the collection center.

Many other communities run programs similar to the one operating in Snohomish County. Johnson County, Kansas, collects paint by "appointment only." Three staff bulk most of the paint, with volunteers occasionally helping out. Johnson County staff segregate the paint into light and dark batches. Staff state that their paint recycling process is very time-consuming and that latex and oil based paints are, by far, the largest waste streams they handle in terms of cost, volume, and weight. The paint has two main uses, for low-income housing and graffiti cover. The County gives its paint to anyone who requests it and does not charge. County officials state that they have had a steady demand for paint but know of some smaller communities that recycle paint and can't get rid of it.

7.1.3 PAINT REPROCESSING

Paint reprocessing, sometimes called paint remanufacturing, is the process of converting leftover paint into recycled content paint products that exhibit consistent color, sheen, and performance characteristics. Reprocessing procedures typically include the following steps:

1) Screening to eliminate paints that are either of poor quality or contain contaminants;
2) Sorting paint based on whether it is oil or latex paint
3) Sorting by characteristics such as color, finish, and type (e.g., interior vs. exterior);
4) Pouring the leftover paint from the original containers into batches of 1,000 gallons or more;
5) Filtering and testing; and
6) Mixing with additives, pigments, and virgin materials to achieve a product that meets the manufacturer's internal standards for color, quality, and performance. Since paint tends to have a

[7] 41,407 gallons / ($19,500 + .(75 * $48,000)) = $1.34 per gallon.

lower pH after it is stored, paint reprocessors will typically add amines or ammonia to restore it to a pH of 7.5 to 9.5. (www.ciwmb.ca.gov/ConDemo/FactSheets/Paint.htm)

Paint reprocessing differs from paint consolidation in that reprocessing requires processing equipment, more experienced workers, and large volumes of leftover paint. Therefore, it is generally not feasible to reprocess paint at the point of collection. For these reasons businesses, rather than municipalities, typically perform paint reprocessing. Reprocessed paint is produced in various colors and sheens and is generally suitable for both interior and exterior applications. Several regional and national paint manufacturers offer reprocessed paint products and, in some areas, reprocessed paint is available at retail outlets.

Advantages of reprocessed paint include that it is available in a variety of colors and sheens, with the colors, sheens, and other performance characteristics being consistent from batch to batch. For many applications, reprocessed paint can be used as a replacement for virgin paint with significant cost savings. Another advantage is that reprocessed paint manufacturers often back the performance of their products. One of the disadvantages of using reprocessed paint is that it is generally available in a limited number of colors. Custom tinting at the point of purchase can also be difficult, and some consumers have concerns regarding product performance. Limited availability is another disadvantage, as most retail outlets do not carry it.

7.1.4 PAINT REBLENDING

Paint reblending is the process of using post-consumer leftover paint as a feedstock in the production of "virgin" paint. In the reblending process, leftover paint is added as a minor constituent, generally representing less than 20 percent of the finished product. Manufacturers of reblended paint screen out unusable paint and then sort the leftover paint by characteristics such as type, color, and sheen. One manufacturer that PSI interviewed limits the leftover paint it uses for reblending to only its own brand owing to concerns about quality and performance when mixing it with other companies' paint.

While many manufacturers blend manufacturing equipment wash water and pre-consumer scrap paint (e.g., off spec paint and returns from retailers) into their paint products, the term reblended applies only to paint with post-consumer content. However, it should be noted that not all manufacturers that reblend with post-consumer leftover paint label their products as containing recycled paint content.

The primary advantage of reblended paint is that it is typically indistinguishable from virgin paint with respect to the consistency of color, sheen, and performance because leftover paint is a minor constituent.

7.1.5 REUSE IN OTHER PRODUCTS

In some cases, collected leftover latex paint is blended into other products. Amazon Environmental, for example, processes leftover paint for use as a raw material in the manufacture of Portland cement.

7.1.6 ALTERNATIVE DAILY COVER FOR LANDFILLS

Hernando County, Florida, uses latex paint for landfill cover. By law, cover must be applied daily to control disease vectors, fires, odors, blowing litter, and scavenging. The County spent $3,700 to build a machine that sprays latex from the top of its landfill. The latex is mixed with an equal part of water and roughly one to two drums are sprayed per day. The latex-water mixture replaces a product called Formula 480, which costs roughly $2/gallon.

Southeastern Public Service Authority (SPSA) Regional Landfill in Suffolk, Virginia, received approval from the Virginia Department of Environmental Quality to use Posi-Shell Cover System for its Alternative Daily Cover in February 1999, and began adding latex paint in a 10% solution in March 1999. It is mixed with non-potable water, kiln dust powder, and Posi-Pak fibers. SPSA used 8,000 gallons of leftover latex paint in fiscal year 2002, saving approximately $27,345 in disposal fees. The initial cost of $12,500 was recovered after the first year of use. Prior to implementing this system, SPSA was disposing of latex paint with household hazardous waste or transporting it to a Refuse Derived Fuel plant to be co-mingled with the waste stream and incinerated in a power plant. In addition to the financial benefits, this alternative daily cover uses less landfill space than the bottom ash-soil mixture used previously.[8]

7.1.7 SOLIDIFICATION AND LANDFILLING

Paint can be solidified for disposal with municipal solid waste in two main ways – via evaporation or through the addition of a chemical catalyst (known as a hardener). Evaporation is rarely used for large quantities of paint since it is expensive and time consuming. It requires the removal of paint can lids and space to store open cans until the remaining paint is air-dried. Sometimes, an absorbent material is added to help the drying process. The dried paint and the containers are disposed in solid waste landfills and incinerators. Some government recycling program managers report that many consumers find the process of drying latex paint to be difficult. These officials find it hard enough to change consumer behavior to recycle bottles and cans. Drying latex paint, particularly for those people in apartments or those with more than residual amounts, requires extra steps that consumers might not desire to take. If done, paint should be dried out in an outdoor location secure from rainwater, children, pets, and wildlife.

Due to the high cost of management, many communities across the United States are shifting away from collecting latex paint to recommending that the public dry the paint and dispose of it as solid waste. Thurston County, Washington, halted all latex paint collection and instituted an education campaign to encourage the public to solidify its own paint. According to county officials, paint collection volume went down but complaints increased, so the community decided to resume collecting latex. The County's transfer station contractor disliked the latex collection ban because of the liquid paint they were finding mixed with household trash. According to a Thurston County official, "our education (campaign) was not universally effective, and numerous problems resulted."

Chemical catalyst hardeners for latex paint can be purchased at paint retail stores. These hardeners, in powders or crystals, are added in small quantities to paint. After putting the can lid back on, one shakes the can for two to three minutes. The resulting hardened paint can then be disposed with the household

[8] Presentation by Charles Harrell, Environmental Supervisor Suffolk Regional Landfill, *Beneficial Use of Waste Latex Paint in the Posi-Shell Cover System, Southeastern Public Service Authority Regional Landfill, Suffolk, VA*, at The 2002 Posi-Shell Operator's Roundtable, October 30, 2002.

trash as long as local regulations do not prohibit disposal. *Waste Paint Hardener,* sold by Napier Environmental Technologies, (www.biowash.com) costs the consumer roughly $1.75 to $3.00 per packet. Each packet can harden up to 2/3 of a gallon of leftover latex paint. The Material Safety Data Sheet (MSDS) for Napier Environmental Technologies product states that it is a "non-regulated product mixture" and its literature states that *Waste Paint Hardener* is nontoxic.

The use of hardeners, however, makes steel can recycling difficult, if not impossible, so that both the can and the hardened paint must be disposed of together.[9] At least one local government program promotes the use of *Waste Paint Hardener* in its promotional materials (www.montgomerycountymd.gov). The Montgomery County, Maryland, Division of Solid Waste encourages consumers to donate their latex paint, use it up, or dry it up for disposal. This strategy has resulted in a 50 percent reduction in the amount of paint brought into the collection center. The County's program manager views the hardening of paint as a last resort option due to the current high cost of other management options.

Consumers can also add pet litter, granulated clay, or saw dust to absorb the latex for drying. These products tend to cost less than hardeners and can be used in the paint container if the container is not full.

7.2 Managing Left-Over Oil-based Paint

Oil-based paint (also known as solvent-based) is combustible and contains materials that are defined as hazardous under federal regulations. Due to these hazardous characteristics, the regulations and policies of some states and municipalities require that leftover oil-based paint generated by households be managed as a hazardous waste once it has been collected.

As with latex paint, all those interviewed agreed that the first recommendation for reducing the amount of surplus solvent-based paint is to use it up or to give it to someone else who might use it. Beyond such exchanges, most solvent-based paints in the U.S. are currently not recycled due to the incompatibility, complexity, and variety of their formulations. During collection, the paint is typically consolidated into 55-gallon drums, or cans are stacked in gaylord boxes and tested using the EPA Toxicity Characteristic Leaching Procedure (TCLP). If the paint passes this test, it is shipped to energy recovery facilities (e.g., cement kilns). Paint that cannot pass the TCLP test is typically disposed of in permitted hazardous waste landfills or incinerators. The main options for management of surplus oil-based paint are listed below.

7.2.1 Paint Exchange/Reuse

Similar to latex paint, oil-based paint can be reused through simple swap programs, exchanges, and donation to a willing neighbor, friend, or local community project. Some HHW collection sites offer formal exchanges or swaps. However, with oil-based materials, storage facilities must be properly constructed, materials managed, and inventory controlled to prevent the site from becoming a fire hazard or a storage area for large quantities of hazardous materials.

[9] Paint can metals can be recovered from municipal waste combustion units.

7.2.2 RECYCLING

Currently, no facility exists in the United States that recycles oil-based paint. However, municipalities in Massachusetts, Texas, and several other states send their oil-based paints to Hotz Environmental in Ontario, Canada (Hotz Environmental Services, 2002). The 35,000 square foot plant is one of three oil-based recycling facilities in North America. The Hotz facility takes leftover paint from 6 countries on 4 different continents and recycles about 1 million gallons of paint per year. The finished product is sold overseas, so no recycled oil-based paint is available for purchase in the U.S.

Two other Canadian facilities, Peinture Récupérée du Québec, located in Victoriaville, Quebec, and The Paint Recycling Co., located in Springhill, Nova Scotia, also recycle oil-based paint. Both facilities have formed partnerships with Laurentide Resource, Inc., a major Canadian paint manufacturer. The recycled solvent-based paints are sold in Canada or are exported to several Caribbean and African countries.

7.2.3 FUEL BLENDING

Solvent paint can be used as a fuel source in cement kilns or other energy recovery facilities because of its high BTU value. This is the primary disposal method for household oil-based paint. The BTU of the material is highly sought after and therefore fuel blending is the lowest cost management method.

7.2.4 HAZARDOUS WASTE INCINERATION

Hazardous waste incinerators use high temperatures to destroy hazardous materials. This approach is very rarely used to manage oil-based paints since it is much more expensive than fuel blending, and generally not required unless the paint is contaminated with hazardous materials. According to the Toxic Substances Control Act (TSCA), paints and paint sludge should be sent to hazardous waste incinerators for disposal if they:

- Have been contaminated with hazardous chemicals and fail TCLP, or
- Contain certain other hazardous materials, or
- Contain over 50 ppm of PCBs.

7.2.5 LAB PACK/LANDFILL

This approach is rarely used for leftover paint and involves packing unusable contaminated solvent-based paint in a drum or gaylord container and sending it to a hazardous waste landfill for disposal.

7.3 Managing Paint Containers

The majority of paint cans are made of high-grade steel. Since the production of new steel requires approximately 25% recycled steel, there is generally a demand for recyclable steel. The steel recycling process is conducted at 3,000 degrees Fahrenheit, so small residual amounts of dried leftover paint in the containers pose no operational problems (NPCA 1993).

As the Steel Recycling Institute states, steel cans are included in 98% of U.S. municipal recycling programs, but nearly two-thirds of those programs do not accept paint cans. The Institute attributes the low inclusion rate to miscommunication regarding the desirability of steel paint cans. Requirements for preparing the containers for recycling include emptying the containers of all but residual paint, ensuring residual paint is completely dry, and leaving the lids off containers. Many municipalities report that metal recyclers will not accept empty paint containers. Their refusal is based on prior experience when paint leaked on their equipment or the ground. Subsequently, consumers throw out containers with their municipal trash. For those communities where garbage is sent to a waste-to-energy facility, the metals are recovered following, and sometimes prior to, the burn cycle.

Our research found that municipal recycling of paint cans is an inconsistent practice. An informal survey of government agencies indicated that roughly half of the communities recycled some of the paint cans collected at HHW events and collection facilities. Several prominent programs, including Metro Oregon and Winston-Salem-Forsyth County in North Carolina were unable to find scrap dealers interested in recycling their empty paint cans.

Some communities use can crushers, which, depending on the type of crusher, can either help or confound paint can recycling efforts. The better units completely empty the contents, while others leave liquid paint trapped in the crushed cans. There are a number of good can crushers on the market. Hennepin County, Minnesota, uses a one-step process where the paint is de-canned through shearing and crushing in a can "Kruncher." Recovered metal is transported to a scrap metal dealer. TeeMark manufactures an explosion-proof paint can processor that crushes up to six gallon-sized containers and paint filters. In the TeeMark system, crushing of open cans takes place on a grate that liquids pass through for collection in a drum below. One unit (Super 6P) opens and empties cans and pails as they are crushed, eliminating the labor-intensive step of removing the lids. Other options are available, including one unit (PCC1) that opens the can, forces out its contents, and squeezes it "empty" to standards defined by the EPA.

Some paint manufacturers are switching from steel to plastic containers. The advantages of plastic containers include resistance to dents, dings, and rust. One disadvantage is that plastic containers can burst if dropped from high heights. Currently, about 10% of paint containers are made of plastic. Behr, Home Depot's largest national paint supplier, sells more than 30 million gallons of paint per year in a polypropylene plastic and metal hybrid container. The can itself, manufactured by KW Plastics, is made of 100% post consumer plastic with a conventional steel ring and cover. The U.S. Can Corporation also manufactures plastic and metal hybrid containers made from 100% post-consumer recycled plastic. Although made of recycled content, after use they are thrown out. Currently there are no recycling options for these containers. A company representative stated that a cost difference of as little as two to three percent would lead much of the industry to switch to plastic and metal hybrid containers.[10] In some cases, manufacturers are purchasing scrap polypropylene from Europe to manufacture hybrid cans. In fall 2002, the commodity price for recycled plastic was $0.28 – 0.33 per pound, while the cost for virgin plastic was $0.31 – 0.38 per pound.

[10] See International Trade Commission Remedy Hearing Transcript, Nov. 6, 2001 at 298 (testimony of Mr. Thomas Scrimo of U.S. Can Company)

8. PAINT PRODUCT STEWARDSHIP EXAMPLES

This section highlights some of the best examples of product stewardship currently being demonstrated in the paint industry. It includes manufacturer initiatives, consumer education initiatives, and collaborations between retailers and government as well as manufacturers and government agencies.

