BEFORE THE METRO COUNCIL

FOR THE PURPOSE OF SUPPORTING PROGRAMS TO IMPROVE THE COLLECTION AND RECYCLING OF RIGID PLASTIC CONTAINERS	))))	RESOLUTION NO. 94-1940A Introduced by the Solid Waste Committee

WHEREAS, The State of Oregon has enacted legislation requiring that 25 percent of rigid plastic containers be recycled by 1995; and

WHEREAS, The American Plastics Council has issued an Request for Proposals and received eleven responses for the operation of a plastics recycling facility (PRF) to process two million pounds of plastics annually; and

WHEREAS, The American Plastics Council is actively seeking markets and supplies of rigid plastic containers of all resin types; now, therefore,

BE IT RESOLVED,

1. That the Metro Council supports the establishment of a plastics recycling facility capable of processing plastics of all resins types collected in the Metro region.

2. That the Metro Council encourages the plastics industry to exceed the recycling requirements establishing by state law.

3. That the Metro Council encourages the plastics industry to provide collection and marketing opportunities for the recycling of all plastic resin types.

4. That the Metro Council requests that the plastics industry to report to the Metro Council in six months concerning the status of plastics recycling in the Metro region.

ADOPTED BY THE METRO COUNCIL this 23rd day of June, 1994.

Judy Wyers

Judy Wyers, Presiding Officer

SOLID WASTE COMMITTEE REPORT

CONSIDERATION OF RESOLUTION 94-1940A, FOR THE PURPOSE OF SUPPORTING PROGRAMS TO IMPROVE THE COLLECTION AND RECYCLING OF RIGID PLASTIC CONTAINERS

Date: June 16, 1994 Presented by: Councilor Monroe

Committee Recommendation: At the June 7 meeting, the Committee voted 5-0 to recommend Council adoption of Resolution No. 94-1940A. Voting in favor: Councilors Hansen, McFarland, McLain, Monroe and Wyers.

Committee Issues/Discussion: Resolution 94-1940 was originally drafted at the request of Presiding Officer Wyers. The intent was to express Council support of the "Bottoms Up, Threes Down" consumer boycott of #3 PVC plastic packaging being organized and promoted by Recycling Advocates, OSPIRG and others.

The resolution was initially presented at the April 5 Committee meeting. Jeanne Roy and Betty Patton, Recycling Advocates, testified concerning the nature of boycott. Roy noted that the principal intent of the boycott was to get consumers to use alternative forms of packaging and to contact product manufacturers to encourage them to eliminate PVC packaging. She cited evidence that PVC is damaging to human health and the environment.

Patton reviewed the results of a supermarket survey conducted by Recycling Advocates. They found that, while PVC containers represent a very small percentage of all plastic packaging, in most cases the same product is available in alternative types plastic or other packaging. She indicated that Recycling Advocates had contacted several product manufacturers and that some had indicated that they are moving away from the use of PVC containers.

Roy raised another concern about the effect of PVC packaging on plastics recycling. She contended that minor PVC contamination of loads of recyclable plastic makes the entire load unusable. She noted that the Association of Oregon Recyclers supported the boycott. Roy also noted that there are active efforts to reduce or eliminate PVC containers in many foreign countries.

William Carroll, representing the American Plastics Council (APC) and Occidential Chemical Company, testified in opposition to the resolution. He disputed several of the whereas clauses in the resolution that cited the potentially damaging environmental and health effects of PVC. He contended that the plastics industry has the capacity and interest to recycle PVC containers and that technology had been developed to separate PVC containers from loads of mixed plastics to avoid the contamination problems cited by Ms. Roy.

He noted that the industry will be required to significantly increase its recycling efforts to meet the requirements of a new state law which mandates that 25% of all rigid plastic containers must be recycled by 1995. He offered to purchase and recycle any loads of PVC containers that could be collected in the region.

The Committee voted unanimously to recommend Council adoption of the resolution. But, at the April 14 Council meeting, Chair McFarland asked that the resolution be rereferred to the Committee to address additional questions that had been raised since the April 5 meeting.

At the May 3 Committee meeting, Chair McFarland, Councilor Wyers and Council Analyst Houser noted that additional information related to the resolution would be forthcoming and that no action should be taken at this meeting.

Ray Phelps, Laurie Hansen and Steve Engel, testified on behalf of the APC. They reviewed efforts being made by the industry to comply with the state law relating to rigid plastic container recycling. The principal effort will be focused on the development of a plastics recycling facility (PRF) to process and recycle rigid plastic containers. The APC would provide about $1 million in sorting and handling equipment for the facility and an operating subsidy for the first three years of operation. The facility would be capable of handling at least two million pounds of material a year. An RFP has been issued for the facility, and eleven responses from Oregon and Washington have been received. It is intended that the PRF will be operational by the end of 1994.

To obtain sources of supply for the PRF, the APC has worked with Lane County to initiate a curbside program for all plastic resins and is working with Thriftway concerning an expansion of their plastics recycling program. They also expressed interest in working with Metro and others in the region to expand collection opportunities in the Portland area.

They contended that the Council should use the proposed resolution as an opportunity to affirm its support of these newly initiated efforts to recycle a broad spectrum of plastics rather than focusing on the banning of a narrow segment of the plastic container market.

At the June 7 meeting, a substitute resolution was presented by Chair McFarland. The new resolution provided that the Metro Council: 1) supports the establishment of the PRF to process all plastic resin types collected in the Metro region, 2) encourages the industry to exceed the recycling requirements of state law, 3) encourages the industry to develop collection and recycling market opportunities for all types of plastics resins and 4) requests a report from the industry in six months concerning the status of plastics recycling in the region.

Representatives of the APC testified in support of the substitute

resolution. They noted that they had met with Metro Solid Waste staff, local recyclers and local jurisdictions to develop and improve working relationships that will hopefully result in improving plastics collection and recycling in the region.

Councilor Wyers asked whether the proposed PRF would be located in the Metro region so that it could process material collected in this area. The APC representatives responded that the responses to the RFP had all been from southwest Washington, the Metro region or the Willamette Valley. They noted that to meet the recycling goals set in state law, the PRF would have to be able to serve the Metro region because most of the feedstock would be generated in the Portland area.

Wyers also asked if any of the material from the PRF would be processed at a pyrolysis facility. The APC representatives responded that a recent Attorney General's opinion held that pyrolysis was not recycling and therefore material sent to a pyrolysis facility could not be counted to meet the state recycling goals. Therefore, they indicated that no material from the PRF would be sent to a pyrolysis facility.

Wyers asked about the potential for curbside collection of plastics in the Portland area. The APC representatives noted that the city of Portland had recently decided not to impliment a curbside program at this time. They indicated that curbside programs will be important in providing an adequate supply of material for the new PRF. They suggested that once the PRF is operational, Metro may wish to designate plastics as a principal recyclable, which would facilitate the establishment of curbside programs in the region.

Betty Patton, Recycling Advocates, testified that the organization would be willing to support the substitute resolution. She indicated that they were very pleased with the proactive stance being taken by the APC to comply with the new state law.

The committee discussed the nature of the reporting that would be required from the industry in six months. Councilor Wyers suggested that others, such as local jurisdictions, processors and haulers should be invited to participate to foster a fuller discussion of issues related to the future of plastics recycling in the region.

The Committee voted unanimously to adopt the substitute resolution and identify itself as the sponsor.

SOLID WASTE COMMITTEE REPORT

CONSIDERATION OF RESOLUTION NO. 94-1940, FOR THE PURPOSE OF EXPRESSING METRO COUNCIL SUPPORT FOR THE "BOTTOMS UP, THREES DOWN" CAMPAIGN TO BOYCOTT AND ELIMINATE PVC (#3) CONTAINERS

Date: April 7, 1994 Presented by: Councilor McLain

Committee Recommendation: At the April 5 meeting, the Committee voted unanimously to recommend Council adoption of Resolution No. 94-1940. Voting in favor: Councilors Buchanan, Hansen, McFarland, McLain, Monroe and Wyers.

Committee Issues/Discussion: This resolution was drafted at the request of Councilor Wyers, to express Metro Council support for an upcoming campaign initiated by Recycling Advocates to boycott #3 PVC plastic packaging. Councilor Wyers reviewed the rationale behind the proposed boycott. She noted that PVC is harmful to the environment and has been linked to various health problems. She noted that PVC packaging retards the recycling of other types of plastic packaging because when loads of such packaging are contaminated by PVC packaging, the PVC must be removed before the remaining material can be processed. She noted that a press conference to announce the boycott will be held in the Metro courtyard on April 12 at 10:00 A.M.

Jeanne Roy and Mary Blankevoort testified in favor of the resolution on behalf of Recycling Advocates. Roy noted that in many areas of the country #1 plastics are recycled, but in the Portland area she indicated that #1 container recycling has been difficult because loads are often contaminated with #3 PVC packaging. This requires additional sorting and cost to remove the PVC packaging. Roy indicated that Recycling Advocates targeted PVC packaging because it is only a small portion of the total packaging market, there are alternatives for PVC packaged products (ie. other brand names or even the same brand name in a different size), and PVC is environmentally damaging.

Blankevoort reviewed Recycling Advocates supermarket survey which identified about 80 products packaged in #3 containers. She noted that in each case, the same product was available in alternative packaging. She noted that the 50 companies that manufactured the products were contacted. About half responded, with five companies indicating that they were decreasing or eliminating PVC packaging.

Roy noted that they will be creating written material related to the boycott and that Metro's support would be very helpful.

William Carroll, representing Occidental Chemical Corporation of Dallas, Texas, submitted written testimony in opposition to the resolution. He noted that PVC is generally required when a plastic container requires a rigid handle, which is often necessary on

larger-size containers. He explained that he has been involved in with a PVC recycling program for five years. He contended that automated recycling systems have been developed that separate PVC packaging from other types of packaging. He also expressed concern that several of the "whereas" clauses in the resolution were not supported by hard evidence. He advocated that Metro support the development of a collection and recycling system for PVC plastic instead of supporting a boycott. He noted that automated plastic sorting systems would probably soon be available in the Portland area.