8.1 Manufacturer Initiatives to Reduce the VOC Content of Paint Products

The volatile organic compound (VOC) emissions for architectural paints and industrial coatings totaled 561,000 tons in 1990 when the Clean Air Act went into effect. Paint sources represented 9% of VOC emissions from all consumer and commercial products (40CFR Part 59). Since then, the EPA has set limits on the VOC content for various paints and coatings (see Section 10.1 VOC Regulations on Architectural Coatings). The current Federal VOC limit for interior flat paint is 250 grams/liter, and 380 grams/liter for interior non-flat paint. Many paint manufacturers are now offering products with VOC levels that are well below the Federal limit. There is no governmental or industry standard for what constitutes a "low VOC paint" or a "zero VOC paint." The term low VOC paint is often used to refer to paints with less than 100 grams/liter for flat paint and 150 grams/liter for non-flat paint. Zero -VOC paints typically have less than 5 grams/liter. Table 7 highlights some of the zero-VOC paint products that are available on the market.

Table 7: Manufacturers of Zero VOC Paint

Paint Manufacturer	Zero VOC Paint Product Line
BioShield	Solvent Free Wall Paint
Devoe Paint	Wonder-Pure
Dunn-Edwards	Sierra
Duron Paints	Genesis Odor-Free
ICI Dulux	Lifemaster 2000
Kelly-Moore	Enviro-Cote
Pittsburgh Paints	Pure Performance
Benjamin Moore	Pristine Eco-Spec
Sherwin Williams	Healthspec, Harmony

8.2 Consumer Education Initiatives

Consumers' purchasing decisions greatly influence the manufacturers' efforts to reduce the health and environmental impacts associated with paint products. Consumer education initiatives typically involve informing consumers about the following:

- Selection of low-VOC or non-toxic paints
- Selection of recycled-content paints[11]
- Guidance on buying the correct quantity for a given application

[11] Some manufacturers believe that the selection of recycled-content paint for consumers cannot be supported unless more comprehensive, regular testing on the paint ingredients is undertaken.

- Guidance on painting techniques
- Information on the proper management of leftover paint

8.2.1 National Paint and Coatings Association

The NPCA developed a series of consumer education brochures on health and safety issues, painting techniques, and paint selection. The NPCA also developed a guide for consumers entitled, *The Six-Point Program for Leftover Paint.* The guide addresses buying the right quantity, proper storage, management of leftover paint, and recycling of paint cans. In addition, NPCA has published the *Post Consumer Paint Protocol,* and publishes a newsletter that include interviews with industry experts on a variety of topics including the management of leftover paint and resources aimed at assisting municipalities with the management of leftover paint. These resources are available on the NPCA website at www.paintinfo.org.

8.2.2 Paint Manufacturers

Paint manufacturers typically include information on paint can labels to inform consumers regarding the area (in square feet) that can be covered by the contents of the container. For many consumers, it is challenging to translate coverage information expressed in square feet per gallon to the quantity of paint needed for their particular application. For this reason, several paint manufacturers now offer website-based, interactive calculators to assist consumers in estimating the quantity of paint they require. For example, Benjamin Moore's Paint Calculator is accessible from its homepage (www.benjaminmoore.com).

Most paint manufacturers have websites that typically include product information, product MSDS sheets and/or technical data sheets, selection guides, and application advice. It is common for manufacturers to encourage retailers to advise consumers to purchase only what is needed. Manufacturers also provide information on proper storage and disposal. For example, the Sherwin-Williams website (www.sherwin-williams.com) advises consumers to follow the following guidelines:

- Save small amounts of leftover paint for future touch-ups.
- To keep it fresh, place a layer of plastic wrap over the mouth of the can before replacing the lid. Pound down the lid securely.
- Store it in a safe place until your community holds a leftover paint/stain collection day where you can safely dispose of the leftovers.

8.2.3 State and Local Governments

Many State and local government agencies have developed educational materials to assist consumers in calculating the appropriate quantity of paint to purchase, and to provide information on proper management of leftover paint. For example, the King County, WA Hazardous Waste Management Program's website (www.metrokc.gov/hazwaste/house/paint.html) includes a calculator to determine how much paint to purchase, how to choose the right paint, painting safety tips, how to use up all the paint, where to recycle the leftover paint, and how to dispose of paint properly.

In 2000, the City of Eugene, OR initiated a paint disposal public education campaign concerning stormwater protection. The City, in partnership with local paint retailers, supplied participating stores with paint "stir sticks" imprinted with the words, "Keep Stormwater Clean — Manage Paint Waste Wisely," along with posters and brochures outlining the various ways to reuse, recycle, or otherwise dispose of leftover paint. The following participating retailers include both large retailers, manufacturer-owned stores, and independent hardware stores and home centers: Miller Paint, Tommy's Paint Pot, Forrest Paint Company, Sherwin-Williams, Fred Meyer, Home Depot, and True Value Hardware. The Eugene Public Works web site (www.ci.eugene.or.us/pw) contains information on paint disposal as well as the names of participating stores and links to their web sites. The campaign is also advertised in *The Register Guard* and the *Eugene Weekly* and on local radio stations.

8.3 Manufacturers of Recycled Content Paint

Manufacturers of recycled content paint, also known as reprocessors, play an important role in developing and producing products that use the leftover paint. Creating a market demand for leftover paint is a key goal of product stewardship. Through their marketing efforts, manufacturers of recycled paint are educating consumers about the benefits that these products offer in terms of lower environmental impacts and, in many cases, lower costs.

Some paint manufacturers, however, have concerns regarding product liabilities associated with selling recycled content paint, specifically in the area of hazards assessment and ingredients disclosure on material safety data sheets and labels as required by law. These manufacturers believe that there are no assurances of the recycled paint content. They assert that, without identification of chemical identity, manufacturers of recycled paint cannot provide consumers or their employees with accurate information on the product material safety data sheets, product data sheets, and product labels. Therefore, they believe that it is impossible to provide proper, compliant hazard communication, and that users may not properly use recycled paint, protect themselves against unnecessary exposure, or ensure proper end-of-life management. (See also Section 9.3.5 for a discussion of these concerns and how they are handled by paint recyclers.)

To illustrate the point, one virgin paint manufacture articulated the following potential scenario about which they were concerned. A consumer could become concerned about exposure of their child and other family members to recycled paint and call the recycled paint company's emergency response resource. The company would not be able to definitively tell the consumer what was in their can of paint and the accompanying hazards associated with those constituents. In the event of a civil suit, the manufacturer could not definitively tell what was in their paint. Regardless of whether the paint is safe or not, this virgin paint manufacturer believes that this uncertainty could be sufficient to expose the manufacturer to financial damages. Out of concern for the paint industry as a whole (including the budding U.S. and Canadian paint recycling industry), some paint manufactures that have these liability concerns disapprove of paint recycling even by other companies because they believe that a single high-profile incident could damage the entire industry.

8.3.1 AMAZON ENVIRONMENTAL, INC. (AEI)

AEI has paint recycling facilities in California (Whittier), Ohio (Lima), and Minnesota (Roseville) and accepts all types of leftover water-based paint (pre-consumer and post-consumer) for recycling. By producing a variety of products, AEI is successfully recycling 100% of the paint they accept. AEI offers a consolidated paint product, which is coarse strained and packaged in 55-gallon drums. It is available in limited earth tone colors such as gray or beige, and is used for graffiti abatement and similar applications. AEI's Amazon Select ™ product line includes reprocessed paints that are fine strained, filtered, tinted, adjusted for viscosity, and have added preservatives. This product line is offered for applications that require high quality paints, including airless sprayer applications. It is available in six standard colors at a price of $50 for a 5-gallon container. Custom colors are also available. AEI markets its products directly to its clients, which are primarily contractors, and state and local governments. It also makes some paint available for donation to non-profit organizations. Dunn-Edwards Paint Company sells AEI's paint under the brand name "Recover" in Arizona, California, Colorado, Nevada, New Mexico, and Texas. Leftover and waste paint that is not usable for paint products is used to manufacture AEI's Processed Latex Pigment (PLP), a patented additive for Portland cement. For more information, see www.nvo.com/amazon/door/.

8.3.2 E-COAT: KELLY–MOORE

In 1993, the Kelly-Moore Paint Company formed a separate operating division known as E-Coat Recycled Paint Products. An E-Coat Recycle Center was opened in Sacramento, California, that same year. E-Coat recycled paint is made with a minimum of 50% (up to 80%) post-consumer paint, which is completely reprocessed to assure consistent performance. In this process, paint designated for recycling is sorted and tested. It is then filtered, mixed and adjusted for quality. New ingredients are often added to batches of E-Coat to assure consistent performance, coverage and color consistency. The product is manufactured in 7-10 colors. E-Coat paint is also processed to assure good adhesion, abrasion resistance and durability.

In 2001, 80% of the 400,000 gallons of paint recycled by E-Coat came from local government, and the other 20% originated from painting contractors, individual homeowners, and consumer returns and miss-tints from Kelly-Moore retail stores. E-Coat products represent roughly 2% of Kelly-Moore sales. E-Coat is a supplier of interior flat and semi-gloss paint to several federal agencies, as well as California state agencies. For more information, see the E-Coat website: http://www.ecoatonline.com/home.html

8.3.3 METRO OREGON PAINT RECYCLING PROGRAM

Metro opened a new $700,000 latex paint consolidation facility in 1999. The facility produces 100% post-consumer paint, packaged into 5-gallon pails for resale. The majority of paint comes from Metro residents. Metro accepts paint, free of charge, at two permanent hazardous waste facilities that serve both Metro residents and CESQG's, area municipal collection programs, and two independent retailers that collect leftover paint from their customers (participants in the OR Paint Smart Program). Metro also accepts paint dropped-off by small business customers for a fee of $2.90 per gallon, and collects paint from other municipalities outside the Metro area for a fee of $2.50 per gallon including transportation.

From July 2002 to June 2003, the facility took in 176,401 gallons of raw material, produced 115,816 gallons of recycled paint, sold 108,576 gallons, and gave away more than 7,000 gallons to government agencies and non-profit organizations. (Some of the paint given away was in inventory from prior years.) The program has actually begun looking for additional sources of recovered paint. Metro's two major markets are the general public and commercial entities (see Table 8).

Table 8: MetroPaint 2002 Calendar Year Sales by Customer Type

Customer type	Gallons sold	Transactions	% of total sold
General public	50,128	4600	51%
Commercial	17,583	780	18%
Non-Profit	6,930	272	7%
Government	3,614	133	4%
Retailers	19,081	162	20%
Total	**97,336**	**5,947**	**100%**

Metro produces nine basic colors. The market for Metro's off-white product is strong, but sales of other colors, such as brown, green, and pink are weaker and are sometimes given away. Metro uses a two-tiered system, in which government agencies and non-profit organizations receive a discounted price. Prices are significantly below the market price for virgin latex paint, with the exception of off-white, due to high demand (See Table 9). Metro's operating costs average $3.26 per gallon collected. For more information, see the Metro website at www.metro-region.org.

Table 9: Metro Pricing

Customer	Price per 5-gallon pail	
	Off-White	Other Colors
Governments and non-profits	$19.00	$12.00
All other customers	$30.00	$20.00

8.3.4 NU-BLEND PAINTS, INC.

Nu-Blend Paints, located in Cincinnati, OH, reblends leftover latex paints into different colors and finishes (over 150 colors in stock) and offers 100% satisfaction guarantee. The company can also custom color match if it has the right paint available. About 4,500 gallons of leftover latex paint are donated to the company every month by a variety of sources including consumers, who return the paint through independent hardware stores and municipal solid waste departments in Hamilton and Butler counties. The company also accepts paint returns and mis-tint donations from Home Depot and leftover paint from commercial painters. Any resident of the community where Nu-Blend is located can drop-off latex paint at no cost. Nu-Blend sells to non-profits (75% of sales) and the general public (25%) via a company store and an independent hardware store (Hader Hardware) at $8.50 per gallon or $42.50 per 5-gallon container.

Nu-Blend also runs a training program to teach people how to paint. Located in an economically depressed area, the company hires and trains many who cannot otherwise find employment due to prior

alcohol or drug addiction problems. The training program is supported through grants. Its mission is to provide "…opportunities for individuals to become productive community citizens." For more information, see the Nu-Blend website at www.nublendpaints.com.

8.3.5 LAURENTIDE RESOURCE - PAINT RECYCLING COMPANY

The Paint Recycling Company, located in the province of Nova Scotia, Canada, started research and development of post-consumer paints in the late 1980's. By 1992, the company was collecting and processing post-consumer paints in Eastern Canada. The company formed a new partnership with Société Laurentide (paint manufacturer) in 2001 and currently manages industry stewardship programs in the provinces of Quebec and Nova Scotia. The Paint Recycling Company takes leftover post-consumer paint from residents in the province for $1.50 per gallon in one-gallon containers. The company then sorts it into 25 oil-based and latex colors, and bulks the paint in drums that are sold through its partner, Laurentide. Laurentide blends the paint and markets it through a variety of labels including Nature's Stain post-consumer paint. Key to the partnership is a strict sorting protocol developed by Laurentide to simplify paint reprocessing. The subsequent products are not marketed as containing post-consumer content, but as virgin paint. The company has also developed recycling markets for its metal and plastic containers and for its solidified latex paint waste, which is sold for blending with cement. In 2002, the National Research Council of Canada and the Canadian Manufacturers Association recognized the company for its efforts in Sustainable Development.

8.3.6 VISIONS RECYCLING, INC.

Visions Recycling, Inc.™ (VRI) is a latex paint reprocessor located in Sacramento, California. VRI receives latex-based paints from city and county collection sites, homeowners, and participating contractors. They sort, test, and remanufacture paint using virgin materials supplied by participating manufacturers to produce low-cost, high-quality, post-consumer latex paint. VRI produces highly viscous, adherent paint for primer, rough coat, and finish surface paint applications. VRI does not accept post-consumer paint that has been bulked at the collection site.

VRI's customers include local, state, and federal contractors and organizations including Caltrans, county hospitals, The Presidio, California Department of General Services, California Department of Corrections, and multiple California school districts. For more information, see VRI's website: www.visionsrecycling.com.

8.3.7 PEINTURE RÉCUPÉRÉE DU QUÉBEC – LAURENTIDE RESOURCE

Located in Victoriaville, Quebec, Canada Peintures Récupérées du Québec inc. recovers and recycles post-consumer paint and containers in the province of Quebec. The company, which employs over 50 people, was founded in 1992 and acquired by Société Laurentide in 2003. It currently sells its products under the name Peinture Récupérées.

With the cooperation of municipalities and building supply and hardware distribution chains, Peintures Récupérées du Québec inc. has organized a paint recovery network that covers the entire

province of Quebec. The 45,000 square foot facility recovered two million kilos (4.4 million pounds) of post-consumer paint in 2001 and 2.5 million kilos (5.5 million pounds) in 2002.

Peintures Récupérées du Québec inc. is currently the only company in Quebec that markets recycled paint. Paint sales are divided into two categories: retail sales of Peintures Récupérées products, which represent 60% of the production, and exports, accounting for the remaining 40%. Regular export customers include Cuba, Haiti, Angola, and Guinea.