BEFORE THE METRO COUNCIL

FOR THE PURPOSE OF EXPRESSING METRO COUNCIL SUPPORT FOR THE "BOTTOMS UP, THREES DOWN" CAMPAIGN TO BOYCOTT AND ELIMINATE PVC(#3) CONTAINERS	)))))	RESOLUTION NO. 94-1940 Introduced by Presiding Officer Judy Wyers

WHEREAS, PVC packaging contains chlorine, which is highly toxic and damaging to the environment; and

WHEREAS, PVC is made of chemicals linked to cancer, birth defects, liver and kidney damage; and

WHEREAS, Incineration disposal of PVC packaging produces hydrochloric acid, a corrosive air pollutant; and

WHEREAS, PVC packaging has a recycling rate of less than one percent and may reduce Oregon's ability to meet the 1995 goal of recycling 25% of all rigid plastic containers; and

WHEREAS, PVC container contamination of more valuable plastics eliminates or reduces recycling opportunities; and

WHEREAS, several European countries and Australia are phasing out PVC packaging; now, therefore,

BE IT RESOLVED,

That the Metro Council supports the "Bottoms Up, Threes Down" boycott of PVC #3 plastic packaging and the elimination of such packaging from the marketplace.

ADOPTED by the Metro Council this _____ day of _____, 1994.

_____

Judy Wyers, Presiding Officer

PVC BAN INFORMATION

Some of the reasons Metro supports the PVC container ban.

* Metro supports designing for recyclability and minimizing the number of plastic resins utilized in packaging.

* PVC is a contaminant in a plastics recycling program. It looks a lot like PET and would be indistinguishable in a ground or flaked form. This causes problems in plastics collection and processing systems.

* Although PVC containers can be recycled, they do contaminate a program where other plastics are involved. This is the main reason they are not included in our local recycling programs.

* PVC cannot be easily sorted from other plastics, particularly in a mechanical sorting process that uses a float system. Removing PVC in an automatic system can be expensive and involves special equipment, such as electronic detectors.

* The vinyl chloride component of PVC can cause environmental and health concerns. In particular, burning will release chlorine in the air. That is why the APC has spent so much time studying how to keep this material out of the pyrolysis unit in the Chehalis plant.

* PVC has been preferred for certain packages because of chemical properties that make it suitable for oil products (salad oils) and for large bottles with handles. It appears that new advances make it possible to utilize PET for these types of products. For the reasons mentioned above, this substitution of PET should be promoted through consumers' buying preferences. Programs for custom PET recycling are currently being established in Oregon.

BOTTOMS UP, 3 s DOWN

Why PVC Packaging Should Be Eliminated

NOT RECYCLED IN OREGON

And it is not likely to be recycled. Nationally, 700 million pounds of PVC packaging is produced annually, but the nationwide recycling rate is only .2%. In contrast, almost 40% of PET bottles are recycled.

Oregon law requires a 25% recycling rate for all rigid plastic containers by 1995. A low recycling rate for PVC resin helps to pull down aggregate rates for all plastic packaging to a current 7%.

HINDERS RECYCLING OF OTHER PLASTICS

When PVC containers get mixed in with more valuable plastics, they wreak havoc on the recycling process. PVC bottles are almost indistinguishable from PET, but PVC has a lower melting point. So it burns first, and leaves black spots in PET resin. Just one PVC bottle in the process can ruin 10,000 PET bottles.

If PVC packaging were eliminated from consumer products, PET (#1) containers might be worth collecting for recycling in Oregon, in addition to the returnable bottles.

PRODUCTION IS HARMFUL TO THE ENVIRONMENT

PVC and its building blocks contain chlorine, which is highly toxic and accumulates in the tissue of living organisms, working its way up the food chain.

The organochlorine compounds used in PVC have environmental effects similar to dioxins, PCBs and DDT, which contaminated Love Canal.

Because 50% of the major contaminating chemicals found in the Great Lakes are chlorine-based, a 1992 U.S. - Canadian Joint Commission has called for the phase-out of chlorine and chlorine-containing compounds.

PRODUCTION IS HARMFUL TO HUMAN HEALTH

PVC is made of chemicals linked to cancer, birth defects, liver and kidney damage.

Health studies show workers in PVC plants run the risk of cancer up to 16 times that of the general public.

People living within a two-mile radius of PVC production facilities face increased risks of cancer and asthma.

DISPOSAL IS HARMFUL TO THE ENVIRONMENT AND HUMAN HEALTH

Incineration of PVC produces hydrochloric acid, which is a corrosive air pollutant, a contributor to acid rain, and a precursor to dioxins and other chemicals shown to have toxic effects on human health.

A German study showed that although PVC packaging makes up only .5% of the volume of waste by weight, it is responsible for 50% of the chlorine in household waste. This has prompted several European countries and Australia to phase out all PVC packaging.

IT'S EXPENSIVE - - - WE DON'T NEED IT!

The environmental and energy costs of PVC - - its production, cleanup, and disposal - - are the highest of all packaging materials.

Products contained in PVC plastic can ALL be packaged in something else, including glass, steel, paper and recyclable plastics. Look for alternatives!

BOTTOMS UP, 3 s DOWN

WHAT YOU CAN DO

1. Check the resin code on the bottom of plastic containers. If you find a 3 (PVC), purchase the product in another, recyclable material.

2. Write or phone the manufacturer of the product in which you are interested, asking them to change the packaging for that product.

3. Ask your governmental representatives to introduce and/or support legislation banning the use of rigid PVC packaging.

4. Continue to reduce, re-use and recycle whenever possible.

5. Share this information with your family, neighbors and friends.

SOURCES

"Solid Waste Action Paper #8" by the Environmental Action Foundation, 1992

"Testimony in Support of H.B. 3279" by OSPIRG, 1993

Study commissioned by the German Federal Ministry for Research and Technology, 1989

Inventory of Material and Energy Use & Air and Water Emissions from the Production of Packaging Materials, Tellus Institute, Boston, MA, 1991

PVC: Toxic Waste in Disguise, Greenpeace International, Amsterdam, the Netherlands, 1992

"Recycling - Is It Worth the Effort?", Consumer Reports, Feb. 1994

PREPARED BY:

RECYCLING ADVOCATES
2420 S.W. Boundary St.
Portland, OR 97201

FOR FURTHER INFORMATION, CONTACT:

ASOMA INSTRUMENTS

VINYL BOTTLE SORTER MODEL VS-2

In the recycling of plastic bottles, there is a need to sort mixed bottles according to polymer. Of particular interest is the need to separate vinyl (PVC) from all other polymers (PET, HDPE, and PP), primarily because of mutual chemical and physical incompatibilities.

The ASOMA Model VS-2 is a PVC Sensor suitable for pilot plant or production use that can separate vinyl bottles from a mixed stream of bottles.

SORTING STRATEGY

The strategy of the ASOMA VS-2 Vinyl Bottle Sorter is simple: move bottles past a sensor; if a bottle has chlorine (vinyl), eject it; if it does not, let it pass.

The sensor is a high-performance X-ray Fluorescence (XRF) analyzer. XRF is a non-destructive, fast, and low maintenance analytical technique. It identifies vinyl bottles by their high chlorine content. A computerized controller uses the XRF information to decide to divert the vinyl bottles from a chute carrying the mixed bottle feed-stream.

XRF sensitivity is so great that a ten millisecond analysis is sufficient for a reliable vinyl/non-vinyl decision. In operation, the system repeatedly performs ten millisecond analyses. If an analysis result is below a predetermined threshold, either there is no bottle in front of the aperture or there is a non-vinyl bottle. Several analyses are performed while a single bottle passes to ensure that a vinyl bottle is not missed because of dirt or a non-vinyl label. If an analysis is above the threshold, there is a vinyl bottle present and the deflection/ejection unit is triggered to eject that bottle from the stream.

SYSTEM DESCRIPTION

The Model VS-2 consists of a high performance, high speed sensor head and an electronic controller/data processing module. The head senses signals from the items being sorted and the controller decides whether or not PVC is present. The controller then generates a signal that can be used to operate an ejector that would deflect the PVC containing item. Note that if the stream being sorted is "vinyl rich," the unit can be set to eject the non-vinyl items.

Typically, the sensor head is mounted in a chute (optional) which is oriented at an angle such that gravity will cause the items to slide, one at a time, down the chute and over the sensor head. It is very important that the input to this chute be "managed" such that the items being sorted are singulated as they travel down the chute. It is also a requirement that no items largely dissimilar to those being measured are allowed to travel into the chute. The equipment to singulate or deter dissimilar items is not part of the Model VS-2. ASOMA can supply the chute and bottle ejector as an option.

After sensing, typically an air or mechanical ejector (optional) diverts the unwanted (PVC) items to a chute paralleling the sorting chute.

The sensing head will operate across a 12 inch wide chute. The controller (about 24 x 30 x 8 inches) interprets the signals from the sensor head and triggers a relay/solenoid in the deflection equipment when it detects a vinyl bottle. The controller also contains diagnostics and an RS-232 interface which allows it to report to and/or be controlled by a host computer. A typical configuration is shown below.

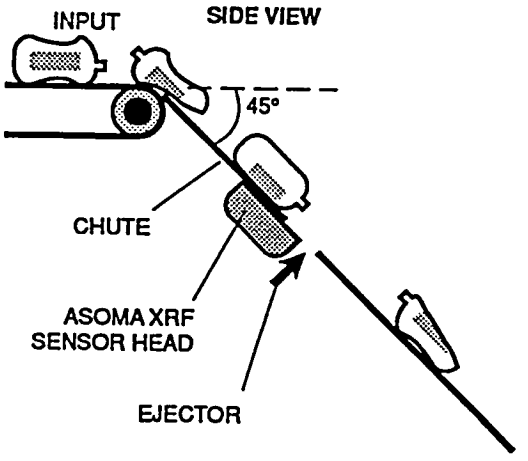
BOTTLE PRESENTATION

The sorting strategy (test a bottle then pass or eject it) requires one bottle at a time be presented to the XRF sensor. The XRF sensor has a capability of making almost 100 tests/second. However, because of the limitations of most presentation systems, the practical rate is about three bottles/second.