8.4 Government Recycled Content Paint Procurement Initiatives

8.4.1 United States Environmental Protection Agency

Under Section 6002 of the Resource Conservation and Recovery Act (RCRA), the U.S. EPA is required to designate products manufactured with recovered content. Government agencies, including state agencies using appropriated federal funds for procurement, are required to purchase U.S. EPA-designated items, as codified in 40 CFR part 247, Comprehensive Guideline for Procurement of Products Containing Recovered Materials (CPG) and Recovered Materials Advisory Notices (RMANs).

Executive Order 13101 (September, 1998) Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition states that agencies shall ensure that their procurement programs require *every* purchase of designated products to meet or exceed the EPA guidelines. For reprocessed and consolidated latex paints, U.S. EPA recommends 20% total recovered content with 20% post-consumer recovered content for white, off-white, and pastel colors and 50 – 99% total recovered content with 50 – 99% post-consumer recovered content for gray, brown, earth tones, and other dark colors.

8.4.2 California

The California Public Contract Code section 12170 requires state agencies to purchase recycled paint containing at least 50% post-consumer paint. The Department of General Services has awarded a statewide contract for purchasing recycled latex paint by state agencies and any local government body or corporation empowered to expend public funds. The State Agency Buy Recycled Campaign Procurement Report for Fiscal Year 2000/2001 shows that 75,161 gallons of recycled paint were purchased, which represents 25% of all reported paint purchases.

8.4.3 Massachusetts

In 1996, Massachusetts first developed a statewide contract for the purchase of recycled paint, awarding the contract to an in-state paint manufacturer that produced a paint containing 50-100% post-consumer content. The paint was available to all state and local agencies in the state. Added to the list in the next year was a second manufacturer that produced a 50% post-consumer paint. The recycled paints sold for less than their virgin counterparts. The Executive Office of Environmental Affairs (EOEA), working in conjunction with the Operational Services Division, provided free paint to state agencies in exchange for their evaluation of the product. EOEA also worked with the

Department of Environmental Protection (DEP) to include paint procurement as one criterion by which municipalities would receive state recycling incentive grants. To receive the grants, municipalities were required to attend a workshop and report on the amount of recycled products (including paint) purchased.

Unfortunately, both manufacturers of recycled paint ceased their operations and the contract expired in 1999. At that time, the state was purchasing an estimated $46,000 annually in recycled paint, which represented approximately 21% of all paint purchases in FY1998. Massachusetts is currently in the process of including a request for recycled and/or reprocessed and low VOC paints under the upcoming Building Materials and Supplies contract. The specification requests that such paints meet the Green Seal standard, GS-11 for maximum acceptable VOC levels and/or contain little or no heavy metals or toxic ingredients. The bid process also encourages vendors to offer a take-back program for paint. Once awarded, Massachusetts will work to educate and encourage state and local agencies to purchase environmentally preferable paints and use paint take-back services.

8.4.4 MINNESOTA

Minnesota has state procurement contracts for two grades of recycled latex paint – reprocessed and reblended. The grade of paint is defined by the number of tests to which the paint is subjected and the percent of recycled materials it contains. Both grades of recycled latex paint on the state contract are less expensive than the non-recycled brands, with savings as high as 50 percent.

The contract specifies that reprocessed paint must contain a minimum of 20% post-consumer content material and undergo extensive testing to ensure performance that matches or exceeds non-recycled paints of the same grade. Hirshfield's won the Minnesota State contract for reprocessed paint.

The contract specifies that reblended paint must contain a minimum of 80% post-consumer recycled content material while still adhering to testing standards that ensure paint quality. The state contract for reblended paint was awarded to Amazon Environmental, Inc.

Minnesota's Solid Waste Management Coordinating Board adopted a resolution on April 25, 2001, encouraging Minnesota state agencies, counties, cities, and other jurisdictions to begin using or increase the use of recycled content paint for government projects. The resolution asks each participating SWMCB county to incorporate into their contract specifications a requirement and waiver provision that recycled paint be used rather than virgin paint on county construction and renovation projects. For more information, see the Office of Environmental Affairs website: www.moea.state.mn.us/lc/purchasing/latexpaint.cfm.

8.5 Government and Industry Partnerships

8.5.1 BENJAMIN MOORE – PSI – MASSACHUSETTS PROGRAM

Over the past three years, the Product Stewardship Institute, Benjamin Moore, and the Massachusetts Department of Environmental Protection (MA DEP) have piloted the take-back of leftover Benjamin Moore latex paint. In 2001, roughly 1,250 cans of latex were collected at permanent paint collection sites in five greater Boston municipalities. Most cans were partially full, and roughly 280 gallons were reclaimed. Benjamin Moore company trucks picked up paint from the municipalities on backhauls from customer deliveries. The five communities involved in the pilot saved a total of up to $3,500 rather than having that paint transported to Ontario, Canada, to be recycled, which was their next best alternative. In 2002, Benjamin Moore expanded the initiative to additional permanent paint collection sites in Massachusetts and offered the program to state and local officials in New Hampshire, Connecticut, and Dallas, Texas.

In 2002, 1,712 cans were collected (85% gallon containers, 15% quart containers) from six Massachusetts communities. On average, cans were roughly 30% full and 73% of containers could be reworked (see Figure 5). Staff estimated it took roughly three hours to sort a tote of paint cans. According to Benjamin Moore, there was little difficulty reworking the paint and relatively little labor after cans were sorted. Non-recyclable paint was returned to the participating communities at the end of the paint collection season, which runs from the spring through the fall.

Figure 5: 2002 Benjamin Moore -Massachusetts Take Back Results

Description	Number	Percent
Good Reusable Paint	1,256	73%
Solid Paint	148	9%
Oil Paint	251	15%
Frozen Paint	0	0%
Contaminated (Bad Odor)	27	2%
Other Paint Manufacturer	30	2%
Total	1,712	100%

In 2003, the program was expanded to seven communities in Massachusetts and to Fort Worth/Dallas, Texas. The Benjamin Moore Ft. Worth and Dallas area program collected 1069 cans, with 95% reworkable and 5% unusable.

8.5.2 PARTNERS FOR WASTE PAINT SOLUTIONS – ILLINOIS EPA

Paint comprised roughly 50 percent of the material collected during the Illinois EPA's (IEPA's) one-day HHW collection event. To address the large volume of paint, the agency initiated the "Partners for Waste Paint Solutions" Program. These partnerships offer consumers the opportunity to deliver unwanted paint to local participating paint retailers, where it will be reformulated or remixed for reuse. IEPA pays a contractor to pick-up unusable paint.

Under this program, retailers and local governments volunteer their facilities to collect latex or solvent-based paint, or both. The IEPA provides training on procedures, such as sorting, mixing, and clean up, signs to ensure safe storage and management, as well as program advertising and signage. The retailer or other participating organization determines the collection logistics, such as the fee (if any), days and times of collections, maximum acceptable container size, and the types of paint products that will be accepted. Consumers bring usable or unusable paint for reformulation, reuse, or disposal to the drop-off location, and staff determines whether the paint is acceptable. If the paint is usable, it is combined into five-gallon containers for reuse or reformulation. The IEPA also arranges for the recycling of steel containers. If the paint is unacceptable, it is placed in special containers and IEPA arranges for transportation, assumes generator status, and pays all paint disposal costs.

In Fall 2002, IEPA listed 19 locations on its website including nine retail stores, two recycling companies, six local government sites, and two county sites. Fees collected from consumers ranged from $0.10 to $1.50 per container and, according to retailers interviewed for this report, the fees were not a significant deterrent to participation. One retailer commented that the program helps to foster customer loyalty. However, while he believes it is the right thing to do for his community, he also noted that the program has not necessarily increased his customer base. Not all participating retailers have been successful in selling the reblended paint in their stores. Table 10 below provides IEPA program data for the past seven years.

Table 10: IEPA Partners for Waste Paint Solutions

State Fiscal Year	Gallons Reused	Gallons Disposed	Costs Incurred	Cost per Gallon	Percent Reused
1996	5,000	2,805	$17,773	$2.28	64%
1997	10,800	6,775	$33,844	$1.93	61%
1998	6,495	17,545	$62,902	$2.62	27%
1999	13,334	25,135	$96,159	$2.50	35%
2000	6,723	16,445	$82,222	$3.55	29%
2001	10,500	27,335	$116,188	$3.07	28%
2002	16,200	27,225	$123,094	$2.83	37%
Totals	69,052	123,265	$532,181	$2.77	36%

During a seven-year period, Partners for Waste Paint Solutions received $532,181 from IEPA's Solid Waste Management Fund, generated from local landfill tipping fees. Funding covers supplies, labor for the pickup and delivery of containers, and shipment and disposal of all collected paint. For more information on IEPA's program, see the IEPA website: www.epa.state.il.us/land/citizen-involvement/paint.html.

8.5.3 OREGON PAINT SMART

From 1997-2000, the Oregon Department of Environmental Quality (DEQ) ran a pilot project where retail paint stores collected leftover paint from residents for recycling or safe disposal. Eleven retail stores in four communities participated in this pilot program. The stores accepted latex and oil-based paint in sealed original containers from area residents (who are allowed up to 10 containers

per customer in five-gallon size or smaller). Leftover paint from contractors was not permitted in the program. The paint was placed in drums at the stores and then transported to the Metro, OR facility for processing. Good quality latex paint was reblended and poor quality latex paint and all oil-based paint was incinerated or disposed in a hazardous waste landfill. DEQ provided training and advertising (print, radio, and direct mail). Retailers provided significant in-kind services including transportation of collected paint, printing of brochures, and the use of staff and storage facilities. The program was 30% less expensive for the agency, on a per-gallon basis, than paint collection at HHW facilities or events (see on page 20). In 2000, Oregon DEQ withdrew from the program citing needs to focus on other waste streams. Retailer participation subsequently has decreased from eleven to six stores.

8.5.4 KELLY-MOORE PAINT COMPANY AND SAN BERNARDINO COUNTY

In April 1992, the Kelly-Moore Paint Company, headquartered in San Carlos, California, began working with the San Bernardino County Department of Environmental Services, to provide a safer, more environmentally responsible way to dispose of leftover latex paint. Through this cooperative effort, the County of San Bernardino delivered excess latex paint collected through it's HHW program to Kelly-Moore's San Bernardino factory. Kelly-Moore, in turn, recycled the collected paint into a 100% post-consumer paint product. San Bernardino County then used the recycled paint for graffiti abatement, low cost housing, and volunteer beautification projects. As a result of this initiative, Kelly-Moore formed a separate operating division known as E-Coat Recycled Paint Products. (See section 8.3.2)

8.5.5 PRODUCT CARE ASSOCIATION

Product Care's paint stewardship programs in British Columbia and Nova Scotia demonstrate the cost and environmental effectiveness of a province (state) wide, industry-managed program. Product Care is a not-for-profit industry association formed by "brand owners" of product sectors, including paint and coatings, flammable liquids, pesticides, and petroleum products in response to provincial stewardship regulations. Under those regulations, the "brand owners" of the regulated products must provide a way for consumers to dispose of their leftover products, and then manage the collected material in an environmentally responsible manner.

In British Columbia, with a population of about 4.2 million people, Product Care contracts with more than 100 depots across the province, where consumers may return leftover paint, and 35 depots where consumers may dispose of flammables, gasoline, and pesticides at no charge. In 2002, Product Care collected about 400,000 US gallons of leftover consumer paint in the British Columbia province. This represents about 5% of new paint sales by volume. Since program inception, collection rates have increased at an average rate of about 10 percent per year. The collected paint is managed in a number of ways, including paint give-away to individuals and non-profits, paint reprocessing, fuel blending, and concrete manufacture. Empty metal and plastic cans and pails are also recycled. Product Care's Nova Scotia program is operated in cooperation with RRFB Nova Scotia, the provincial beverage container depot system. After the program's first year, recovery rates are at about 1.6% of new paint sales.

The program is funded by eco fees charged to the industry "brand owners" based on the volumes they sell in each regulated province. In most cases, the eco fees are recovered at the retail level as a visible "eco fee" which builds awareness of the program. To date, eco fees have never been raised, and have been reduced in certain categories.

Product Care is affiliated with Eco Peinture, the Quebec paint stewardship program, and the programs are harmonized where possible. Product Care currently manages paint stewardship programs in British Columbia (beginning in 1994) and Nova Scotia (beginning in 2002). Paint stewardship regulations are expected in other provinces, including Ontario, Alberta, Saskatchewan, and New Brunswick within the next year or two. Product Care's objective is to establish a harmonized multi-provincial paint/hazardous solid waste stewardship program, giving industry an administratively easy "one stop" solution. For more information, see Product Care's website: www.productcare.org.

8.5.6 MUNICIPALITIES AND LOCAL PAINT MANUFACTURERS

Several municipalities that PSI interviewed contract with local manufacturers to reprocess paint that is collected at municipal collection programs. For example, some communities (e.g., Broward County, FL) send paint to be consolidated and then shipped back to them for resale as recycled paint or to give away to residents. Other communities recycle their own paint collected from residents (Metro), and others employ a state-wide contract (Massachusetts) where the contracted hauler takes all latex leftover paint for consolidation, blending, packaging, and resale (see Table 11).

Table 11: Municipal Latex Recycling Programs

State/Local Government	Notes
Massachusetts	Statewide contract with Hotz Environmental. Hotz sorts, recycles and sells paint product.
Hennepin County, MN	Paint reblended/recycled by Hirshfield's and/or Amazon.
Broward County, FL	Includes pick up of paint, transportation, reblending, packaging in 5-gal pails and delivery of finished product to the County; or $3.75/gallon (excluding pick up and transportation to recycling location). Contract allows for a 20% variance in color
Sarasota County, FL	Includes pick up of paint, transportation, reblending, packaging and delivery of finished product to the County. Contractor must match the county's color request. Cost is $5.50/gallon for five-gallon pails. Send only the light color tones for recycling; all medium and dark tones are sent for disposal.

9. THE MARKET FOR RECYCLED CONTENT PAINT

This section includes a review of the markets for recycled content paint, including consolidated, reprocessed, and reblended paints. In this section, PSI estimates the total supply of recyclable latex and oil-based paints, and provides an overview of markets for recycled paint including contractors, consumers, and government purchasers. Barriers to the sale of recycled paint are discussed and the section concludes with a review of several efforts to promote the procurement of recycled content and low VOC paint by governments.

9.1 Potential Annual Supply

Not all paint that is collected can be recycled. Some paint is hardened, contaminated, or has been otherwise rendered unusable due to freezing, bacteria, and other factors. Table 12 presents an estimate of the potential supply of leftover paint available for recycling into paint and non-paint products. The following assumptions were made for this estimate:

- The total annual supply of leftover consumer paint is estimated to be 34 million gallons based on figures developed in Section 6.1 on page 16.
- The ratio of leftover latex paint to leftover oil-based paint parallels paint sales, which are 80% latex paint and 20% oil-based paint.
- Roughly 65% of leftover latex can be recycled back into paint; the rest must be disposed or recycled into other products (e.g., cement)[12].
- Little data is available regarding reprocessing rates for oil-based products, so assumptions similar to that of latex will be used – that 65% of leftover oil-based paint can be recycled into paint products.

Table 12: Potential Supply of Leftover Paint

Total Leftover Paint Available for Collection (mil gal)	35.0
Latex Paint	
% of Paint Sales	80%
Amount Latex Available for Collection (mil gal)	28.0
% Usable	65%
Total Recyclable to Paint (mil gal)	18.2
Total Recyclable to non-paint products (mil gal)	9.8
Oil-Based Paint	
% of Paint Sales	20%
Amount Oil-based Available for Collection (mil gal)	7.0
% Usable	65%
Total Recyclable to Paint (mil gal)	4.5
Total Recyclable to non-paint products (mil gal)	2.5

[12] The 65% reprocess rates reflect a 45% reprocess rate based on data collected by Amazon Environmental in MN (Jan – Nov 2001) and an 80% reprocessing rate based on data collected by the Metro, OR latex recycling plant (2000-2001).

Note that the estimates above do not include volumes generated by contractors, dealer miss-tints, paint manufacturers, private business (corporations), and public agencies (e.g., schools or public works departments). There are numerous factors that could impact the overall supply of leftover paint.

- The quantity of supply is impacted by volumes collected by non-municipal entities, including those generators listed above.
- The quality of latex paint collected by municipal government is impacted by both consumer and collection facility paint management practices such as proper paint storage and sorting.
- The quantity of latex paint collected by municipal government will vary with government funding for collection programs. Many local governments discourage and, in some cases, prohibit the public from bringing latex paint to collection sites and events.

9.2 Demand for Recycled Paint

Most recycled paint manufacturers state that their greatest challenge is finding buyers for reprocessed paint – particularly for non-white paint. For example, Amazon Environmental accepted 700,000 pounds of leftover latex paint from municipal collection programs and others in California over a year's time, but because demand for their paint products was low, they only processed 100,000 pounds into paint. The other 600,000 pounds were processed into a cement additive product. The experience of Kelly-Moore, a manufacturer of both virgin and reprocessed paint located in California, is similar to that of Amazon's. Company officials note that the market for recycled paint in the 10 western states is very weak, with sales mostly to the state and federal government, as well to farms for fence paint and other low-end applications. Hirshfield's Paint also had a similar experience with manufacturing a recycled content paint that found few buyers. According to one company official, its firm has "warehouses full of recycled paint."

The Metro, OR latex paint program has had success selling paint to a variety of customers, including the general public, commercial entities, and non-profits (see Table 13). Demand for white and off-white outstrips supply, but demand for many non-white colors (especially pinks) remains an issue. Even though Metro gave away 39,700 gallons of paint between August 1999 and June 2002, Metro still had 64,000 gallons of unsold paint in inventory at the end of the FY 2002. However, by the end of the 2002 calendar year, they had sold 110% of production, including much of the stockpiled paint.

Table 13: Metro Sales by Customer

Customer	Gallons Sold	Transactions	% of Total Sold
General Public	49,023	3,994	38%
Commercial	36,436	1,357	28%
Non-profit Organizations	24,701	550	19%
Resellers	11,532	50	9%
Government Agencies	7,160	181	6%
Total	128,852	6,132	100%

Recycled content paint, depending on how it is reprocessed, can be used in most interior and exterior architectural applications such as wallboard, ceilings, and trim; gutter boards; and concrete, stucco, masonry, wood, and metal surfaces (EPA CPG). Consolidated paint is thought to have more limited

applications, since it is not reprocessed to meet performance standards such as durability and hiding power. Most paint reprocessors offer 8-10 colors and a variety of finishes (e.g., flat, semi-gloss, gloss). The following subsections examine the main recycled paint market segments: contractors, homeowners (known as Do It Yourselfers, or DIYs) and government agencies.

9.2.1 PAINTING CONTRACTORS

In 2000, roughly 63% of architectural coatings were applied by painting contractors and 37% by DIYers. Contractors purchase most of their paint at paint retail outlets. Retail outlets offer many advantages including low pricing, product availability, credit terms, job-site delivery, and multiple container sizes. Depending on volume, contractors can receive significant discounts (25-40%) that reduce the price below those found at home centers and discount stores. Manufacturers typically formulate special paint for the retail outlets that are known as "professional grade" products. These products are formulated with mid-range performance, excellent application properties, and lower cost materials. Retail outlets allow manufacturers to sell large quantities of paint without having to share the profit margin with other retailers. Brand name paints are often important to contractors, since some customers specify the type of paint used (see Table 14).

Table 14: Architectural Coatings Market Share by Channels of Distribution, 2000

Distribution Channel	DIY	Contractor	Total
Retail Outlets	22.0%	94.9%	65.7%
Home Centers/Building Supply	46.0%	3.5%	20.5%
Discount/Department Stores	24.0%	0.2%	9.7%
Hardware Stores	6.0%	1.4%	3.2%
Other	2.0%	0.0%	0.8%
Total	100%	100%	100%

Source: Credit Suisse First Boston, 2001.

9.2.2 DO IT YOURSELFERS MARKET (DIY)

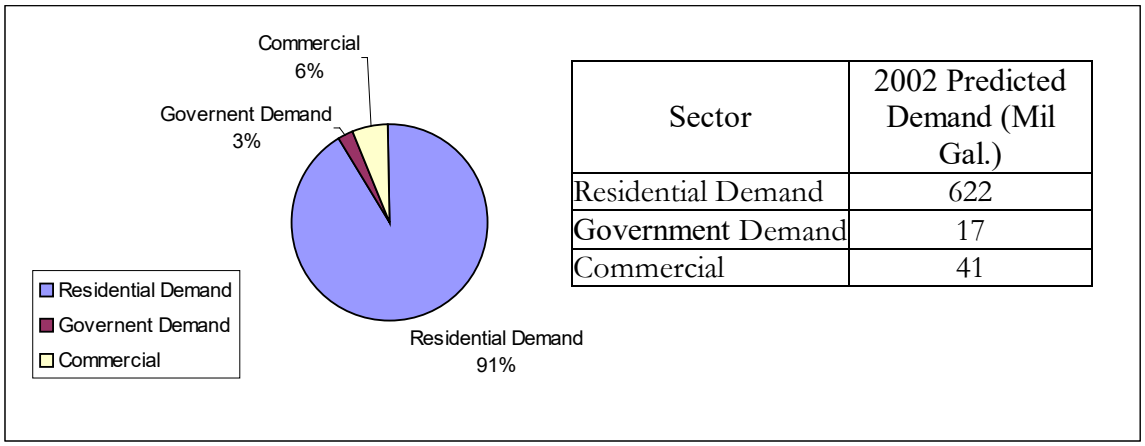
As shown in Table 14, DIYers purchase from a variety of retail channels, including retail outlets, home centers, discount stores, and independent hardware stores. However, DIYers purchase almost twice as much from home centers than from other sources. Prices are slightly higher when purchased at home centers and hardware stores (also known as independent dealers). Therefore, the DIY segment accounts for a slightly higher percentage of market value (see
Table 23 on page 67). The DIY market is built in part on the use of water-based latex paints. Because latex paints are easier to use, this has reduced the need for professional painters for many projects.

9.2.3 GOVERNMENT

The public sector building market, including federal, state and local government, comprises roughly 3% of architectural coating demand (see Figure 6). Most government buildings are painted by contractors. Government has attempted to enhance the market by developing recycled content standards and encouraging government procurement officers to buy recycled paint. Unfortunately, these efforts have met with limited success. Several recycled paint manufacturers interviewed for this

report cited that, after they successfully bid on state and local government contracts, very little paint and, in some cases, no paint, was purchased from these contracts. Several firms were so discouraged that they expressed unwillingness to put the time into a future bidding process to qualify as a supplier.

Figure 6: Public Building Architectural Demand



Sector	2002 Predicted Demand (Mil Gal.)
Residential Demand	622
Government Demand	17
Commercial	41

Source: The Freedonia Group,

Despite these experiences, some state and local governments are moving forward with recycled paint procurement programs. For example, the California Integrated Waste Management Board (CIWMB) has an on-going program within its Buy Recycled Section entitled, "The State Agency Buy Recycled Campaign," also known as the SABRC. Within the SABRC mandates, state agencies are required to purchase recycled-content products in eleven categories, including paint.

Every year, CA state agencies must report the number of gallons of paint purchased and the amount spent on recycled-content paint in comparison to the overall amount of paint purchased. According to SABRC reports for fiscal year 2000-2001, the State spent $428,394 for 75,161 gallons of recycled-content paint and $2,830,998 for 297,395 gallons of both recycled-content and virgin paint. This is equivalent to nearly one gallon of recycled-content paint for every four gallons of paint purchased.

9.2.4 INCORPORATING LEFTOVER LATEX PAINT INTO OTHER PRODUCTS

Post-consumer latex paint can also be incorporated into lower grade products. For example, Amazon Environmental also manufactures Processed Latex Pigment (PLP), a patented additive for Portland Cements. Hernando County in Florida uses leftover paint as alternative daily cover for its landfill. Researchers at Rutgers University are experimenting with other markets for leftover latex paint, including colored concrete products. While reblending paint into new paint products is still the highest value added market for leftover paint, the soft market for non-white colors is driving paint resellers to find other uses for leftover paint. Other than the cement market, current alternative outlets for leftover paint are scarce.

9.3 Barriers to Expanding the Market

Barriers to market expansion include general negative perceptions regarding recycled paint quality, the lack of color selection, difficulty in color matching, and limited availability of specific finishes (e.g., low luster, gloss). Other barriers include consumers' fear that the leftover paint could be contaminated with hazardous materials, and concerns by manufacturers regarding liability and the threat that expanding recycled paint production might negatively impact sales of virgin products.

9.3.1 Color Selection, Color Matching, and Finish

Consumers often like to choose very specific colors for their painting projects but most recycled paint manufacturers are unable to provide a wide variety of choices. To address this, Metro, OR has experimented with blends of their nine colors, resulting in an additional 192 colors that customers can create by mixing two or three colors of paint in equal proportions.

Some consumers want assurances that they can exactly match the color and sheen at any time in the future. But with most recycled content paint, there is a slight variation in the colors produced from batch to batch. To guarantee an exact match, the paint would have to come from the same batch, unless the retailer has a computer-aided color matching system. In addition to color selection and matching, some consumers want a specific paint finish such as a flat, pearl, semi-gloss, or high gloss, or want paint that is clearly specified as interior or exterior grade. Color matching equipment can almost exactly match colors but may not match the exact sheen of the paint.

Paint color selection, matching, and finish are not issues when post-consumer paint is incorporated in small proportion with virgin materials (e.g. <20% recycled, >80% virgin). In these cases, the high virgin material content allows the manufacturer to add recycled content to the batch without compromising color and grade requirements.

9.3.2 General Negative Perception of Recycled Paint

Products that contain recycled content are often successfully marketed to the niche of environmentally conscious consumers. In the case of office paper, consumers will often pay a premium for paper with recycled content. However, recycled paint does not share that market appeal. Knowledgeable state and industry representatives interviewed for this report noted that many consumers react negatively to recycled content in paint. Purchasers view "recycled paint" as an inferior grade of paint. While some recycled paint manufacturers are selling their products, they are doing so primarily by targeting the niche of price-sensitive consumers and charging significantly less than the price for the equivalent virgin paint. This strategy of targeting a low price point results in low profit margins. Therefore, most manufacturers spend little on marketing and brand-name promotion. Most consumers believe that the quality of a product is reflected in the cost, so the strategy of making sales based on a low price also perpetuates the consumers' perception that recycled paint is of inferior quality.

Virgin paint manufacturers invest heavily in their brand names with the goal of achieving strong brand-name recognition and having consumers associate their paint with desirable attributes such as quality, performance, and value. This strategy apparently works because paint comprises only 10-

15% of the cost of a typical paint job, and most consumers will pay extra for brands of paint that they associate with quality. Given the consumer perception that recycled paint is of inferior quality and the slow sales of "environmentally friendly" paint in general, paint manufacturers are understandably reluctant to introduce paint lines that are marketed as "recycled paint." One recycled paint manufacturer, Nu-Blend Paints, changed its name and the brand name of its paint, calling it reblended paint instead of recycled. Several other paint manufacturers that blend post-consumer paint with virgin material into products do not advertise the post-consumer paint aspect of their products since doing so appears to have no market advantage.

9.3.3 NEGATIVE PERFORMANCE AND QUALITY PERCEPTIONS

The quality of recycled paint varies significantly, as does the quality of virgin paint. However, with virgin paint, most consumers have confidence that they will get a high quality product if they purchase a premium grade of paint from any of the leading paint manufacturers. Manufacturers help to build consumer confidence by offering long performance warranties (up to 25 years) on their premium products. Consumers have more difficulty identifying quality recycled paints. Recycled paint is often sold by companies with little brand-name recognition, and performance warranties are typically for shorter time periods, if they are offered at all.

Another important difference between the way virgin paint and recycled paint is marketed is that virgin paint is formulated and marketed for specific applications. For example, manufacturers offer ceiling paints that are formulated to reduce splatter, exterior paints that are weather and mildew resistant, and stain-blocking primers. In contrast, recycled paint is typically marketed as a general-purpose paint and not formulated for optimum performance for specific applications. The "one size fits all" approach to marketing recycled paint may not work with consumers that feel they will get better performance with a specially formulated paint.

A number of studies have shown that reprocessed paint (containing 50 to 99% post consumer paint) does meet the performance requirements for most standard architectural coating applications. For example, a latex paint study conducted by the California State Polytechnic University (Cal Poly) found that latex paints containing post-consumer materials could be manufactured to provide consistent performance, normal coverage, surface hiding, and durability (Cal Poly 1993). The Paint Technology Center at the U.S. Army Construction Engineering Research Laboratories (USACERL) performed similar tests to confirm that reprocessed latex paint meets the Federal General Services Administration performance criteria for different applications. USACERL found that the reprocessed paints met the specifications for "recycled" latex paint, interior latex paints, and exterior latex paints. Product testing by both Cal Poly and USACERL showed that reprocessed latex paints provide the same coverage as virgin latex paints and do not require more frequent repainting. Furthermore, reprocessed and consolidated paint meet specifications for sag resistance (a measure of a paint's tendency to run on vertical surfaces), and scrub resistance (an indication of paint film resistance to repeated washing or scrubbing). EPA also found that none of the users it contacted had experienced problems with paint coverage or durability (EPA CPG). Metro, OR has also extensively tested its recycled paint products. The results of these tests, conducted at the independent Rodda Paint laboratory in Portland, are listed below.

Scrub-resistance – This test uses a mechanical scrub brush on a sample of paint that has dried for seven days. The result is based on the number of back-and-forth cycles completed before the paint starts to

abrade through to the surface below. Sixteen batches of Metro Paint were tested; results ranged from 208 cycles to 483 cycles. These results are in the normal range for low-sheen paints. They exceed the requirement of the Green Seal Environmental Standard for Paint.

Stain resistance and washability – Three colors of Metro Paint (off-white, tan and blue) were stained with various household products and then washed according to a standard protocol. No erosion or change in gloss or color was noted after washing. The degree to which the stains were removed was evaluated; some stains were completely removed, others left some residue. On average the colors tested rated 8 on a 1 to 10 scale, with 10 being the most desirable rating.