Experience with an actual Materials Recycling Facility has led to the development of a configuration that can tolerate a wide variety of materials other than plastic bottles. Post consumer plastics gathering techniques vary widely, but even the "cleanest" methods result in occasional "odd" pieces coming down the line. Laundry baskets, film, industrial plastic waste, hair curlers, etc. may find their way into the feed-stream. The VS-2 sensor head has been specially ruggedized to help it survive impacts from random materials.

RADIATION

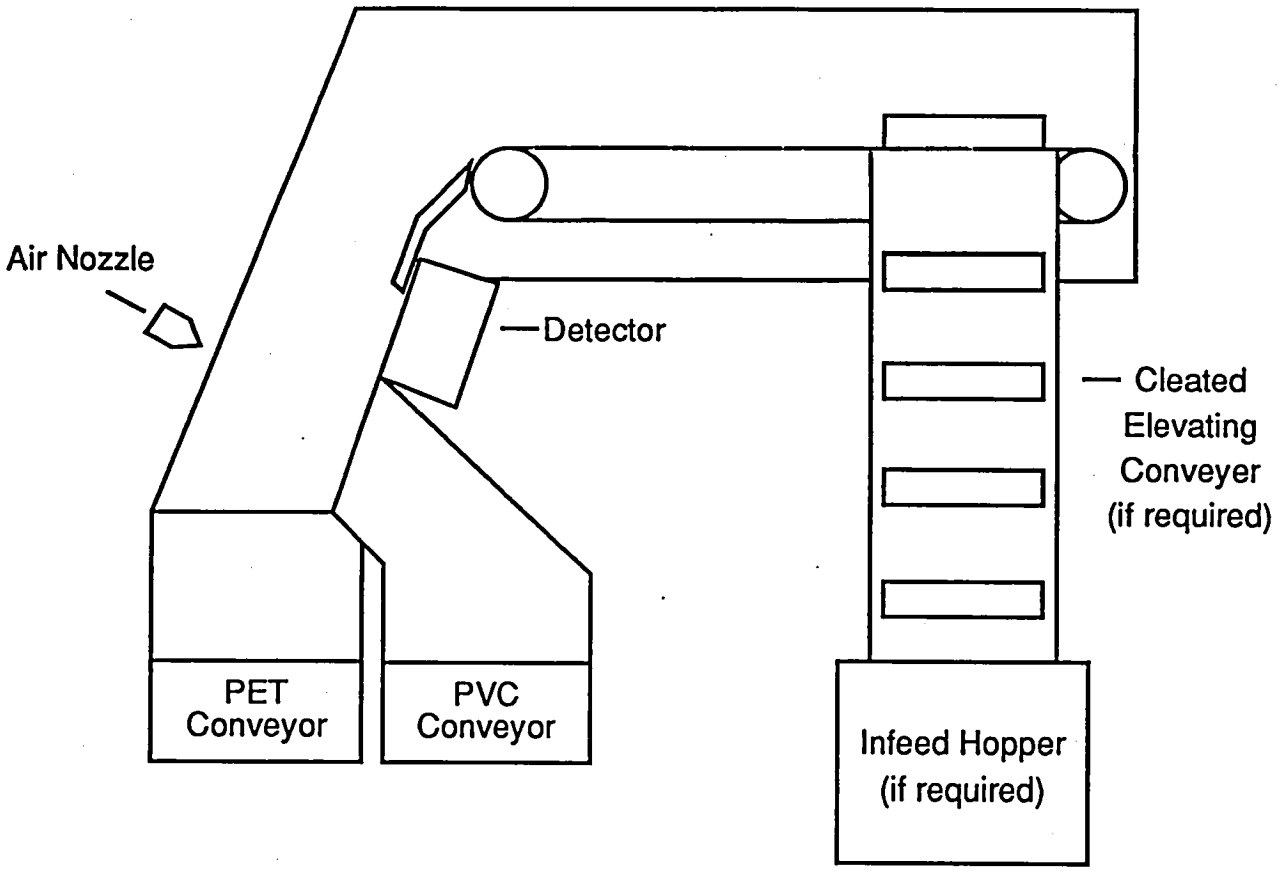
The XRF sensor contains a source of x-rays. The radiation emitted by the instrument is very "soft" and is easily absorbed by a sheet of plastic. The system is well shielded and presents no radiation hazard to personnel in the area. An interlock system prevents exposure during service or maintenance.



ASOMA Instruments, Inc.
11675 Jollyville Road ✦ Austin, Texas 78759 ✦ USA
Phone (512) 258-6608 ✦ Telex 76-7177 ✦ Fax (512) 331-9123

PM901105jb-911018jb

ASOMA Bottle Feed, Slideway and Ejection system



Using
Black Light (UV) Lamps
for PVC/PET Identification and Separation

This report was prepared by Moore Recycling Associates Inc. for the Plastic Recycling Corporation of New Jersey (PRCNJ). The PRCNJ was formed by New Jersey Soft Drink Bottlers and the National Association of Plastic Container Recovery (NAPCOR) to spearhead a program to have PET included in New Jersey's mandatory recycling program. This report is for informational and safety purposes. It is not intended to be an endorsement of blacklight technology as used in PVC/PET identification and separation.

Separation of PVC and PET resins is a critical issue in plastics recycling today. PET melts at a higher temperature than PVC. When trying to recycle PET even a very small amount of PVC resin mixed in with the PET will create problems. The PVC will burn, destroy the surrounding PET and possibly damage processing equipment.

Conversely, PET mixed in with a PVC resin stream will not melt. The PET plugs up processing equipment and creates an off-spec recycled resin. With sink/float separation systems PET and PVC are not easily separated because they have almost identical densities (1.4 grams per cubic centimeter).

Technology which automatically and accurately separates PVC from PET is commercially available. Complete 1,500 pph systems are in the range of $100,000. Black light lamps may represent a less expensive opportunity for controlling quality of recycled PET and PVC. Several plastics processors already use black lights to identify and separate PVC and PET before granulating or as a final quality control measure.

What is black light?

Black light fluorescent lamps contain a phosphor that emits its energy in the black light or "ultraviolet" region of the electromagnetic spectrum. Ultraviolet (UV) radiation is produced by many natural and artificial sources and often accompanies visible light.

Ultraviolet light, or ultraviolet radiation, is a form of energy that occupies only a small portion of the electromagnetic radiation spectrum. The complete electromagnetic radiation spectrum ranges from the highest energy (shortest wavelength) cosmic rays to the lowest energy (longest wavelength) radio waves.

MOORE RECYCLING ASSOCIATES, INC. P.O. Box 136 • Hancock, NH • 03449 - 0136 • Phone 603/ 525 - 4916 • Fax: 603/ 525 - 6611

In the electromagnetic spectrum, near ultraviolet (black light-long wave) ranges from 310 nanometers to 400 nanometers. Visible light frequencies are between 400 and 700 to 800 nanometers. Near infrared frequencies range from 800 to 1400 nanometers.

The Sun's Radiant Energy

Ultraviolet	*Blue*	*Visible Light*	*Infrared . . . Heat*
(Cause cataracts)	(Causes macular degeneration)	(Creates glare)	(Causes eye fatigue)
200 nm	400 nm	510 nm	800 nm 1400 nm

Source: Noir Medical Technologies

How does black light separation work?

When placed under a black light fluorescent lamp, most PVC containers emit a green color and most PET containers reflect a blue/purple color. With the fluorescence, usually workers can quickly visually distinguish the PVC from the PET on a conveyor belt or can visually detect any PVC flakes in a gaylord of PET. (See "A final word of caution.")

When a substance absorbs electromagnetic radiation, either visible or invisible, and converts the energy into radiation of a different wavelength, the converted energy is called luminescence. The luminescence occurs at a longer wavelength. This phenomenon can transform ultraviolet energy to a visible form of energy or visible energy to even longer wavelengths in the visible part of the spectrum.

Two kinds of black light lamps

There are two kinds of black light fluorescent lamps: BL (black light) and BLB (black light, blue) types. BL lamps are similar in appearance to standard fluorescent lamps. They produce near ultraviolet light and some visible light, which under some circumstances, may "wash out" the fluorescing effect. Therefore to be effective for PET/PVC separation, BL lamps may require that an external filter is used that transmits near ultraviolet, but will absorb the visible light that is also produced. BLB lamps have tubes made of special deep blue filter glass that absorbs nearly all the visible light but transmits ultraviolet, making an external filter unnecessary.

Using black lights for quality control

One opportunity for quality control is to hang a black light above the conveyor carrying the sorted bottles to the baler or granulator. If appropriate frequencies and filters are used, this method would allow the operator to visually scan whole bottles to ensure that they are properly sorted. Other processors use the blacklights after PET is granulated as a final quality check.

Southeastern Container, Enka, South Carolina, installed black lights made by General Electric on their sorting line for a brief period. Lamps were hung about 8 inches above the mixed bottle stream on a flat conveyor line. Two standard fluorescent fixtures, each about 4 feet long, were used with two bulbs in each fixture. The fixtures hung 1.5 feet apart, covering a 3.5 square foot area on the conveyor line.

According to Sandi Maurer, Recycling Manager for Southeastern, they have discontinued using this sorting technology because a worker complained of headaches after using the lights for one week. Headaches may have been caused by the flickering of the lamp but would not have been caused by the UV radiation.

Are there health risks for workers using black light?

Symptoms of excessive exposure to UV radiation include surface burns of the eyes or skin and reddening of the skin (as in sunburn). Processors can significantly reduce any possibility of worker injury by ensuring that no part of the body is directly exposed to UV radiation.

In prolonged exposure to UV light, employers should be sensitive to two potential health risks: cataracts and skin cancer. A substantial body of scientific research links cataract formation to prolonged exposure to long wave UVA. One option for protecting workers during extended UV exposure is protective eye wear and sun screen lotion. Protective eye wear is available from Noir Medical Technologies, Medical Product Division, 6155 Pontiac Trail, South Lyon, MI 48178, 800/521-9746,

Another relatively simple precaution is to install a Plexiglas shield (Plexiglas UF3 or UF4) which will absorb all UV radiation below 390 nm. The shield could extend vertically between the picking line and the workers and have a slot to permit the workers' hands to access the containers easily. Such a shield would create a UV barrier and would permit workers to observe and select the containers. (Local plastics supply houses may have Plexiglas material for storm door applications. One manufacturer of this Plexiglas is Rohm and Haas). The workers' hands can be protected with comfortable opaque rubber gloves.