Wet adhesion – This test measures the degree to which a dry paint film adheres to surfaces, particularly under wet conditions. In this test, a dry paint sample is soaked in water, scored with a knife, then scrubbed repeatedly. Samples of each color of Metro Paint were tested; no blistering, peeling, or flaking was observed during the procedure, indicating a high degree of adhesion.

Hiding power – This test, generally conducted on white paint, measures the ability of the paint to obscure the surface to which it has been applied. A comparison is made between the reflectance of the paint when applied over a black surface compared to that same paint when applied over a white surface. Paints with good hiding power will have nearly the same reflectance in both cases. The reflectance ratio for Metro's off-white paint was 96 percent, indicating excellent hiding power, and exceeding the Green Seal Environmental Standard for Paint.

Accelerated weathering – In this test, samples of paint are subjected to alternating cycles of ultraviolet radiation and moisture at an elevated temperature. This simulates repeated exposure to adverse weather conditions, compressed into a relatively short time frame. A sample of each color of Metro Paint was placed in Rodda's accelerated weathering machine for 2,000 hours. No blistering was observed when the samples were removed, indicating excellent adhesion and resistance to moisture. Some color fading and gloss reduction resulted from the extreme conditions. However, this does not necessarily correlate with the results of actual weathering in exterior applications.

Resistance, flow, and leveling – These tests measure how paint will behave when it is applied. Metro Paint received the highest possible rating for these properties. Sag resistance is a measure of paint's tendency to flow downward or "run" when applied. Flow and leveling measures a paint's ability to flow out and obliterate any surface irregularities. Eight colors of Metro Paint were tested for these two properties. For sag resistance all received a 12 (most desirable) on a 1 to 12 scale; for flow and leveling they received a 0 on a 0 to 10 scale, with 0 being the most desirable rating.

Roll out – In this test, paint is rolled out using a standard roller onto special contrast paper to determine the degree of spatter, foaming, and so-called "paint-picking" in which paint sticks to the roller rather than the painting surface. When Metro's off-white paint was tested, no spatter, foaming or paint-picking was observed, indicating that the paint has excellent roller application qualities.

It is important to note, however, that paint with significant levels of post consumer leftover paint is not appropriate for all applications. Some applications require high levels of mildew resistance (e.g., bathrooms), high scratch resistance (interior trim), or greater than normal adhesion (unprimed surfaces).

9.3.4 INDUSTRY SPECIFICATIONS

Some procurement specifications, such as those used by government agencies and architects, require paint to meet industry standards, such as the Master Painters Institute Standard. Not all recycled content paint can meet all of the specific performance and quality specifications. For example, consolidated and some reprocessed paints cannot meet sheen or color-matching requirements.

9.3.5 HEALTH AND SAFETY, LIABILITY, AND THE COMPOSITION OF RECYCLED PAINT

The potential for contamination of post-consumer leftover paint with hazardous materials is frequently cited as a barrier to the expansion of the recycled paint market. For some manufacturers, the potential liability makes consideration of manufacturing recycled paint untenable. This barrier can be divided into three inter-related concerns: (a) one cannot be certain of the composition of recycled paint; (b) contamination and the unknown composition may present risks to consumers; and (c) the uncertain composition leads to unacceptable liability for some companies. Each of these issues are discussed in greater detail in this subsection.

Paint recyclers counter that they employ visual sorting protocols and periodic chemical constituency tests to ensure that their paint does not expose the consumer to hazards beyond those from virgin paint. Post-consumer recycled paint manufacturers point out that they are working with a blend of the same products made by many North American paint manufacturers, which is an overall high quality feedstock. Operations such as Metro, Oregon, open and inspect every can. Older cans of paint often do not pass the quality inspection, and won't make it into the recycled product. However, cans with old paint or some that contain a small amount of contaminants will, on occasion, inevitably slip through the sorting protocol. Recyclers believe that these incidents are rare enough and low enough in volume that the safety and quality of any 300-gallon batch will not be compromised. They state that the occasional testing they perform helps confirm this.

Nevertheless, it is a fact that recyclers cannot be as confident of the exact chemical composition of their paint when compared to virgin paint products. To prepare Material Safety Data Sheets (MSDS) and provide proper warning and chemical constituent information for the label, recycled paint manufacturers profile their paint and represent the chemical constituents in the paint by using ranges – a practice that is accepted when preparing MSDSs. In our research, we found several studies regarding the levels of hazardous materials in recycled paint. These levels were below regulatory thresholds for paint products, but did exceed those set by Green Seal (and others). Section 10.2 (page 59) discusses this issue in more detail. The potential health and safety risks lead some to recommend that recycled paint products be used for exterior applications, or for interior situations where the painted area is well ventilated and not inhabited for a time period following paint application. But for others, this unknown risk is unacceptable from a product stewardship standpoint – since product stewardship applies to paint throughout its lifecycle, including human exposure during paint application.

To illustrate the point, one virgin paint manufacture articulated the following potential scenario of which they were concerned. A consumer could become concerned about exposure from paint of their child and other family members and call the recycled paint company's hot line. The company could not

definitively tell the consumer what was in their can of paint and the accompanying hazards associated with those constituents. In the event of a civil suit, the manufacturer could not definitively tell what was in its paint. Regardless of whether the paint is safe or not, this uncertainty could be sufficient to expose the manufacturer to financial damages. Some paint manufactures that have these liability concerns disapprove of paint recycling even by other companies; since they fear a high profile incident would damage the industry.

9.3.6 Regulatory Barriers to Paint Recycling

Regulatory barriers to paint recycling can be divided into two main categories: (a) VOC restrictions and (b) federal and state regulation of handling and transporting leftover paint. Certain California air districts and Delaware have adopted very strict VOC restrictions, sometimes as low as 50 grams/liter. (This issue is examined in detail in Section 10.1.) While post-consumer recycled paint products have been able to meet federal VOC standards, they have had difficulty meeting some of the very low VOC restrictions proposed in California and New England. Since leftover paint contains older paints, they often lag behind the newer, lower VOC paints entering the marketplace. Several recycled paint manufacturers interviewed for this study indicated they would seek an exception to the VOC rules to allow them to continue to market their product in these regions.

There are few regulatory barriers to latex paint recycling since most states do not regulate it as a hazardous waste even after it has been collected. Massachusetts is one exception to this rule, since once paint (latex of oil-based) is collected from consumers, it must be managed as a federally regulated hazardous waste requiring a manifest and generator number.

Regulatory barriers to the collection and transportation of oil-based paint wastes are more prevalent. In some states, any entity that collects oil-based paint becomes the "generator" of a regulated hazardous waste and is responsible for proper transportation and disposal of the material. In all states, those who transport oil-based paint waste must comply with Department of Transportation regulations. This may serve as a disincentive for non-municipal collection of oil-based paints. Government officials have devised means of circumventing this issue by assuming the generator responsibilities themselves. For example, the IEPA accepts the legal responsibility as the generator for any oil-based paints collected by retailers that participate in its Partners for Waste Paint Solutions program. Regulatory barriers relating to leftover paint storage and transportation are covered in detail in Section 10.4 on page 63.

9.3.7 Recycled Paint May Impact Paint Manufacturer Margins

According to some paint industry officials interviewed for this study, many large national paint manufacturers fear that the development of a large-scale recycled paint industry could compete with sales of virgin paint. Generally speaking, recycled content paint sells at a discount compared to mid and high-grade paint products. Furthermore, the profit margins on recycled content paint tend to be lower than on higher-grade products.

In addition, the paint industry's growth is threatened in part by the current global economic slowdown, but also by alternative residential coverings (such as vinyl siding) and the growth of large mass merchandisers. Vinyl siding has taken market share from wood siding in both new houses and in the retrofitting of existing houses. This trend has seriously reduced demand for exterior coatings used on new

houses and for the repainting of existing houses. In addition, vinyl windows are now standard on most new homes and have replaced wood-frame windows on many existing homes. This has reduced the requirements for exterior trim coatings.

Pricing has been negatively affected by the growing dominance of large mass merchandisers, particularly DIY home improvement centers. These retailers hold a measure of bargaining power with paint suppliers that is unprecedented in the industry. This shift represents a significant change from even a decade ago, when the marketplace was more fragmented among small hardware stores and decorating centers.

9.4 Government Efforts to Stimulate Demand

Federal, state, and local government agencies have worked to stimulate demand for government procurement of recycled content paint. These efforts have included hiring dedicated market professionals, conducting market studies, developing procurement policies, creating qualified vendor lists, and sponsoring demonstration projects. This subsection reviews several of these efforts.

9.4.1 GENERAL SERVICES ADMINISTRATION (GSA)

GSA, a Federal government agency focused on asset management, has developed specifications for reprocessed and consolidated paint. GSA specification TT-P-2846 covers three types of latex paint (interior, exterior, and interior/exterior), three classes (flat, eggshell, and semi-gloss) and three grades (A: 40% minimum volume solids, B: 30% minimum volume solids, and C: utility paint for graffiti abatement). GSA requires 50% post-consumer content for Grades A and B and 90% post-consumer content for Grade C. GSA has two types of recycled paint that can be purchased on a government-wide contract: GSA Class 1 (flat) paint in 10 colors and Class 3 (semi-gloss) paint in 13 colors. GSA's specification for all grades of recovered or consolidated latex paint contain requirements for freeze-thaw stability, application properties, odor, dry time, consistency, VOC content, and contrast ratio. For Grades A and B, the specification sets additional requirements for alkali resistance, flexibility, scrub resistance, biological growth, total solids, fineness of dispersion, and gloss. Reprocessed and consolidated latex paint meeting TT-P-2846 is available through the GSA Federal Supply Service.

In developing the standard referenced in the EPA's Recovered Materials Advisory Notice (RMAN), EPA determined that the reprocessed paint recommendations were too high for white, pastel, and white-based paints since white colors are often not segregated properly during leftover paint collection. Therefore, EPA added a separate content recommendation for these colors (see Table 15).

Table 15: EPA Recovered Materials Content Recommendations for Latex Paint

Product	Material	Post-consumer Content
Consolidated Latex Paint	Left-over latex paint	100%
Reprocessed Latex Paint Gray, Brown and Earth Tones	Left-over latex paint	50 to 99%
Reprocessed Latex Paint White, Off-White, and Pastels	Left-over latex paint	20%

GSA pre-qualifies recycled content paint vendors for government agencies to purchase paint products from under the GSA recycled paint specification, known as commercial item description (CID) A-A- 3185. GSA does not publish a report on the amount of recycled content paint purchased by the Federal government. Not all paint is purchased through the GSA contract, as some purchases are done directly by government employees at local retail outlets.

9.4.2 MINNESOTA SOLID WASTE MANAGEMENT COORDINATING BOARD

The Minnesota Solid Waste Management Coordinating Board (SWMCB) is an example of a metropolitan-area level effort to promote the use of recycled content paint. The SWMCB has developed a number of tools to increase recycle paint purchases including:

- A Powerpoint presentation designed for a government audience which describes the products and how to purchase paint;
- A recycled paint specification template to use in building construction and renovation planning and contracting; and
- Recycled paint application guidelines that detail the recommended applications for recycled paint. The application guidelines can be found in Appendix C: Paint Application Guidelines.

Using these tools, the SWMCB has been promoting recycled paint purchase by state and local government agencies. Board efforts have also included increased marketing and the sponsorship of demonstration projects. Lastly, Minnesota has included low VOC and recycled and/or reprocessed paints in the state's Sustainable Building Guidelines.

9.4.3 GREEN SEAL

While procurement guidelines have expanded the sale of recycled paint products to government markets, these same guidelines have also acted as a barrier to the purchase of recycled paint. In 1993, Green Seal, a private not-for-profit organization that develops standards for environmentally preferable products, developed a standard for architectural paint. In addition to certain performance criteria (such as hiding power, washabilitiy, and stain resistance), the standard establishes maximum VOC limits on paints and lists 25 restricted substances that should not be part of the formulation (see

Table 16 and

Table 17).

Table 16: Green Seal VOC Limits

(VOC weight in grams/liter of product minus water)

Coating Type	Interior Coatings	Exterior Coatings
Non-Flat	150	200
Flat	50	100

Table 17: Green Seal Restricted Substances

Metals
Antimony
Cadmium
Hexavalent chromium
Lead
Mercury

Preservatives
Formaldehyde

Phthalate Esters
Di (2-ethylhexyl)phthalate
Butyl benzyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate
Diethyl phthalate
Dimethyl phthalate
Isophorone

Various Petrochemical Solvents
Methylene chloride
1,1,1-Trichloroethane
Benzene
Toluene (methylbenzene)
Ethylbenzene
Vinyl chloride
Naphthalene
1,2-Dichlorobenzene
Methyl ethyl ketone
Methyl isobutyl ketone
Acrolein
Acrylonitrile

Source: Solyan, R., Aberdeen Proving Ground Study, 1999.

A 1999 Aberdeen Proving Ground (APG) study found that most architectural coatings on the market did not meet the Green Seal standards. The study evaluated 565 paints and included a screening of MSDSs for banned and restricted materials and VOC content screening and testing. MSDSs were available for only 469 of the paints. A review of those 469 paints found that 399 contained no prohibited organic compounds, while 70 paints were eliminated based on the presence of harmful ingredients. Table 18 lists each of these chemicals together with the number of paints in which they were found. Results demonstrate that paints were most often likely to contain toluene, MEK, and ethyl benzene.

Table 18. Toxic ingredients in APG Paint

Ingredient	No. Paints with Ingredient
Toluene	17
Methyl ethyl ketone (MEK)	16
Ethyl benzene	13
Lead chromate	7
Benzene	6
Formaldehyde	2
Lead	2
Methyl isobutyl ketone	2
Dibutyl phthalate	1
Lead napththelate	1
Naphthalene	1
Phenyl mercuric acetate	1

Source: Aberdeen Proving Ground Study 1999.

Of the remaining 399 paints, 118 met the standards for VOC levels as stated by the manufacturers and 281 exceeded the VOC standards and, therefore, were eliminated. Of the remaining 118 samples, 11 were no longer available on the market. From the remaining 107 paints, which met APG standards for ingredients and VOC levels based on the MSDS information, only 71 (or 66%) passed VOC testing at the Maryland Environmental Technology Demonstration Center using EPA Reference Test Method 24 (APG 1999).

Only 13% of the 565 APG paints reviewed meet the Green Seal standards. Since many virgin paints do not meet the standards, it is unlikely that recycled content paint would meet them. Furthermore each batch of recycled paint could have slight contamination of any of the 25 materials. The recycler would be forced to test each batch to ensure they meet the standard. Several federal, state, and local entities have used the results of the study to encourage the purchase of the 107 commercially available paints noted in the APG study. Furthermore, the Green Seal standard is used as the basis of other standards, such as the U.S. Green Building Council's Green Building Rating System. Therefore, although recycled content paint meets legal requirements for banned and hazardous substances, the use of eco-labels such as the Green Seal standard can act to discourage the purchase of recycled content paint since paint with significant percentages of recycled content are not likely to meet the eco-label standards.

10. REGULATORY BARRIERS TO PAINT REUSE AND RECYCLING

This section reviews three leftover paint regulatory issues. The first is VOC limits on paint (section 10.1), the second covers banned and other toxic substances found in paint products (section 10.2); and the third reviews collection, management, and transportation of leftover paint (section 10.3).

10.1 VOC Regulations on Architectural Coatings

New VOC standards for latex paint pose a potential regulatory barrier to the use of recycled paint, since recycled paint may not meet some of the more stringent standards adopted by California and being considered by some Northeastern States. Since 1970, increasingly more stringent Clean Air Act requirements on VOCs have driven the shift from solvent-based to waterborne formulations. Under the Clean Air Act Amendments of 1990, stricter VOC standards were placed on paint sold throughout the U.S. by 2000. The paint industry invested heavily in research and development to formulate products to meet these new standards that are expressed in pounds of VOCs per gallon (or grams/liter) of coating excluding the volume of water.

California and Delaware (under the Ozone Transport Commission, or OTC), are allowed by the Clean Air Act to adopt stricter standards. These two states have adopted Architectural Coating Rules for VOCs for all main types of coatings that are significantly more stringent than the federal standard (CARB 2002)[13].

Table 19 compares the federal standards with the stricter standards of California, and two counties in California that are implementing some of the strictest standards in the U.S. These new standards will be a challenge for the industry and are the focus of current research and development efforts. The architectural coatings industry fought OTC attempts to adopt the stricter California Air Resources Board (CARB) standards. Their argument is that low VOC paint does not cover well; therefore more coats are required, which increases the overall VOC use. Other OTC states are currently considering the adoption of more stringent VOC standards similar to those now in place in California and Delaware.

Table 19: Federal and California Architectural Coating VOC Rules

	Federal (g/l)	California Air Resources Board (g/l)	Antelope Co, CA (g/l)	South Coast, CA (g/l)
Flat (Interior and Exterior)	250	250 [100: 1/1/2003]	250 [100: 7/1/2001] [50: 7/1/2008]	250 [100: 7/1/2001] [50: 7/1/2008]
Nonflat Coatings	380	250 [150: 1/1/2003]		250 [150: 7/1/2002] [50: 7/1/2006]
Nonflat High Gloss Coatings	380	[250: 1/1/2003]		

1. The EPA rule states that if a coating is not defined in the table above, it falls into the flat (250 g/l) or nonflat (380 g/l) category based on the gloss level, and the applicable limit applies.
2. Under the CARB 2000 Suggested Control Measure for Architectural Coatings, a coating not defined in the table above, falls into the flat (100 g/l 1/1/2003) or nonflat (150 g/l 1/1/2003) category based on the gloss level.
3. Antelope and South Coast are air districts located in the State of California; see www.arb.ca.gov/coatings/arch/rules/ruleinfo.htm

[13] The OTC is comprised of Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont and Virginia.

Manufacturers of reprocessed paint state that their products comply with the current national standards for VOCs. For example, twenty-four batches of Metro Paint have been tested for VOCs. Results range from 30 to 100 grams per liter. This is well below the limit of 150 grams/liter for interior paints and 200 grams/liter for exterior paint for non-flat coatings used by the Green Seal Environmental Standard for Paint, the U.S. Green Building Council Green Building Rating System, and other environmental guidelines. While Metro's products are not below the Antelope and South Coast California 50 g/l standards (see Table 19), those standards do not come into effect until 2008. It is uncertain whether paint with significant percentages of leftover consumer paint will have difficulty meeting these stricter California and OTC standards since it will likely contain paint that was manufactured prior to the standard's implementation date. The lag time between when the paint is manufactured to when it is collected and reprocessed is likely to be several years and may result in higher VOC levels in paints with recycled content.

10.2 Banned and Restricted Toxic Materials

Several of the paint manufacturers interviewed by PSI expressed concern that paint collected from municipal programs could contain banned or restricted materials that have the potential to contaminate their products.

In 1978, the Consumer Product Safety Commission (CPSC) banned the manufacture of lead-containing paint that is intended for use by consumers. The CPSC defined lead-containing paint as paint that contains lead or lead compounds in excess of 0.06 percent of the weight of the total nonvolatile content of the paint or the weight of the dried paint film. Details of the ban can be found under sections 8 and 9 of the Consumer Product Safety Act (CPSA), 15 U.S.C. 2057, 2058 and 16 CFR 1303. Although most manufacturers have long since removed lead from their products, 2% of the 565 architectural and anti-corrosive latex paints tested in the 2000 Aberdeen Proving Ground study listed lead or lead compounds (lead chromate, and lead napththelate) on their MSDSs (see section 9.4.3 on page 54 for more detail on this study).

In 1990, EPA banned mercury in interior latex paint manufactured after August 20, 1990. Prior to the ban, approximately one-third of all interior latex paint contained mercury anti-mildew agent, antibacterial agent, and fungicide. Mercury was not typically used in oil-based paint. Generally speaking, the type and amount of dangerous materials in leftover paint is directly related to its age (see Table 20).

Table 20: Mercury and Lead in Paint Products

Date	Hazardous Materials Used in Paint
1953	Paint industry standards reduced lead levels in paint to 1.0% (or 10,000 parts per million)
1962	Lead reduced to 0.5% (or 1,000 parts per million).
1972	The Lead Based Paint Poisoning Prevention Act established the level of 0.5% in house paints.
1972	Mercury compounds were banned by the U.S. Environmental Protection Agency from use in marine paint.
1978	The final 1977 Lead Based Paint Poisoning Prevention Act regulation setting the maximum allowable level at 0.06% (or 600 parts per million) became effective and lead at 0.06 percent or more was banned from consumer paints. The ban does not apply to certain art supplies and industrial paints.
1990-1992	Until the early 1990s, paint manufacturing used EPA-approved mercurial biocides. The mercury compound phenylmercuric acetate was used as a biocide to control mildew in latex paints. However, the EPA banned this use, eliminating mercury in interior latex paints in 1990 and exterior paints in 1991. Paint manufactured before 1991 may contain mercury.
1993	A Consumer Product Safety Commission study of consumer paint samples found that lead levels in paints on the market meet the standard and are actually below the 0.06 percent level.

Source: Washington State Department of Ecology, Hazardous Waste & Toxics Reduction Program (www.ecy.wa.gov/programs/hwtr/demodebris/pages2/demopaint.htm) and Background Information on Mercury Sources and Regulations, USEPA Great Lakes National Program Office, September 1994. www.epa.gov/grtlakes/bnsdocs/mercsrce/merc_srce.html

The levels of lead and mercury in reprocessed and consolidated paint will depend on the age of the leftover paint used as feedstock. Recycled paint can also be contaminated if a non-architectural coating material containing lead or mercury is inadvertently mixed with it at the collection site. The Metro OR recycling facility has tested samples of recycled paint for lead and mercury content and results show concentrations well below EPA and Consumer Product Safety Commission requirements.

- **Lead** – Metro Paint has been tested for lead 26 times between 1993 and 2000, and every test has shown 25 ppm or less.

- **Mercury** –Metro Paint has been tested 26 times between 1993 and 2000. The average mercury level is 23 ppm; the highest level recorded was 81 ppm, all well below the EPA limit for interior paint of 200 ppm (there is no EPA limit for exterior paint).

For at least one virgin paint manufacturers, however, this testing frequency is insufficient to provide a margin of comfort regarding lead and mercury content in recycled paint, as well as other ingredients that must be taken into consideration when providing consumers and workers with accurate hazard information. These include the presence of ethylene glycol, mineral spirits, crystalline silica, asbestos from talc, trace amounts of formaldehyde, and other materials. Such information is necessary when preparing MSDS sheets and labeling the container.

For this report, PSI was not able to ascertain the exact testing procedures used by recyclers (e.g., which constituents are tested and how often).. However, Metro, Oregon, has profiled its recycled paint, and uses that data to prepare their MSDSs, product labels, and other information for consumers and workers.

For products sold in California, manufacturers also must ensure that they comply with Proposition 65 requirements, which requires the Governor to publish a list of chemicals that are known to the State of California to cause cancer, birth defects, or other reproductive harm. This list must be updated at least once a year. Businesses are required to provide clear and reasonable warnings prior to knowingly and intentionally exposing individuals to chemicals that have been listed under Proposition 65. Warnings are not required when the manufacturers can show that the California exposure occurs at a level that poses no significant risk of cancer. Thus, manufacturers can be sued under Proposition 65 if they knowingly and intentionally exposed individuals to listed chemicals without providing a warning. Several firms that sell recycled paint in California have developed compliance strategies for Prop 65 and are providing the required warnings on their product labels. One manufacturer, however, believes that the difficulty in knowing the exact constituents of recycled paint makes it all but impossible to assure Prop 65 compliance. Whatever the case, firms selling products in California should carefully examine Prop 65 and develop an appropriate compliance strategy.

10.3 Federal and State Regulation of Leftover Paint

10.3.1 The Federal Regulatory Status of Leftover Paint

Leftover Paint Generated by Households

Leftover paint generated by households is not regulated as hazardous waste at the federal level. Therefore, according to federal rule, it is acceptable to manage leftover latex and oil-based paint that is generated by households as a non-hazardous waste, regardless of whether it is in liquid or solid state. The federal exemption applies to "household waste that has been collected, transported, stored, treated, disposed, recovered (e.g., refuse-derived fuel) or reused" (40 CFR 261.4). The definition of "household waste" extends to materials derived from single and multiple residences, hotels and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds and day-use recreation areas (40 CFR 261.4).

The federal exemption stays with the waste even if it is commingled or mixed with Conditionally Exempt Small Quantity Generator (CESQG) waste, even if the mixed CESQG and household hazardous wastes were to exhibit a characteristic of a hazardous waste.[14] However, those handling wastes from households or CESQGs are not exempt from other regulations, including OSHA, fire codes, and Superfund liability. Some states impose stricter regulations than federal regulations governing HHW programs and facilities. In those states, paint collection programs may be required to obtain a municipal or industrial waste permit, license, or registration.

Nevertheless, the federal government discourages the disposal of both liquid latex and oil-based paint with municipal trash. According to the Solid Waste Association of North America (SWANA), an association of solid waste professionals, high liquid content solid wastes: "…can be a significant source of leachate generation. Increased amounts of leachate can result in a greater risk of ground or surface water contamination in the event of liner failure. Further increased amounts of leachate will result in additional leachate and/or other

[14] United States Environmental Protection Agency Memorandum from Sylvia K. Lowrance, Director, July 22, 1992. This memorandum can be found in Appendix E of the NPCA's *Protocol for the Management of Post-Consumer Paint.*

management costs." It is important to note that EPA does not discourage the disposal of dried up latex and oil-based paint with municipal trash.

Leftover Paint Generated by Businesses

Under the Code of Federal Regulations, 40 CFR, waste generated by businesses is classified as hazardous waste if it is listed (see 40 CFR Part 261 Subpart D) or if it exhibits a characteristic of a hazardous waste (see 40 CFR Part 261 Subpart C). Oil-based paints exhibit a characteristic of a hazardous waste (e.g., ignitability) and, when generated by a business, must be managed as a hazardous waste. Under 40 CFR this paint cannot be disposed of with municipal household waste.

The U.S. EPA also has regulations regarding the residues of hazardous waste in empty containers. Under 40 CFR 261.7, any hazardous waste remaining in an empty container is not subject to regulation if all of the wastes have been removed using practices commonly employed to remove materials from that type of container (e.g., pouring) *and* no more than 2.5 centimeters (1 inch) of residue remain *or* no more than 3 percent by weight of the total capacity of the container remains in the container.

Latex paints typically do not exhibit characteristics of a hazardous waste (as defined by 40 CFR Subpart 261.20-.24). A 1997 study, conducted by DynCorp Environmental Health and Safety Services of Reston, Virginia, found that leftover latex paint would not be considered a "hazardous waste," according to procedures and protocols listed in U.S. EPA documentation, specifically 40 CFR, Subpart 261 20-24. The study examined 16 representative consumer latex paint samples that were tested for ignitibility, corrosivity, reactivity, and hazardous constituents -- including metals, volatiles, semi-volatiles, pesticides, and herbicides. The tests did not find any of the samples (including flat, semi-gloss, satin, other non-flat paints, in both interior and exterior formulations.) to meet any of the requirements to be considered a hazardous waste (NPCA 1999).

Exemptions to Federal Legislation

Federal solid waste rules do have exemption provisions for certain wastes. These exemptions may assist businesses interested in recycling paint wastes generated by businesses. 40 CFR 261.2(e)(1) states that, "Materials are not solid wastes when they can be shown to be recycled by being:

(i) Used or reused as ingredients in an industrial process to make a product, provided the materials are not being reclaimed; or
(ii) Used or reused as effective substitutes for commercial products; or
(iii) Returned to the original process from which they are generated, without first being reclaimed. The material must be returned as a substitute for raw material feedstock, and the process must use raw materials as principal feedstocks.

In addition, CFR 261.2(f) states that anyone making the claim that a material is not a solid waste or conditionally exempt from regulation must demonstrate there is a known market for the material. Such demonstration would include documentation, such as contracts showing a second person uses the material as an ingredient in a production process, to demonstrate that the material is not a waste, or is exempt from regulation. CFR 261.1(c)(8) addresses the issue of speculative accumulation. It requires that during a calendar year, the amount that is recycled or transferred to a different site for recycling must equal at least 75% by weight or volume of the amount that was present on January 1 of that year. Lastly, EPA has developed criteria that distinguish recycling activities from "sham recycling". This includes requirements that the recycled material be effective as a replacement, are handled in a manner consistent with their use

as raw material or commercial product substitutes, and that records be kept regarding material use and reuse.[15]

10.3.2 Regulation of Leftover Paint by States and Local Government

States have the ability to be broader in scope and/or stricter than the Code of Federal Regulations, 40 CFR. California has among the strictest regulations prohibiting the disposal of paint waste with municipal trash, regardless of whether it is latex or oil-based. Paint wastes are listed as "presumptive" hazardous wastes based on toxicity in California Code of Regulations (CCR) 22 Chap. 11 Appendix X (at the end of sec. 66261, which defines the criteria for evaluation and listing of hazardous waste). The regulations do not differentiate between oil and latex in this listing. If the waste fails the criteria of the listed waste (metals and/or organics), as determined by CA's Total Threshold Limit Concentration (TTLC) and Soluble Threshold Limit Concentration (STLC) or the Federal Toxicity Characteristic Leaching Procedure (TCLP), then it is hazardous. If wastes pass these tests, there are also LD 50 criteria and a 96-hour fish bioassay test which, if the material fails, cause it to be a hazardous waste. Studies by the California Department of Toxics Substances Control and Cal Poly have found that latex paints fail the aquatic toxicity test and often fail the CA TTLC test (Cal Poly 1993).

In Minnesota, liquid waste paint is prohibited from disposal as mixed municipal solid waste due to the possible mobility of toxic materials via leaching that can occur with liquids (MN Solid Waste Rule Chapter 7035.2535, Subpart 1). Paint is also prohibited from disposal in a sanitary sewer (Met Council Waste Discharge Rules, 406.11) (MN SWCB 2000). In North Carolina, the Division of Waste Management Rules (T15:13B.0100.0505) for operation of sanitary landfills bans the disposal of all liquid wastes.