Protection of the sort described should be sufficient to protect most employees. Some individuals, such as those with lupus or psoriasis, may be much more sensitive to UV radiation.

Processors considering using this technology for PET/PVC separation should research the emission frequency of the lamps being considered for use. Ask the manufacturer for information on the "luminosity curve" of the lamp. The human body is increasingly sensitive to wave lengths as they approach the visible light spectrum. Therefore, the closer the peak (highest wavelength) of the emitted energy is to the visible light spectrum, the more sensitive the body is to that wavelength. Example: a lamp peaking at 311 nm is less hazardous than one peaking at 380 nm.

A final word of caution

The use of black light can be a very effective separation method in some cases, less effective in others and perhaps not at all in some cases. Why? The answer lies in understanding the relationship between various additives in PVC containers, the effectiveness of certain wavelength frequencies, the use of filters and the age of the PVC material. PVC as a polymer does not fluoresce. It is the additives to the PVC (anti-oxidants, plasticizers, impact modifiers, stabilizers) which most likely are the cause of the fluorescence. Furthermore, as PVC degrades it may become more likely to fluoresce. Additional scientific study is needed to understand and optimize the process. Such a study would assess which additives fluoresce, what frequencies work best and if the use of a filter (or filters) makes a difference.

Processors interested in staying up-to-date on this emerging, and potentially effective, separation technology should contact Lea Anne Connelly, Director of Technical Affairs at the National Association for Plastic Container Recovery, 4828 Parkway Plaza Blvd, Charlotte, NC 28217.

Resources

The Occupational Safety and Health Administration (OSHA) in Washington, DC, has staff who work on issues of protective eye wear (202/523-7216) and on health standards (202/523-7151). OSHA's standard for UV exposure is "appropriate personal protective equipment." If called to assess an industrial environment, OSHA would use guidelines developed by the American Conference of Governmental Industrial Hygienists (ACGIH). The ACGIH distributes a booklet (publication number 0021) "Threshold Limit Value for Chemical and Biological Exposure Indices, 1991-1992" which is available by contacting them at 6500 Glenway Avenue, Building D-7, Cincinnati, OH 45211 (513/661-7881). The cost is $6.00, plus shipping and handling.

For additional technical information on UV exposure guidelines, see *Safety with Lasers and Other Optical Sources: A Comprehensive Handbook* by David Sliney and Myron Wolbarsht, Plenum Press, NY, 1980, page 740.

Black Light Manufacturers & Distributors

The following is a list of available companies that supply fluorescent and UVA lamps. You contact these companies directly for more technical information or for purchasing or pricing a product.

S & S Industrial Lighting
Corporation
Main Street
PO Box 69
Marlton, NJ 08053
Phone in NJ: 609/768-6300
Phone in PA: 215/624-5585
Toll-free: 800/525-4448

Lamp Technology, Inc.
Bohemia, NY 11716
Phone: 516/567-1800
Fax: 516/567-1806
Toll-free: 800/KEEPLIT (533-7548)

Shogyo International Corporation
Dept. TR, 287 Northern Blvd.
Great Neck, NY 11021-4799
Phone: 516-466-0922

UV Lamps & Equipment
Spectronics Corporation
956-T Brush Hollow Road
Westbury, NY 11590
Phone: 516/333-4840
Fax: 516/333-4859
Toll-free: 800/274-8888

Light Sources, Inc.
72 Cascade Blvd.
PO Box 3010
Milford, CT 06460
Phone: 203/877-7877
Fax: 203/877-7212

Phillips Lighting Company
200 Franklin Square Drive
Somerset, NJ 08875-6800
Toll-free: 800/631-1259

Hanovia, Inc.
100-T Chestnut Street
Newark, NJ 07105
Phone: 201/434-0722

Aamsco Lighting
15 Brook Street
Jersey City, NJ 07302
Phone: 201/434-0722

Meyer & Company, Inc.
70-T Kingsley Way
Freehold, NJ 07728
Phone: 908/308-0077
Fax: 908/308-4493

Northwest Lighting Systems Co.
PO Box 149 (T)
Maple Grove, MN 55369
Toll-free: 800/234-1146
Fax: 612/544-9348

DAMAR Worldwide Inc.
1653 Panama Street
Memphis, TN 38108
Toll-free: 800/238-9080
Fax: 901/382-1908

EcoVinyl® Echoes

News of Vinyl Recycling | Dallas, Texas | Fourth Quarter, 1992

Collection up in 1992

By Debbie Kurucz

Our nationwide regular supplier pool increased to over twenty this year, as we added about ten new suppliers. A recent study conducted by R.W. Beck for the American Plastics Council has opened up some possible doors for us in finding postconsumer PVC recyclers. We were able to select 45 potential suppliers, most of whom were glad to hear from us! Surprisingly, word of mouth referrals seem the most common, so if you know someone that has postconsumer PVC bottles without a home, please keep us in mind. Hopefully, we can generate some new collection points and divert more PVC from the waste stream.

When a new supplier does sign on, we first test random bales to check initial sorting quality. Two problems surface most often: contamination and bale density. We experience all types of contamination, from other types of plastics, to colored material mixed in with clear, to aluminum cans, to a frying pan. Obviously, these pose problems for our finished product quality. We ask that suppliers keep their contamination level below 5 percent; however, we work with our suppliers as they learn to refine their initial sort process to meet our specifications. Bale density is an issue for one of our sorters, Clearvue. Clearvue does not have an automated bale breaker, and as they sorted through material in storage, they discovered that very tightly packed bales are nearly impossible to take apart without damage to the bottles. So when you bale material, keep Clearvue's sledgehammer crew in mind. For large bales, please keep the weight between 800 and 1000 pounds.

(See "Collection", Page 3)

Thank you for your support!

We at OxyChem Commercial Development want to take a minute to thank everyone who helped in 1992. Recycling Coordinators from New York to California who supported PVC collection. Collectors, from those operating small drop-off centers in Pennsylvania and Minnesota to large municipal programs and national waste haulers like Browning-Ferris Industries and Waste Management have kept an ever-increasing supply of bales coming our way. Sorting line operators, both manual and automated, deserve special recognition for their improved quality over the year. Processors like Wheaton and Clearvue who had the courage to clean postconsumer PVC bottles. Compounders like HiTech and Interplast who stuck with us through the painful adoption of new technology for melt-filtering. And finally, our customers, who worked with us during the difficult start up stages. All of you had a part in making this project a business. Thank you, one and all, for a job well done and please stay with us in 1993!

Automated Sorting Update

Advances in sorting technology are occurring at a rapid pace. In the span of little more than two years since the first autosort instrument was introduced, more systems have been invented and over twenty devices have been purchased. Two machines can even sort the entire stream of plastic bottles, with another in prospect.

Let's review some autosort basics. Two types of equipment exist: those which singulate bottles prior to the detection and identification step, and those which employ multiple detectors that eliminate the need for singulation. Detection systems measure the response of bottle materials to some frequency of light, and in some cases visually identify the shape and color of the bottle.

Singulating systems allow for discreet identification. After the bales and clumps are broken (no mean feat in itself), a bottle passes the detector on a belt moving at known speed. There are multiple stations at which bottles can be ejected, and computers are necessary to follow the progress of bottles and eject them at a precise time.

(See "Sorting", Page 4)

OxyChem®

Occidental Chemical Corporation

Legislative Update

Massachusetts battle won; whither the war?

It's an ill wind that blows no good, they say. For whatever else they did, the winds of November 3 blew away the most draconian packaging initiative seen to date--in Massachusetts. The MASSPIRG bill was classic "rates and dates"--meet a recycling rate by a certain year or else--like the California and Oregon initiatives killed in 1990. In those cases, similar bills passed legislatively in the next session, despite previous voter rejection.

There are three states with laws now on the books with true rates and dates requirements: California, Oregon and Wisconsin. In California, if 60% of households have access to curbside recycling of beverage containers, the rules are simple. Unless all plastics reach a recycling rate of 25% or individual plastics or packages meet the same rate then 25% postconsumer content is required. The law can also be satisfied by packages which are returnable five times or source reduced ten percent during every five-year period. There is an exception for PET since California is a quasi-deposit state where PET bottles are already under a collection mandate.

We see less vinyl-specific legislation in 1993.

In Oregon the rule is similar, but there is also a local collection requirement if there is a stable market for collected materials that defrays 75% or more of the collection cost. PET is subject only to the 25% hurdle rate.

However, the devil is in the details, and the details are just now being worked out for each state. Examples of details include: whether there will be blanket food-grade exemptions or only for certain selected applications, and exactly how to determine recycling rates: in-state or total US. And there are a million others.

Wisconsin, a state with a modified content requirement, was the only state to launch a serious anti-PVC effort this year. The Governor's Council on Recycling took up the topics of design for recycling (regarding cap liners, labels, etc.) and look-alike PET and PVC bottles. Correctly, in November the council soundly rejected any PVC ban or restriction.

Next year may be different, however. The environmental community greeted the end of the "pax Republicana" with cheers and parades. We expect significant activity at the federal level regarding reauthorization of many environmental laws. Recycling initiatives could take the form of the German system, mandating high recycling rates and industry responsibility for waste disposal.

The key to this kind of legislation is recharacterization of normal household waste from a public (read: taxpayer) disposal problem to an industrial-type waste. As Alan Hershkowitz of the Natural Resources Defense Council notes, "I am always a taxpayer, but I am only sometimes a consumer." He argues that he should not be taxed to compensate for other peoples' poor buying habits. This logic is interesting, but similar to the argument that families who do not use public schools should not have to pay school taxes. Public vs. industrial funding of household waste disposal will become the main point of philosophy in coming years.