PSI's review of eight Washington State counties found that liquid latex paint was banned from landfills either by the county itself or by the hauler. In addition, states and communities discourage the disposal of liquid latex paint because consumers frequently cannot tell the difference between latex and oil-based paint.

The National Paint and Coatings Association similarly discourages the disposal of liquid oil-based paint by consumers and recommends disposal through a community collection program. We know of no state or local government that advocates for disposal of liquid oil-based paint nor any that suggest to consumers that they dry out oil-based paints to permit disposal (since drying releases hazardous solvents and poses a fire risk and health risk).

10.4 Regulatory Barriers to Leftover Paint Collection and Transportation

10.4.1 Regulatory Barriers Related to Leftover Paint Collection Sites and Events

Oil-Based Paint

Federal rules exempt HHW from hazardous waste management rules and should not pose a barrier to the collection of oil-based paints from consumers. However, transportation costs for oil-based paints are often higher than for latex paints since oil-based paints are generally regulated as hazardous materials and must be transported in compliance with U.S. Department of Transportation hazardous materials transportation regulations. Furthermore, many transporters do use a hazardous waste manifest and U.S. EPA hazardous waste generator number to manage waste from municipal collection centers and events.

[15] See Federal Register/Vol. 50. No. 3/ January 4, 1985 Solid Waste Final Rule, p. 638, Distinguishing Sham Situations.

Despite the exemption of HHW from federal rules, the private sector can be hesitant to collect waste that is shipped on a hazardous waste manifest. Several states have used creative means to deal with the private sector's reluctance to take on this liability. In Illinois Partners for Waste Paint Solutions, for example, the IEPA assumes the liability and uses its generator number for any oil-based products that must be shipped off-site from the retailer.

Both California and Massachusetts have regulations regarding the management of leftover paint from consumers. Thus barriers to collection of oil-based paints are greater in both of these states.

Latex Paint

Generally speaking, there are few barriers to the transport of latex paint for recycling. In Oregon, like in most states, there are no state regulations concerning the collection of latex paint. As a result, retail stores have acted as leftover latex paint collection points for the Metro, OR paint recycling program. Florida and Washington also have minimal regulatory controls over latex paint.

The states of California and Massachusetts have greater controls in place. In California, the California Health and Safety Code Section 25217.3 provides regulatory relief for the transport of recyclable latex paint by not requiring a manifest or registration as a hazardous waste, but simply a bill of lading and some additional information on the transporter and the representative of the originating location. Moreover, Section 25217.4 states that a latex paint recycling facility does not need to obtain a permit for hazardous waste facility operations.

In Massachusetts, however, once leftover latex paint is collected, the material must be managed as a federally regulated hazardous waste requiring a manifest and generator number. These rules discourage retailers and other non-governmental entities from collecting paint, since doing so would make them "hazardous waste generators." State regulations are, however, more flexible regarding transportation of leftover paint, allowing a licensed hazardous waste transporter to use a shipping paper in lieu of a hazardous waste manifest for transportation of waste between individual HHW events or between an HHW event and an HHW collection center if the transporter meets a series of conditions.

10.4.2 Barriers Due to State Rules on Inter-State Waste Transportation

Regulation concerning the interstate transportation of leftover latex paint can be a barrier to recycling. Some states regulate latex paint as a hazardous waste, but most don't. If a waste is not considered hazardous, it can be shipped on a bill of lading. A hazardous waste must go via a uniform hazardous waste manifest. Also, hazardous waste is subject to timelines in terms of how long it can be in transit, and whether or not it can be off-loaded and re-loaded onto larger trucks at hazardous waste transfer stations. This issue became evident in 2002 when the northeast states were trying to figure out what to do with mercury switches. In this case, if a waste is not a hazardous waste in Connecticut, but is one in MA, but is not one in VT, then the same truck could theoretically not transport the waste from CT to VT through MA. In CT, the waste could go via common carrier, but once it reached MA, it would have to be transported by a hazardous waste hauler. If the hauler were not both, that would mean that before reaching MA, the waste would have to be off-loaded from the common carrier into the truck for the hazardous waste hauler.

The status of the waste as a hazardous waste also influences intra-state transport. In MA, once latex paint is collected, it becomes a hazardous waste. And, as hazardous waste, containers cannot be re-opened while in transit, and the waste must reach a destination facility in 10 days[16].

11. OVERVIEW OF MAJOR INDUSTRY PLAYERS

This section presents information on parts of the paint industry, including manufacturers, retailers, and trade associations.

11.1 Major Manufacturers

The number of paint manufacturers and producing facilities has declined steadily since 1963, when an estimated 1,580 firms produced paints in approximately 1,800 plants. Most of the decline occurred in the 1970s. In 1990, about 750 companies operated about 1,000 manufacturing plants in the United States. By 2000, the number of companies decreased to about 500 and the plants to 700. There is a high degree of concentration within the industry as result of numerous mergers and acquisitions. The top ten firms account for about 65% of total industry sales and the top fifty control about 85%. Table 21 below outlines the main industry players in 2000:

Table 21: North American Coatings Market

Company	Market Share
Sherwin-Williams	23.0%
PPG	13.0%
Valspar	9.0%
DuPont	8.5%
ICI	6.0%
RPM	5.0%
Akzo	4.0%
Benjamin Moore	4.0%
BASF	3.4%
Others	24.6%

Source: Chemical Market Reporter, October 16, 2000.

The major suppliers of **architectural coatings** are the largest paint and coatings producers, including Sherwin-Williams (market share of 25-30%), ICI-Glidden (15%), PPG (8%), Valspar (8%), and Benjamin Moore (7%) (see Table 22). All of the major suppliers increased their market shares in the mid-1990s, but since 1997 there have been few significant merger and acquisition activities, other than Benjamin Moore being acquired by Berkshire Hathaway, an investment company, in December 2000 (CEH 2002, 592.5101 C).

[16] Andrea Adams, Planner/Hazardous Waste Specialist, Cape Cod Commission, MA. Personal Correspondence.

Table 22: North American Architectural Coatings Market

Company	Market share
Sherwin-Williams	25-30%
ICI	15%
Pittsburgh Paint (PPG)	8%
Valspar	8%
Benjamin Moore	7%

Source: CEH 2002, 592.5101 C.

11.2 Industry associations

The National Paint and Coatings Association (NPCA) is the chief association for paint manufacturers. The association represents some 400 paint and coatings manufacturers, raw materials suppliers, and distributors. NPCA's primary role is to serve as an ally and advocate on legislative, regulatory, and judicial issues at the federal, state, and local levels.

The Painting and Decorating Contractors of America (PDCA) represents the paint contracting industry. PDCA promotes the use of professional painting and decorating contractors to the consumer and works to develop industry standards, training programs, and other tools to support the business practices of painting contractors.

The Paint and Decorating Retailers Association (PDRA) represents retailers in the paint products industry that sell paint, wallpaper, and window treatments. The association runs an annual trade show, publishes two trade magazines, and provides education and business development services to its membership.

11.3 Distribution Channels and Retailers

There are three main architectural paint distribution channels: Retail Outlets (owned by paint manufacturers such as Sherwin Williams), Mass Merchants (such as Home Depot, Lowe's, or Wal-Mart), and Independent Dealers. The independent dealer category can be split into three sub-channels: (a) contractor oriented specialty paint dealers (which are very similar to the retail outlets), (b) hardware stores, and (c) decorator centers. Sales are greatest at Retail Outlets, followed by Independent Dealers, and finally by Mass Merchants. Growth has been greatest in the Mass Merchant category while Dealer stores sales have shrunken.[17]

The distribution channels show very different profit margins for paint manufacturers. Averaging a full product line, the Mass Merchants pay paint manufacturers $8.45 per gallon, Independent Dealers pay $12 or more, and Retail Outlets (which sell primarily to contractors) pay close to $10 per gallon.

Table 23 summarizes this retail channel data.

[17] Most of the information in this section comes from an article in Paint and Coatings Magazine by Dr. Charles S. Rooney and Charles E. Bangert / Orr & Boss, Plymouth, MI (Bangert et. al. 2000).

Table 23: Retail Channel Facts

	Retail Outlets	Independent Dealers	Mass Merchants
Market Share	56%	26%	18%
Growth Rate	3%	-5%	10%
Average Price (paid by channel to manufacturer)	$10	$12.35	$8.45
Customer Segment	Contractors	DIY, Contractors	DIY

Table 24: Manufacturer Owned Stores

Company	No. Stores
Sherman Williams	2154
ICI	660
Duron	248
PPG	160
Kelly-Moore	150
MAB	150
Williams	90
Dunn-Edwards	70
Diamond Vogel	70
Monarch	50
Color Wheel	35
Bruning	26
Columbia	21
Johnson	21
Jones Blair	19
Valspar	0
Benjamin Moore	0
Behr	0
ACE	0
TruServ	0
RustOleum	0
Zinser	0
Flecto	0
Deft	0
Other	1046
Source: Bangert et. al. 2000	

Table 24 presents the data on company-owned stores. Valspar and Behr, which do not own stores, sell through Mass Merchants and have seen significant growth in recent years. While this market has seen significant growth in recent years, the rate of growth has begun to decline as geographic markets get saturated. From a manufacturer perspective, selling to Mass Merchants carries the business risk that much of the product is sold to a single customer.

Independent dealers have lost market share in recent years – primarily to the Mass Merchants. However some firms, such as Benjamin Moore, which sells almost solely through Independent Dealers, have seen strong growth.

11.4 Manufacturers of Recycled Content Paint

There are a host of mostly small firms that recycle leftover consumer paint:
Amazon Environmental Services, Inc., Minnesota and California
Ecopaint, California
Environmental Purification Industries, Ohio
Envirosafe Paints, South Carolina
Hirshfield's Inc., Minnesota
Hotz Environmental, Canada
Kelly Moore, E-Coat paint Division, California
Metro, Portland, OR
Nu-Blend Paints, Cincinnati, OH
Paint Recycling Company, Nova Scotia, CA
Rasmussen Paint Company, Portland, OR
Rodda Paint, OR
Scott Paint Company, Gainesville, FL
Visions Recycling Inc., Sacramento, CA

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13. APPENDIX A: SHIPMENTS OF PAINT AND ALLIED PRODUCTS (2001)

Product Description	Quantity Million Gallons	Value Million Dollars
Paint and Allied Products	**1,328**	**$ 16,747**
Architectural Coatings	**617**	**$ 6,731**
Exterior	**224**	**$ 2,565**
Solvent Based	66	$ 774
Paints and Tinting Bases	19	$ 217
Enamels and Tinting Bases	11	$ 175
Undercoaters and Primers	8	$ 100
Clear Finishes and Sealers	5	$ 55
Stains	14	$ 159
Other Coatings	8	$ 68
Water-Based	159	$ 1,791
Paints and Tinting Bases	108	$ 1,313
Enamels and Tinting Bases	3	$ 33
Undercoaters and Primers	11	$ 127
Stains and Sealers	12	$ 132
Other Coatings	25	$ 186
Interior	**386**	**4,096**
Solvent Based	43	$ 547
Flat Wall Paint and Tinting Bases	3	$ 66
Gloss and Quick Drying Enamels	3	$ 49
Semi-Gloss, Eggshell, Satin Paints and Tinting Bases	10	$ 149
Undercoaters and Primers	11	$ 114
Clear Finishes and Sealers	7	$ 97
Stains	2	$ 25
Other Coatings	6	$ 46
Water-Based	343	$ 3,548
Flat Wall Paint and Tinting Bases	141	$ 1,249
Semi-Gloss, Eggshell, Satin Paints and Tinting Bases	132	$ 1,593
Undercoaters and Primers	35	$ 306
Other Coatings, Stains and Sealers	34	$ 401
Laquers	**5**	**$ 48**
Not Specified	**2**	**$ 22**
Product Finishes for OEMs	**410**	**$ 5,600**
Automobile Finishes	45	$ 1,088
Automobile Parts Finishes	4	$ 116
Heavy Duty Truck, Bus and RV Finishes	12	$ 272
Other Transportation Finishes	12	$ 177
Appliance, Heating Equipment, AC Finishes	8	$ 117
Wood Furniture Finishes	43	$ 467
Wood and Composition Board Flat Stock Finishes	11	$ 121
Metal Building Finishes	37	$ 582
Container and Closure Finishes	38	$ 437
Machinery and Equipment Finishes	20	$ 470
Nonwood Furniture Finishes	56	$ 480
Paper, Paper Board, Film, and Foil Finishes	14	$ 108
Electrical Insulating Coatings	2	$ 29
Powder Coatings	61	$ 719
Other Industrial Product Finishes	40	$ 370
Not Specified	6	$ 46
Special Purpose Coatings	**154**	**$ 3,247**
Industrial New Construction and Maintenance Paints	43	754
Interior	15	$ 212
Exterior	28	$ 541
Traffic Marking Paints	37	$ 280
Automotive, Other Transportation, and Machinery Refinish Paints	42	$ 1,672
Marine Paints	-	$ -
Ship and Offshore Facilities	14	$ 282
Yacht and Pleasure Craft	-	$ -
Aerosol Paint Concentrates	-	$ -
Not Specified	4	$ 58
Miscellaneous Allied Paint Products	**147**	**$ 1,169**
Paint and Varnish Removers	8	$ 62
Thinners for Laquers and Other Solvent Based Paint Products	33	$ 167
Pigment Dispersions	24	$ 365
Other	81	$ 542
Not Specified	1	$ 33

14. APPENDIX B: ENVIRONMENTAL, HEALTH, AND SAFETY IMPACTS OF CHEMICALS IN PAINTS

I. Metals

Antimony – Because antimony is found naturally in the environment, the general population is exposed to low levels of it every day, primarily in food, drinking water, and air. Breathing high levels of antimony for a long time can irritate the eyes and lungs, and can cause problems with the lungs, heart, and stomach. The Department of Health and Human Services, the International Agency for Research on Cancer, and the Environmental Protection Agency (EPA) have not classified antimony as to its human carcinogenicity. Lung cancer has been observed in some studies of rats that breathed high levels of antimony but no human studies are available, so we currently don't know whether antimony may cause cancer in people (ATSDR 2001).

Cadmium is a toxic, bioaccumulative heavy metal. Breathing high levels of cadmium severely damages the lungs and can cause death. Eating food or drinking water with very high levels severely irritates the stomach, leading to vomiting and diarrhea. Long-term exposure to lower levels of cadmium in air, food, or water leads to a buildup of cadmium in the kidneys and possible kidney disease. Other long-term effects are lung damage and fragile bones. Animals given cadmium in food or water had high blood pressure, iron-poor blood, liver disease, and nerve or brain damage (no data is available for humans. The Department of Health and Human Services (DHHS) has determined that cadmium and cadmium compounds may reasonably be anticipated to be carcinogens (ATSDR 2001). Cadmium has been found in at least 388 of 1,300 National Priorities List sites identified by the Environmental Protection Agency.

Hexavalent chromium – Exposure to chromium occurs from ingesting contaminated food or drinking water or breathing contaminated workplace air. Breathing high levels of chromium(VI) can cause irritation to the nose, such as runny nose, nosebleeds, and ulcers and holes in the nasal septum. Ingesting large amounts of chromium (VI) can cause stomach upsets and ulcers, convulsions, kidney and liver damage, and even death. Skin contact with certain chromium(VI) compounds can cause skin ulcers. Some people are extremely sensitive to chromium (VI). Allergic reactions consisting of severe redness and swelling of the skin have been noted. Several studies have shown that chromium(VI) compounds can increase the risk of lung cancer. The World Health Organization (WHO) has determined that chromium (VI) is a human carcinogen. The Department of Health and Human Services (DHHS) has determined that certain chromium (VI) compounds are known to cause cancer in humans and the EPA has determined that chromium (VI) in air is a human carcinogen. Chromium has been found at 1,036 of the 1,591 National Priority List sites identified by the Environmental Protection Agency (EPA).

Lead is probably the most familiar toxic metal because if its widely publicized effects. It is a persistent, bioaccumulative and toxic chemical, which can affect almost every organ and system in human body. In high concentrations it can cause brain damage, kidney damage, and gastrointestinal distress. Long-term exposure affects the blood (causing anemia), central nervous system, blood pressure, kidneys, and vitamin D metabolism. It can also damage the male reproductive system.

Children are more vulnerable to lead poisoning than adults. Thousands of cases were reported of children poisoning as result of using lead paint before the environmental authorities stepped in to ban the use of

lead in paint. A child who swallows large amounts of lead may develop blood anemia, severe stomachache, muscle weakness, and brain damage. A large amount of lead might get into a child's body if the child ate small pieces of old paint that contained large amounts of lead. If a child swallows smaller amounts of lead, much less severe effects on blood and brain function may occur. Even at much lower levels of exposure, lead can affect a child's mental and physical growth.

Exposure to lead is even more dangerous for young and unborn children. Unborn children can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. These effects are more common if the mother or baby was exposed to high levels of lead.

The Department of Health and Human Services has determined that lead acetate and lead phosphate may reasonably be anticipated to be carcinogens based on studies in animals. There is inadequate evidence to clearly determine lead's carcinogenicity in people (ATSDR 2001).

Mercury – Exposure to mercury occurs from breathing contaminated air, ingesting contaminated water and food, and having dental and medical treatments. Mercury, at high levels, may damage the brain and kidneys. Children and developing fetus are most sensitive. Mercury's harmful effects that may be passed from the mother to the fetus include brain damage, mental retardation, incoordination, blindness, seizures, and inability to speak. Children poisoned by mercury may develop problems of their nervous and digestive systems, and kidney damage. There are inadequate human cancer data available for all forms of mercury. Mercuric chloride has caused increases in several types of tumors in rats and mice, and methylmercury has caused kidney tumors in male mice. The EPA has determined that mercuric chloride and methylmercury are possible human carcinogens (ATSDR 2001).

II. Organic compounds

Methylene chloride – exposure occurs mostly from breathing contaminated air, but may also occur through skin contact or by drinking contaminated water. Breathing in large amounts of methylene chloride can damage the central nervous system. Contact of eyes or skin can result in burns. The World Health Organization (WHO) has determined that methylene chloride may cause cancer in humans. The Department of Health and Human Services (DHHS) has determined that it can be reasonably anticipated to be a cancer-causing chemical and the EPA classifies it is a probable cancer-causing agent in humans (ATSDR 2001).

Benzene – Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death. The major effect of benzene from long-term (365 days or longer) exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection. Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries. It is not known whether benzene exposure affects the developing fetus in pregnant women or fertility in men. Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene. The Department of Health and Human Services (DHHS) has

determined that benzene is a known human carcinogen. Long-term exposure to high levels of benzene in the air can cause leukemia, cancer of the blood-forming organs (ATSDR 2001).

Toluene (methylbenzene) may affect the nervous system. Low to moderate levels can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, loss of appetite, and hearing and color vision loss. These symptoms usually disappear when exposure is stopped. Inhaling High levels of toluene in a short time can make a person feel light-headed, dizzy, or sleepy. It can also cause unconsciousness, and even death. High levels of toluene may affect the kidneys. Studies in humans and animals generally indicate that toluene does not cause cancer. The EPA has determined that the carcinogenicity of toluene cannot be classified (ATSDR 2001).

Ethylbenzene is a colorless liquid found in a number of products including gasoline and paints. Limited information is available on the effects of ethylbenzene on people's health. Breathing high levels can cause dizziness, throat and eye irritation, tightening of the chest, and a burning sensation in the eyes. Animal studies have shown effects on the nervous system, liver, kidneys, and eyes from breathing ethylbenzene in air. The EPA has determined that ethylbenzene is not classifiable as to human carcinogenicity. No studies in people have shown that ethylbenzene exposure can result in cancer. Two available animal studies suggest that ethylbenzene may cause tumors.

Vinyl chloride – Breathing high levels of vinyl chloride for short periods of time can cause dizziness, sleepiness, unconsciousness, and at extremely high levels can cause death. Breathing vinyl chloride for long periods of time can result in permanent liver damage, immune reactions, nerve damage, and liver cancer. The Department of Health and Human Services (DHHS) has determined that vinyl chloride is a known human carcinogen (ATSDR 2001).

Naphthalene – Exposure to large amounts of naphthalene may damage or destroy some of the red blood cells. People, particularly children, have developed this condition after eating naphthalene-containing mothballs or deodorant blocks. Some of the symptoms include fatigue, lack of appetite, restlessness, and pale skin. Exposure to large amounts of naphthalene may also cause nausea, vomiting, diarrhea, blood in the urine, and a yellow color to the skin. The Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC) and the EPA have not classified naphthalene as to its human carcinogenicity (ATSDR 2001).

Di-ethyl-hexyl phthalate (DEHP) can leach from the plastics and has recently been identified as suspected endocrine disrupter and reproductive toxicants. The International Agency for Research on Cancer (IARC) recently downgraded the classification of the carcinogenicity of DEHP from Group 2B (possibly carcinogenic to humans) to Group 3 (not classifiable as to carcinogenicity).

1,4-Dichlorobenzene – exposure happens mostly from breathing high levels in indoor air or workplace air. Extremely high exposures can cause dizziness, headaches, and liver problems. The Department of Health and Human Services (DHHS) has determined that p-DCB may reasonably be anticipated to be a carcinogen. There is no direct evidence that p-DCB can cause cancer in humans. However, animals given very high levels in water developed liver and kidney tumors (ATSDR 2001).

Di-*n*-butyl phthalate is a man-made chemical that is added to plastics, paints, glue, hair spray, and other chemical products. It is a common environmental contaminant, and most people are exposed to low

levels in the air, water, and food. No harmful effects from exposure to di-*n*-butyl phthalate in people have been reported. Workers exposed to di-*n*-butyl phthalate and similar chemicals have experienced effects on the nervous system (pain, numbness, weakness) and high blood pressure, but there is no clear evidence that these effects are caused by di-*n*-butyl phthalate. Di-*n*-butyl phthalate appears to have a relatively low toxicity, and much larger amounts than normally encountered in the environment would be needed to cause injury. Animal studies indicate that ingesting large amounts of di-*n*-butyl phthalate can affect the ability to reproduce, cause birth defects, and cause death in unborn animals. Decreased sperm production has been reported in several species; however, sperm production returns to normal after exposure stops. Large amounts of di-*n*-butyl phthalate applied to the skin of animals have caused irritation. The EPA has determined that di-*n*-butyl phthalate is not classifiable as to human carcinogenicity based on inadequate evidence in both humans and animals.

Exposure to **di-*n*-octylphthalate** occurs mainly from eating food or drinking water that is stored in plastic containers. Very little is known about the health effects that might be caused by di-*n*-octylphthalate (currently there are large risk assessment studies underway in Europe). Some rats and mice that were given very high doses of di-*n*-octylphthalate by mouth died. Mildly harmful effects have been seen in the livers of some rats and mice given very high doses of di-*n*-octylphthalate by mouth for short or intermediate periods of time, but lower doses given for short periods of time generally caused no harmful effects. It is not known whether or not di-*n*-octylphthalate could affect the ability to have children, or if it could cause birth defects. Di-*n*-octylphthalate has not been classified as to its carcinogenicity by the Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), or the EPA.

Diethyl phthalate – No information is available regarding possible effects caused by diethyl phthalate if you breathe, eat, or drink it, or if it touches your skin. Very high oral doses of diethyl phthalate have caused death in animals, but brief oral exposures to lower doses caused no harmful effects. It is not known if diethyl phthalate causes birth defects in humans. Fewer live babies were born to female animals that were exposed to diethyl phthalate throughout their lives.

The only effects of **isophorone** reported by people who have been exposed are irritation of the skin, eyes, nose, and throat, and dizziness and fatigue. These effects have occurred in workers who breathed vapors of isophorone and other chemicals in the printing industry. Short-term exposure of animals to high levels of isophorone has caused inactivity and coma. Some animal studies suggest that isophorone may cause birth defects and slower growth in the offspring of rats and mice that breathed the vapors during pregnancy. These studies found some harmful health effects in adult female animals. When rats and mice were given high doses of isophorone in food or water for a long time, the male rats developed kidney disease. The EPA has determined that isophorone is a possible human carcinogen, based on adequate evidence in animals and inadequate evidence in people.

Formaldehyde, for example, is used in paint as preservative. The most common exposure to it is through contaminated air. Urban residents are at comparatively higher risk and people with asthma are most sensitive. The Environmental Protection Agency and the International Agency for Research on Cancer have classified formaldehyde as a probable human carcinogen. The National Toxicological Program classifies formaldehyde gas as reasonably anticipated to be a carcinogen.

Acrolein – There is very little information about how exposure to acrolein affects people's health. Available information indicates that breathing large amounts damages the lungs and could cause death. Breathing lower amounts may cause eye watering and burning of the nose and throat and a decreased breathing rate. Animal studies show that breathing acrolein causes irritation to the nasal cavity, lowered breathing rate, and damage to the lining of the lungs. We do not know if this chemical causes reproductive effects or birth defects in people or animals. There are no definitive studies on the carcinogenic effects of acrolein in people or animals. The International Agency for Research on Cancer (IARC) has determined that acrolein is not classifiable as to human carcinogenicity.

Acrylonitrile – Breathing high concentrations of acrylonitrile causes nose and throat irritation, tightness in the chest, difficulty breathing, nausea, dizziness, weakness, headache, impaired judgment, and convulsions. These symptoms usually disappear when exposure is stopped. If spilled on the skin, acrylonitrile will burn the skin and produce redness and blisters. There is evidence that children are much more sensitive to acrylonitrile than adults. In a few cases, children have died following exposure to acrylonitrile vapors that caused only minor nose and throat irritation in adults. The Department of Health and Human Services (DHHS) has determined that acrylonitrile may reasonably be anticipated to cause cancer in people. Studies of people are inconclusive, while animal studies have shown cancers of the brain and mammary glands (ATSDR 2001).

Methyl ethyl ketone (MEK) – Acute (short-term) exposure to methyl ethyl ketone in humans, via inhalation, results in irritation to the eyes, nose, and throat, and central nervous system depression. Limited information is available on the chronic (long-term) effects of methyl ethyl ketone in humans. Chronic inhalation studies in animals have reported effects on the central nervous system, liver, and respiratory system. No information is available on the developmental or reproductive effects of methyl ethyl ketone in humans. Reduction of fetal development and fetal malformations has been reported in mice exposed to methyl ethyl ketone in the air. Limited data are available on the carcinogenic effects of methyl ethyl ketone. No human data are available and the only available animal study did not report skin tumors from dermal exposure to methyl ethyl ketone. EPA has classified methyl ethyl ketone as a Group D, not classifiable as to human carcinogenicity (EPA 2001).

Methyl isobutyl ketone is used as a solvent for gums, resins, paints, varnishes, lacquers, and nitrocellulose. Acute (short-term) exposure to methyl isobutyl ketone may irritate the eyes and mucous membranes, and cause weakness, headache, nausea, lightheadedness, vomiting, dizziness, incoordination, narcosis in humans. Chronic (long-term) occupational exposure to methyl isobutyl ketone has been observed to cause nausea, headache, burning in the eyes, weakness, insomnia, intestinal pain, and slight enlargement of the liver in humans. Lethargy and kidney and liver effects have been observed in rats and mice chronically exposed by gavage (experimentally placing the chemical in the stomach), ingestion, and inhalation. EPA has classified methyl isobutyl ketone as a Group D, not classifiable as to human carcinogenicity (EPA 2001).

Dimethyl phthalate has many uses, including in solid rocket propellants, plastics, and insect repellants. Acute (short-term) exposure to dimethyl phthalate, via inhalation in humans and animals, results in irritation of the eyes, nose, and throat. No information is available on the chronic (long-term), reproductive, developmental, or carcinogenic effects of dimethyl phthalate in humans. Animal studies have reported slight effects on growth and on the kidney from chronic oral exposure to the chemical. EPA has classified dimethyl phthalate as a Group D, not classifiable as to human carcinogencity.

15. APPENDIX C: PAINT APPLICATION GUIDELINES

Minnesota's Solid Waste Management Coordinating Board
Recycled Latex Paint – Application Guidelines

Recycled Latex Paint - Definition

Recycled latex paint is an architectural coating product made with a minimum of 20% and a maximum of 100% post-consumer recycled material.

Quality and Cost

Recycled latex paint is made using standard paint processing equipment and is produced in accordance with ASTM standards for viscosity, fineness, density, pH, hide, and volatile organic compound (VOC) content.

Purchasing recycled latex paint can result in savings of 10-50% versus conventional latex paint. Be sure to purchase direct from the manufacturer.

Products Available

Two Minnesota companies produce recycled latex paint:

Amazon Environmental of Roseville produces a Latex Primer and an Interior/Exterior Latex Flat; Eggshell and Semi-Gloss are available by special order. Contact: 651-636-5486 or amazonpaint.com.

Hirshfield's Paint Manufacturing of Minneapolis produces a Latex Block Filler and a Latex Primer. Contact: 612-377-3910 or hirshfields.com.

Recycled latex paint products are also available from many out-of-state manufacturers (e.g. ecoatonline.com).

Recommended Applications

Recycled latex paint is appropriate for interior and exterior applications on gypsum wallboard, plaster, concrete, primed wood and primed metal panel. When used as a finish coat, it is recommended that you order all paint from a single production batch if color and sheen matching are critical.

<u>Recommended</u> applications include:

- ✓ Office interiors - renovation or new construction
- ✓ Warehouse, manufacturing, and garage interiors & exteriors
- ✓ Institutional residential interiors - renovation or new construction
- ✓ Graffiti abatement, traffic sound barriers and other frequently painted surfaces

Applications <u>to avoid</u> include:

- ✓ Poorly ventilated interiors

  (Because VOC levels of recycled latex paint are similar to VOC levels in conventional latex paint, use of low-VOC latex paint may be preferable in applications in poorly ventilated occupied interiors)
- ✓ Un-primed metal surfaces
- ✓ Any surface previously coated with a high gloss paint

- ✓ Knots and resinous areas of previously unpainted wood should be sealed with appropriate primer product. Recycled latex paint may then be used as a topcoat.