In his victory speech, President-elect Clinton made a point of environmental problems. In his campaign literature he suggested mandated content, incentives to purchase recycled material and incentives to companies who could advance recycling. Obviously, Vice President-elect Gore would love to take such measures to Congress.

In the states, lagging recycling activity due to the poor market for commodity plastics may bring impatience on the part of legislators. More rate and/or content proposals should be expected. We are unsure of the future of other PIRG-type initiatives, as they have been defeated three times running.

In short, the good news is that we see less vinyl specific legislation. The bad news is that we're still plastic, and plastics in general still attract attention.

New: EcoVinyl® Natural 25 price break

Occidental Chemical Corporation has announced a price reduction on EcoVinyl® Natural 25, from $0.73/pound to $0.67/pound. Now that EcoVinyl is in full commercial production, the move makes recycled material more attractive to end users. Introduced in 1991, EcoVinyl is a line of blow molding compounds with 20 and 25 percent post consumer recycle content, the only such compounds on the market today.

EcoVinyl Natural 25 can be pigmented the same way as other blow molding compounds, and produces bottles comparable to those made of virgin resin.

For more information, contact Bill Carroll.

Melt-filtering PVC: Adapting known methods to new materials takes development

If sorting and washing were perfect, recycle PVC flake could simply be mixed with virgin pellets to produce recycle-content material. Obviously, as the experience with HDPE proves, they are not, and another step is needed to produce bottle-grade material. That step is called melt-filtering.

As the name implies, this is the process where molten PVC compound is forced under high pressure through extremely fine mesh screens to trap and remove small bits of contamination. This final polishing step is necessary to remove the unwanted particles of PET, paper label, aluminum, wood, fibers and other foreign bodies that somehow make their way through the recycling process. Yes, they all are there.

Filtering of molten plastics is not an unusual process. Most extruders and injection molders can be fitted with screens to filter the melt passing through them. Many producers of virgin materials--especially clear rigid sheet--use a fixed screen in their extruders to trap small amounts of impurities. In recycling, however, fixed screens are not enough. They fill almost immediately with refuse and the extruder must be disassembled and cleaned. Enter the automated screen changer.

A device capable of automatically changing screens insures fresh screen area is being introduced continuously to the melt. These devices are typically of three types: slide-plate, continuous wheel, and continuous mesh. Some of these devices can be combined with backflush equipment to "rinse out" a screen rather than remove it. All this technology is well known for HDPE. Unfortunately the technique and particularly the correct tooling design to accomplish this with rigid PVC did not exist until we started looking for it.

Evaluation of available technology for melt-filtering employed with other plastics shows the Gneuss continuous wheel equipment as the best of the

(See "Melt-filtering", Page 7)

Collection

(Continued from Page 1)

In February, our operation in Dallas expanded to include purchasing and transportation under my direction. This consolidation has cut down on the paper processing time and has allowed quicker movement of material out of your facility and into ours. We have also been able to take advantage of our corporate transportation group, located in Dallas, and utilize their rate structures and preferred carriers to minimize shipping costs.

When you call for a pickup, I'll need to know: approximate weight of full shipment, piece count (number of bales), loading dock hours, contact name and phone number at dock and when shipment will be ready for pickup. A carrier can usually be arranged with only one day notice. That is "usually"; we occasionally have delays in finding trucks. Purchasing requirements, equally important, are: pickup location, mailing address if different from pickup, contact name and phone number. Remember, the more information you can offer us, the easier and faster the process becomes.

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Automated sorting technology advances

(Continued from Page 1)

Non-singulating systems also require bale breakers and "cluster busters" but they send material in a single layer of bottles over an array of detectors and make binary choices at the time--eject or pass.

Neither type of machine is inherently more accurate, although each is subject to different kinds of errors. Singulating systems err in misidentification or errors in timing. Non-singulating systems tend to eject in error when unlike bottles are "shingled" over a detector. Singulating systems have the potential to sort into more specific streams; non-singulating systems are less mechanically intensive.

Neither system gives 100 percent accuracy. Purity of a given stream can approach 100 percent, however, if two sorts are done in series. Still, the human has yet to be eliminated from the sorting line and is used as a final quality check in most systems.

The world's first commercial automated sorting line was developed by Tecoplast-Govoni in Italy. In combination with their reverse vending machines, the "Blue Bottle Eaters," Govoni started recycling PVC bottles in 1988. This X-ray derived system requires singulation.

The first instrument operational in the United States, built by National Recovery Technologies, (NRT) automatically sorts PVC and PET bottles, non-singulated. In the intervening two years, NRT has introduced three models in the VinylCycle™ equipment line. These devices are scaled to process from VinylCycle 8 at 1500 pounds per hour to VinylCycle 20 at 4500 pounds per hour. NRT guarantees less than 50 ppm residual PVC in a PET stream sorted on a VinylCycle 20, if the initial stream contains less than 1 percent PVC bottles.

Currently, NRT is developing a system to separate a mixed stream of plastic bottles by resin type and color. Their method uses sequential non-singulated binary sorts to yield streams of PVC, clear and green PET, translucents and opaques. The first prototype is being installed at REPLASTIC in Rome in conjunction with Sorema.

Magnetic Separation Systems (MSS) was the second US company to introduce a PVC/PET sorting device. The detector employed was developed by ASOMA and requires singulated bottles. Several recycling facilities around the country are already successfully using MSS sorting equipment to purify either a stream of PVC or PET. Most recently, an MSS has been installed at Waste Alternatives in Ocala, Florida for production and public demonstration.

MSS was also the first to introduce a totally automated sorting system. Eaglebrook has installed this system at their facility in Chicago with assistance from the American Plastics Council (APC), Exxon, Amoco and OxyChem. That unit, operating at 4500 pounds per hour, makes positive sorts for HDPE, both natural and opaque, clear and green PET and PVC. This line will be fitted with optical sensors for color-sorting opaque HDPE by the end of the year.

The other singulating system is in operation at North American

(See "Sorting", Page 5)

AUTOSORT TECHNOLOGY SPREADS ACROSS COUNTRY

Here is a list of facilities which have installed PVC sorting equipment over the past few months.

AIC/MRC:
North American Plastics Recycling, Fort Edward, NY, on loan from the American Plastics Council

MSS:
Eaglebrook Plastics, Chicago, IL
Waste Alternatives, Ocala, FL
Environmental Recycling, Greensboro, NC
Image Carpets, Summerville, GA

ASOMA:
R2B2, New York, NY, provided by Georgia-Gulf

NRT:
Mindis Recycling, Atlanta, GA, on loan from OxyChem
Clearvue, Amsterdam, NY, provided by The Vinyl Institute
Union Carbide, Bound Brook, NJ
M.A. Industries, Peachtree, GA
Orion-Pacific, Odessa, TX

Tecoplast-Govoni:
Enviroplast, Oilville, VA

Recovery Processes, Inc.:
Hoechst-Celanese, Summerville, SC

How do we (and you) know it's really postconsumer?

By Bob Elcik

The first commandment of environmental marketing is: Tell the truth. The second is like unto it: Make sure you can prove it. Never mind that the government watches out for dubious environmental claims: we believe our customers have a right to know that the EcoVinyl® they purchase contains the specified level of postconsumer material and that it is true postconsumer material and not postindustrial.

We have established a series of certification documents, checks of origin and audit tracking to insure that when our customers purchase EcoVinyl they are getting the real thing.

The trail starts with our suppliers of discarded bottles. The first step is to tell them what we buy, how much we pay, and most importantly what our specifications are. Our standard price lists define postconsumer bottles: bottles which have held the product for which they were intended. More recently, we lean toward postresidential material that has been through the retail chain. All suppliers sign a letter of certification to that effect covering every load sold to us. That letter and a purchase order number identifies the bales contained in that shipment.

When the bales reach our sorting/washing facilities they are visually inspected for PVC content and postconsumer heritage. Postindustrial material has a certain look about it: many times all the bottles are the same size and brand. Material not conforming to our definition of postconsumer is returned to the supplier. Quality reports on bale composition and certifications are retained at our Dallas office.

During sorting, washing and melt-filtering a lot numbering system is employed. The number enables tracing of the postconsumer material back to the original source.

Blending clean recycle flake with virgin resin during melt-filtering is a critical step. The desired percentage of postconsumer and virgin materials is instrumentally metered at the extruder. In some cases, more than one lot of recycle is used to balance properties of the particular type of bottles from which it came. For example, water bottles typically are less contaminated with PET, but their thermal stability is lower.

Each box of recycle-content EcoVinyl bottle compound is then identified with the lot number which has followed it since it was a dirty bottle, and a second number identifying the site and date of final production. To insure our customers of the integrity of the product, every order sold is accompanied by a signed letter of certification.

Auto sorting

(Continued from Page 4)

Plastics Recycling in Ft. Edward, New York. That equipment, built by Automation Industrial Control (AIC) in partnership with MRC Chamberlain was developed and installed with assistance from APC. Designed for throughput of 1500 pounds per hour, the device makes positive sorts for HDPE, both natural and by color, clear and green PET, PVC and PP.

Automated sorting reduces operating costs and improves quality. Some recyclers still balk at the capital cost, which is significant. Still, a good autosort system is as critical to a plant operation as good grinders, balers and extruders.

Not all separations involve sorting. Recovery Processes, Inc. uses froth floatation to remove residual PVC from mainly PET streams.

Progress continues. Technology leading toward a low cost PVC/PET sort device is being furthered through assistance by the Vinyl Institute. Basic research on separation of mixed polymer granulated flake is showing exciting results. Some of these devices will hit the market in 1993.

Revised definition of postconsumer

As of January 1 we are making our definition of postconsumer material more stringent to alleviate some processing problems we have encountered and to conform with our certification process for our compound customers. Previously, we have accepted all fill-line scrap as postconsumer material. That will no longer be the case.

Our fill-line scrap has mainly consisted of vegetable and tanning oil bottles, and they have caused large problems. Most municipalities have wastewater regulations that prohibit discharge of the wash water from reprocessing this material without extensive pretreatment. Unfortunately, none of our washing operations are equipped in this way. The problem is the product, not the container. These materials packaged in other plastics have the same problems.

Most of our material now is postresidential, which seems to be what most people understand to be "postconsumer." To those of you who have supplied oil fill-line scrap to us in the past, we are sorry to have to make this change.

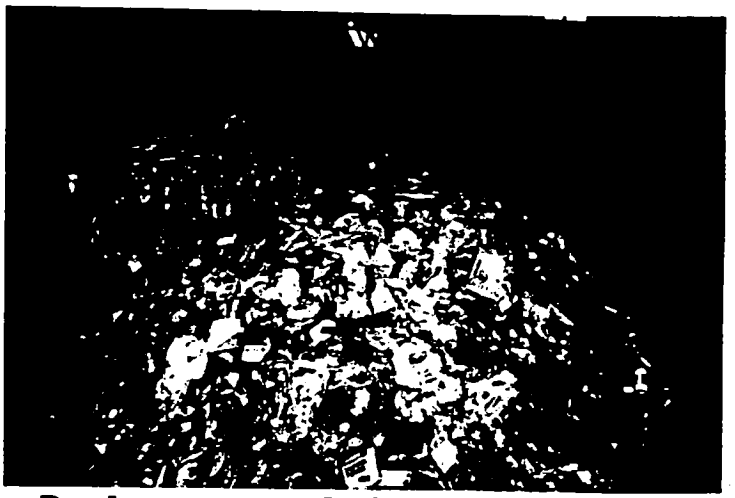
Price List
First Quarter, 1993

Prices paid for postconsumer PVC bottles, baled:

Clear bottles with wash-removable labels: $0.09/lb.

Colored or mixed colored and clear bottles: $0.06/lb.

Freight is paid by OxyChem from your site. $0.01 added for loads greater than 20,000 lbs. We reserve the right to return or downgrade material found not to be as represented. Call Debbie Kurucz for further details.



Postconsumer Bottles at Clearvue

My Turn
By Bill Carroll

What ever happened to the Green Citizen? Remember him? He was the person who responded to all the surveys about our need to recycle. "I'll pay more for recycling," he said. "We've got to take the pressure off our glutted landfills." And what about the Green Consumer? He said he'd pay more for recycled materials and biodegradable everything. If only they were available.

The answer is (to all you potential Green Marketers): he's still out there, but he's a little harder to find. All of us in the recycling business have had a difficult time of it in the past year or so. For that matter, the same thing can be said about the virgin plastics business, or the automobile business or a million others. The key to understanding the green consumer is to understand that he's looking at two "green" commodities: the environment and his money.

The recession, and it says here that the recession is still on, has modified our tastes for consumption of all kinds, especially if it's in the "nice to have" category. And in these times, that's where recycling falls. But take note: all the consumer research still says that people believe--right or wrong--that the single most significant thing they can do to save the earth for their grandchildren is to recycle. It's something that makes them feel good, that they can do with their hands, and it reduces their impact. Allows them to tread softly on the earth, so to speak. In fact, they told us this in the recent presidential election. Exit polls focused on the need to help the environment. Clinton and Gore made it an issue and it stuck.

The problem is that consumers don't make the connection between recycling and recycle-content materials. We simply have to educate them that "buying recycled" is part of the process too, especially now when the material moves slowly for all of us.

If we can do that--make the connection between buying green, being green, and using the blue bin--recycling will come roaring back with the economy. This will happen for two reasons: the return of green disposable dollars, and environmental pent-up demand. If we can't, we run the risk of perpetuating the glut of recyclables in the marketplace. And of draining our own green.

Melt-Filtering PVC Technology

(Continued from Page 3)

continuous screen changers for our purposes. Adapting that equipment for use with bottle-grade PVC, something that had never previously been attempted, required extensive design changes.

The Gneuss device involves a steel wheel whose "axle" is oriented parallel to the melt flow. In the area of the "spokes" of the wheel are placed screens which fit tightly against fixed breaker plates. The melted PVC is pushed through these screens. As back pressure rises, the wheel is automatically indexed about 1 degree, exposing clean screen to the melt. Blocked screen is indexed out, and removed when it exits the body of the machine. An extremely tight fit under pressure between the wheel and the body prevents polymer leakage.

OxyChem's technical staff worked closely with Gneuss, HiTech and Interplast to bring these machines on line. First, a laboratory-scale Gneuss melt-filter was designed for use with PVC and installed on a small extruder at our Burlington facility. Tests determined design changes needed on scale up equipment, potential running conditions and formula modifications. Even so, scaleup from the two-inch extruder to a four-and-one-half inch single screw and eighty millimeter twin was not direct.

US bottle-grade PVC compound handles differently than other PVC. It tends to center-flow, and does not shrink excessively when it cools. It burns if stagnant in a hot extruder channel. Redesign of the traditional Gneuss tooling was needed to accommodate these peculiarities. Once this was accomplished, attention was turned to the breaker plates and screen removal.

Holes in the breaker plates are tapered. In addition, extremely smooth holes are needed to facilitate removal of "plugs" from the holes as the screens are changed.

Improvements are being made in sorting to reduce PET contamination and consequently the number of screen changes. Washing improvements to remove label contamination are ongoing, but after nearly a year of technical effort, commercial PVC melt-filtering is a reality. Even though residual fibers from labels and some gels from adhesive continue to be a small problem, clear bottles can be made from material that was once garbage.

Now appearing...

For those of you who haven't spent the last few years of your lives hanging around in recycling plants or blow molding operations, the chance of a lifetime is yours. OxyChem and Amex Packaging are featured in a segment of "Today's Environment" on cable network CNBC January 9 and 10. The show, airing each day at 1:30 PM EST, features host Ed Begley, Jr., and highlights activities of environmentally active groups.

A tour of Clearvue's recycling operations and Amex's blow molding facility is featured in this seven minute segment, filmed by Five Star Productions. The object is to highlight efforts of OxyChem, customers, suppliers and the rest of the vinyl industry to put recycled vinyl on the map.

"Everyone should have the opportunity to see how vinyl recycling happens," said Rich Peters, Product Manager for PVC bottle compounds at OxyChem. "It's no different than any other plastic in this category."

CNBC is the cable information outlet of the National Broadcasting Company (NBC).

EcoVinyl® Echoes

News of Vinyl Recycling	Dallas, Texas	Fourth Quarter, 199[illegible]

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printed on recycled paper

RECYCLING OF VINYL BOTTLES: 1993 UPDATE

William F. Carroll, Jr., Ph.D.
Occidental Chemical Corporation

INTRODUCTION

Polyvinyl chloride (PVC) is the second-largest volume thermoplastic produced in the United States. Although most PVC goes to long-lived applications such as pipe, siding and wire insulation, about seven percent is used for packaging [1]. Two major problems faced by the PVC industry over the past twenty years have directly affected packaging: residual vinyl chloride monomer and waste disposal. Both these issues figured heavily in delaying full acceptance of PVC by the United States Food and Drug Administration (F&DA).

In 1988, F&DA acknowledged that monomer reduction efforts of the 1970's and 1980's had led to resins acceptable for food packaging [2]. The agency also prescribed an Environmental Impact Statement (EIS) to examine the effects of disposal of PVC packaging before full approval could be granted. The agency indicated that examination of incineration and recycling was critical; however, that EIS has yet to be reported five years later.

It is beyond the desired scope of this paper to recount the total history of incineration of PVC. It has been shown, however, in repeated small- and large-scale studies, that the presence or absence of PVC in incinerator feed has no effect on the amount of 2,3,7,8-tetrachlorodibenzodioxin (TCDD, or "dioxin") produced by the incinerator [3,4,5]. Nor is there adverse effect of HCl generated during the burning process in a well-designed and well-operated incinerator [6,7,8]. The remaining issue to be resolved is recycling of vinyl, especially vinyl packaging.

Europe. In France, Operation Pelican was organized in 1989 [9] to recover 20 percent of the available PVC from packaging in southern France. By paying FF1,200/ton, this joint venture of GECOM and France Nature Environment collected 2,800 tons of PVC in 1990 [10,11]. Material thus recovered is subjected to a grinding process called Micronising [12], wherein inadvertently obtained PET is removed from PVC as a function of differential grinding and screening. Recovered resin is used in coextruded drain pipe, profiles, pallet corners or as asphalt filler depending upon the ultimate particle size of the product fraction chosen.

A similar venture has been established recently among three resin producers and three mineral water suppliers in France. This venture, called GIE GECOM Recyclage PVC, sets the long-term goal of recycling 30 percent of the PVC used in bottles in France. The price for bottles has been set at FF1,350/ton, is effective for three years, and is expected ultimately to net about 15,000 tons/yr [13]. In 1991, 7,000 tons of plastic beverage bottles were recovered from municipalities [14].

There have also been other bottle recycling programs in operation for a number of years. Solvay in Austria and Belgium has collected bottles and reprocessed them into pipes and cable covering plates. EniChem, EVC and Solvay participate in the multi-bottle program Replastic in Italy. And in the United Kingdom, EVC participates in a bottle recycling operation called Reprise. Reprise recycles a mixed stream of bottles into the generic polymers utilizing their DSR 2000 technology [15].

In Germany, the recycling stakes have been raised for all polymers with the passage of Environment Minister Klaus Toepfer's sweeping legislation [16,17,18], and PVC is obviously included and affected. Retailers and manufacturers of packaging are now responsible for its disposal. By law, packaging may be left at the retail outlet or collected at the curb. To achieve the recycling rates mandated (64 percent of plastic packaging by 1995) a program called "Green Dot" was instituted by industry through a consortium called Duales System Deutschland (DSD). Consortium members pay a per-package advance disposal fee, and packages manufactured or sold by consortium members carry an ecomark--the Green Dot. DSD is responsible for collecting marked packages via a shadow trash collection program. Other organizations specific to materials sort the recycled articles and return them to consortium members. The program is expensive: setup cost is estimated at DM15 billion, and annual cost is estimated at DM2 billion [19]. The 1992 subsidized cost of collection and sorting these various plastics averaged DM1.75/kg.

In October, 1993 the fee structure for use of the Green Dot changes to a weight rather than container basis. For plastics, the charge is DM2.61/kg. In addition, a new organization called Deutsche Kunstoffrecycling has been set up to oversee subsidies to recyclers [20].

United States. In 1988, BFGoodrich, in association with Portage Path School, paid a bounty for PVC bottles returned by employees and students. These bottles were ground, washed and processed into a number of recycle content items, including pipe, fittings, bottles and sheet [21]. A similar program was done by the member companies of VI in the Philadelphia area in 1988 [22]. In 1990, Goodrich began a program of collection of vinyl bottles in Waukesha County, Wisconsin in collaboration with Schoeneck Container [23,24].

Certain small businesses also were separating and selling postconsumer PVC. Vermont Republic Industries, under the direction of Al Voegele, recovers profiles which once carried integrated circuits [25]. These "chip carriers" are ground and sold for profile extrusion. Recoverable Resources Borough Bronx/Bronx 2000 (R2B2), a community based recycler, has been separating PVC bottles from the waste stream for a number of years. Both organizations have received grants from VI to develop and continue their work.

The first attempt to improve the PVC recycling rate nationwide was undertaken in September, 1989. At that time, OxyChem announced an initiative to buy back postconsumer PVC from the waste stream all over the United States. Prices paid were equivalent to those paid for PET, as was freight for minimum loads of 2,000 pounds. Although the minimum purchase has been raised to 5,000 pounds, the program remains essentially unchanged three years later.

Grinding, washing and repelletizing was contracted to small recyclers who specialize in HDPE in order to avoid cross-contamination with PET. Specifically, Wheaton Plastic Recycling in

Millville, New Jersey and Clearvue Resources, Ltd. of Amsterdam, New York grind and wash. HiTech Polymers of Florence, Kentucky and Interplast II of Galax, Virginia perform melt-filtration services.

COLLECTION

PVC bottles comprise about four percent of the total plastic bottle stream [26] and can be collected explicitly in "all plastic bottles" programs or inadvertently in programs designed for HDPE and PET. The buy-back program netted nearly 500,000 pounds of PVC bottles in 1990, about 800,000 in 1991, and 1,000,000 in 1992. Current collection rate for postconsumer bottles is about 100,000 pounds per month, and is rising. Prices paid for materials have been kept reasonably constant over the last four years at $0.09/lb. for clear bottles with labels that can be removed in washing and $0.06/lb. for mixed color material. Minimum shipment is 5,000 lbs. with $0.01/lb. bonus for loads over 20,000 lbs.

R. W. Beck and Associates found in a 1992 survey that about 1200 communities had access to PVC recycling [27]. We have purchased material from sixteen states and three Canadian provinces, and have over twenty regular suppliers.

SORTATION

Most sorting of plastic bottles in commercial recycling at the close of 1992 is still manual, which requires visual identification of bottles. The most difficult single determination to make on a sorting line is the difference between PVC and PET. There are a number of ways by which these two types of bottles can be distinguished.

Manual. Trivially, recycling codes can be checked individually as they designate PET bottles "1" and PVC "3". Other means of identification are characteristic of formulation and processing. Extrusion blow molded PVC has a horizontal scar from the parison pinchoff, while injection stretch blow molded PET has a circular scar from the injection sprue. PVC typically has a slightly blue tint, whereas PET tends to be colorless. Also, clear PVC tends to crease-whiten when crushed. Crease-whitening is opacification in a stressed area of a PVC bottle.

Of course, if all else fails, resort to chemical analysis. In this case, PVC is readily identified by the Beilstein test [28]. A loop is made of copper wire, which is heated in a propane torch flame until red hot. After cooling slightly, the loop is charged with some of the unknown plastic and placed back into the flame. A bright green flame indicates the presence of a halogen; for plastics this is most often chlorine, and for bottles most always PVC.

Thus, identification of single bottles is relatively easy; however, sorters work at rates of up to a bottle a second; 3600 decisions an hour may be needed, and errors are probable. Moreover, these methods do not square with the need for multiple identifications per second. Neither do they take into account resin products that process and look like vinyl, such as glycol-modified PET (PETG), extrusion PET (EPET), K-Resin® (styrene-butadiene copolymer), Barex®

(acrylonitrile/acrylate/diene) copolymer or polycarbonate. These products greatly complicate vinyl recycling.

Contamination of sorted product occurs and can be devastating for product quality. Clusters of PET bottles created during the baling process can contain hidden PVC bottles. These situations lead to contamination of PET by PVC. This contamination is a problem because PVC burns at the high PET processing temperature.

PET contamination of PVC occurs in the same way. It was hoped that PET contamination could be melt-filtered out of PVC since PET softens but does not melt at PVC processing temperatures. To some extent it can; however, the upper limit for practical filtration is about 0.05 percent. Thus, little more than one PVC/PET sorting error per hour is allowable (about 0.05 percent). Sorters are not reliably capable of this level of precision; typical samples of twice-hand-sorted bottles are about 95 percent pure. Other researchers report even poorer results [29]. As an example, in Table 1 is shown a sampling of the composition of individual bales hand-sorted by different suppliers.

Table 1. Bale Composition from Recycle Suppliers.

Vendor	Bale Weight, lbs.	Good PVC, %	Reject PVC[1], %	Bad PVC, %	Mixed Color[2], %	PET, %	Other/ Garbage, %
A	330	58	18	2	18	1	3
B	910	64	23	0	10	2	2
C	980	52	19	4	1	14	9
D	700	66	23	1	0	3	7
E	1360	66	25	1	5	3	0
F	1430	50	16	1	4	23	6

[1]PVC rejected from automated sorting in error. Device is run in "reject PET" mode, and some PVC is rejected with PET. PVC is recovered in a second pass.

[2]PVC and HDPE

Automated. The future of plastics recycling lies in the mechanization of the sorting process in conjunction with visual inspection. Fortunately, the leading candidate for automated sorting technology is PVC. PVC is the easiest material to identify instrumentally because it carries nearly 50 percent by weight of a chemical marker: the chlorine atom. Many technologies have been developed to exploit this chemical distinction.

Tecoplast Govoni, an Italian company, has patented a system which takes waste bottles from disposal back to useful product [30,31,32]. It begins with reverse vending machines which accept bottles and subsequently flatten them between heated rollers. These slabs are transported to the sorting site and placed singularly on a cleated conveyer. They pass in turn beneath an x-ray beam, and polymer identity is determined by transmittance of the x-rays. Govoni is represented in the United States by International Food Machinery, and a plant incorporating this technology has been built in Oilville, Virginia by Enviroplast [33].

ASOMA Instruments of Austin, Texas utilizes x-ray fluorescence in a reflectance mode to identify singulated bottles passed near a detector [34,35,36]. This device has been scaled up at the Center for Plastics Recycling Research at Rutgers, the wTe recycling facility in Akron, Ohio and R2B2 in New York City.

National Recovery Technologies (NRT) of Nashville, Tennessee received grants from the Vinyl Institute and the United States EPA to develop a detection-ejection mechanism for PVC that does not require singulation [37,38]. Although the detection mechanism is proprietary, ejection is based upon NRT's commercially successful Pulsort® technology [39]. A prototype device was shown in October, 1990, [40] and the first full-scale VinylCycle™ was installed at the Reprise recycling facility near Manchester, England in April, 1991.

NRT's current product line includes three sizes having capacities up to 4,500 pounds per hour. NRT will guarantee less than 50 parts per million PVC in PET if the input feed is 1% PVC or less [41]. These machines are in use by Union Carbide, Mid-American Waste, M.A. Industries, Orion-Pacific and several other major U. S. recyclers. One is available for open demonstration at Clearvue Resources, Ltd. cooperatively with VI.

All three techniques operate irrespective of the presence of some dirt and residual product. X-ray fluorescence, a surface technique, is responsive to labels and requires passing the sample within one inch of the detector. Neither of the other two techniques appear to have these sensitivities, however, they are less sensitive to thin coatings of chlorine-containing material.

Recently, a number of all-polymer sorting devices have been announced. The first, developed by Magnetic Separation Systems (MSS) of Nashville, Tennessee, currently incorporates ASOMA technology for PVC detection. MSS, in conjunction with a number of industrial sponsors and the American Plastics Council (APC), sold its first device to Eaglebrook Plastics in Chicago [42]. A smaller version, which only sorts vinyl and colors of PET, is available and has been installed at a number of sites including Waste Alternatives of Ocala, Florida under a grant from VI [43].

MSS separates singulated bottles into clear, translucent and opaque fractions, then further separates into generic polymers, by color. Automation Industrial Control (AIC) and MRC Chamberlain, with financial support from DuPont and the APC, have developed a second device using near-infrared spectroscopy to determine polymer identity, and a unique vibratory conveyor. Both MSS and the AIC-MRC device can also be adapted to sort bottles by color [44]. Both, however, require that bottles be singulated and include equipment to do so.

NRT has expanded its technology to include full bottle sorting that does not require singulation. The first commercial application of this technology will be in Italy in a prototype facility otherwise designed by Sorema srl [45].

Development of low-cost "assisted-manual" systems has proceeded as well. Particular wavelengths of ultraviolet light, originally used for quality control of flake PET, can be used to distinguish PET and PVC bottles [46]. Employee protection is critical, however, for eyes and exposed skin.

A proprietary optical technique has been proposed for sortation of PVC from HDPE and PET [47]. This process is under development by a Canadian firm, Microfilm Archimed of Repentigny, Quebec and the Enterprise Development Corporation of Toronto. This technique apparently works on clear bottles; the effects of dirt or residual product are unknown.

Recently, other physical strategies for sortation of flakes of PVC from PET have surfaced. The Refakt hot-belt separator has been announced commercially [48]. In this instrument, PVC melts and adheres to a heated surface. PET does not, and can be removed easily from the surface.

Proprietary systems for removal of flake PVC from flake PET using techniques similar to froth floatation have been announced [49]. Critical to the "Mainstage" system of Recovery Processes, Inc. of Park Cities, Utah, is the use of proprietary chemicals which allow bubbles of air to be attached to PVC. It is then selectively floated out. Hoechst-Celanese has chosen this technology for its plant in Spartanburg, SC [50].

Kali & Salz Ensortgung GmbH of Kassel Germany has patented an electrostatic separation process for separating mixed plastic flake. This process has been used for years in processing potash ore. Purity greater than 99.99 percent is claimed in their laboratory 100 kilogram per hour device [51].

Other flake separation strategies under study include dielectric constant [52] and density separation by supercritical fluids [53]. Typically this research has been conducted at universities under the auspices of the Plastics Recycling Foundation.

REPROCESSING

Based upon the needs of blow molders in the U. S., postconsumer PVC must be ground, washed, purified by floatation, dried, aspirated, tested for metal contamination and melt-filtered like any recycled resin. Alternatively, it may be washed and micropulverised or cryoground [54,55,56,57] with subsequent separation of unground PET, then repelletized or used as a powder blend. The two key steps, for bottle-to-bottle recycling, however, are washing and melt-filtering/repelletization.

Grinding. Process yield and materials handling is affected by the size to which bottles are ground. Typically, blow molders grind material to pass through three-eighths inch screens. This

size works well for fabricators who immediately return ground material to the extruder. Some washing operations have had difficulty handling material ground to this size, and recommend larger (half-inch) flake. Also, PVC grinding can produce a large amount of fine particles, especially if the desired flake size is small and grinder knives are not kept scrupulously sharp. Fines are typically lost in the washing/drying process.

Washing. Virtually every commercial approach to washing recycled plastics is unique, although all technologies have certain elements in common. Most use hot water, and we believe this is critical to cleanliness for PVC. Many use detergent or caustic soda and shear to clean the plastic and remove the labels. After washing, the density separation is done by simple floatation or by hydrocyclone. PVC sinks in water, and recovery strategies are most analogous to those for PET. We find that processors who understand PET recycling have little trouble washing PVC satisfactorily.

An exception to this rule is PVC vegetable oil fill-line scrap. These bottles, which have been filled with vegetable oil and then emptied, can contain as much as 10 to 15 percent residual oil. The material requires prewashing or presoaking to allow the oil to float away from the ground vinyl before transferring to the formal wash operation. If bulk oil is removed and the right conditions are used, good flake material results; however, significant waste water quality questions regarding fats, oils and grease must be answered. Labels tend to be shredded to very fine pieces by the washing process and remain with the water, or are removed by aspiration from dried product. Still, a very small amount of fibers causes a large degradation in the quality of clear products.

One problem associated with vegetable oil fill-line scrap has relevance for all processors. When oil bottles are finely ground and stored in gaylord boxes without some prewashing, oxidation/rancidification of the oil can occur quite rapidly. If this is coupled with storage in the presence of heat or sunlight or as a large, poorly ventilated mass, spontaneous combustion can occur. Other recyclers have noted similar problems with PET bottles from similar source [58].

Obviously, the plastic is not spontaneously combusting, but the oil is. While vegetable oil is a relatively less hazardous Class III flammable liquid, it is nonetheless a flammable liquid. Decomposition products of vegetable oil, including the final product (acetic acid) are more volatile and flammable than the oil itself. Oil-soaked corrugated board is strongly analogous to oil-soaked rags, which we are reminded by fire officials to store only in closed metal cans.

Therefore, recyclers should note that residual product can be an excellent fuel regardless of the type of plastic in which it was packaged. Precautions need to be taken for storage of recycle. Code compliance is critical, and local fire departments or organizations such as the National Fire Protection Association can give further advice on storage regulations. Such advice is now part of the basic information we send in response to inquiries about our program.

Screen printed or heat-transfer labels (which cannot be removed by washing) contain opaque pigments which render otherwise clear material hazy. Thus, even though plastic labels would seem to be a godsend for recycling, they are just the opposite unless they can be removed totally from the bottles. Additionally, many plastic labels are made of PET films which are

incompatible with PVC. An even larger problem is the use of adhesives which cannot be washed off and are incompatible with PVC. Labels of any sort applied with minimal amounts of water-soluble adhesives are best for our purposes. Many end packagers are starting to alter their labeling and overall packaging systems to be more easily handled by recyclers [59].

Melt-filtration. Literally, this means melting the washed flake in an extruder and pushing it through screens installed in the melt channel which catch the residual paper, metal and PET--anything unmeltable. This process is the final step in any of the existing plastics recycling processes, and machines of various types are available. Unfortunately, these machines have been designed for materials that are either very heat stable (HDPE) or low melt viscosity (PET). PVC challenges machine design on both counts as a high melt viscosity, low thermal stability material.

In concept, melt-filtering and repelletizing PVC is not difficult if the substrate is of high purity. The special handling required by recycle, which is rather dirty by comparison with virgin, is not obvious. The common screen changer types are slide-through, continuous wheel and continuous screen roll. In our hands, slide-through changers introduced burned material into the melt. As a result, we believe that continuous wheel changers are best for this duty, and have bought and recommended them. Some processors of sheet use slide-through changers to filter gels from the melt with no apparent difficulty, however.

Two recent studies have been published regarding the effects of impurities on the melt-filtration process [60,61]. The first presents a general outline of melt-filtration efficiency and dependence upon temperature of the melt, screen mesh and recycle purity. The second focuses on screen mesh, screen life, impurity levels and overall final product quality. Both studies confirm that impurity levels must be about 0.1 percent or less of total filterables to obtain acceptable manufacturing performance. Our scaleup work shows that the effective upper limit is below 0.05 percent due to changes in the output-rate-to-screen-area ratio for larger devices.

Filtration through screens of about 150 mesh is necessary for our purposes. Even so, small fibers and shards of PET can still occasionally penetrate the screens. Without proof, this seems to occur because such particles align with the flow so as to present their smallest rather than the largest dimension to the screen. Also, if screens are fully obstructed and the screen itself does not fit tightly into the changer, material can be forced around the screen. Reformulation of virgin material added to the recycle is necessary to compensate for recycle losses in lubrication, stability and color.

The device itself must be designed with a knowledge of American PVC bottle compounds. Due to the high impact modifier concentration compared to bottle compounds around the world, American bottle compounds handle differently than other forms of PVC. At low flow rates the melt tends to center-flow, and material will stagnate in low flow areas. As with other PVC processing devices, tooling for the extruder/screen changer must be designed to eliminate stagnation. Also, backflush screeners especially made for HDPE are too complex for the PVC melt. Finally, easy removal of PVC from breaker plates "on the fly" is more difficult compared to HDPE--especially for non-removable breaker plates--as the PVC does not shrink as extensively as it cools.

Since the raw material was once literally garbage, it is not hard to imagine the problems that await end-users if the material is not processed well. Fibers, PET and leftover adhesive cause major bottle imperfections. Unremoved oil or other products can change color, odor and lubrication characteristics. Pigmented end-use products are more forgiving of color and gel variation.

But even with all these difficulties we have been successful in generating 25% recycled content, clear PVC bottle compounds by screening and repelletizing material as a blend in virgin, using virgin dryblend as the carrier for additives. This product is commercially available as EcoVinyl® Natural 25, and is being produced comfortably at 1,000 pounds per hour. The limiting factor to production at this time is the availability of scrupulously sorted, clear recycled bottles. With effort, higher loadings of recycle may be achievable.

RESALE/ECONOMICS

Costs. Collection, transportation and processing costs drive recycling economics, and must be minimized where feasible. Our purchase price for raw bottles, while high, was designed to attract interest in the program and will be preserved. Operating tolling facilities at remote sites maximizes the need for transportation, and as volume increases these steps may consolidate at single sites. Reduction in processing cost could come from development of higher recycle content compounds, subsequently blending with virgin pellets.

Markets. It has been observed that the pipe market could easily absorb all packaging recycle [62]. A recent publication reviewed the properties of various products, including pipe, made with recycle content [63]. That said, the cost to buy, transport and wash bottles exceeds the current price of virgin pipe-grade resin, not to mention that of clean industrial scrap, the usual offset to virgin resin. Clearly, then, pipe is not an economically feasible outlet for recycle of this type. In addition, code restrictions limit the use of postconsumer recycle [64]. Producers of pipe who can use scrap use lower priced clean postindustrial material. Thus, we believe that the recycling cost structure, product properties, advent of recycle-content legislation and price of virgin bottle compound dictate that recycled PVC bottles be returned to the packaging stream.

Pricing of recycle-content compounds has changed radically in recent months. The first recycled products were priced at or above comparable virgin resins [65,66] for PVC and HDPE. Falling prices of virgin HDPE have put pressure on recycle prices, bringing them largely to parity with virgin [67]. Also, despite the apparent feel-good aspects of environmentalism, the so-called green consumer who demands and pays for recycled materials has not surfaced in great enough numbers. The future of recycling demands on firming prices and demand-pull.

To address the lack of demand for recycled materials, governments at all levels have proposed laws to mandate use of recycled products [68]. At the end of 1992, three states had passed recycled rate or content laws for rigid packaging--so-called "rates and dates" laws. At first blush these laws are attractive, but may serve only to raise the prices of raw materials--garbage--without allowing recyclers to recoup any more of their expenses or creating sustainable markets. In addition, these laws institutionalize the use of recycle in these applications regardless of

development of better outlets. Still, the laws have created more interest in recycled products as the target dates approach. Whether mandated use of recycle generates improved recycle demand and premium pricing over time is undecided.

SUMMARY

The problems encountered in making a bottle grade recycled vinyl are very similar to those encountered with any other material, and they give rise to some principles we have learned during this program.

1) Quality, and necessarily purity, is king. In the recycling business it has to be "garbage in, prime out" because customers want to buy prime--not garbage.

2) Recycling is not cheap. Transportation and processing costs are high compared to even virgin product.

3) The pressure for recycling from government and public isn't going away, but markets and prices which supported infrastructure development in 1990 are less obvious in 1993.

4) Vinyl recycling--even bottles-to-bottles--is real.

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TESTIMONY OF WILLIAM F. CARROLL, JR., PH.D
METRO COUNCIL SOLID WASTE COMMITTEE
APRIL 5, 1994

My name is William Carroll, I am employed by Occidental Chemical Corporation in Dallas, Texas and I am a member of the DEQ Implementation Task Force for the rigid plastic container recycling law. For the past five years I have operated a buy-back program for vinyl bottles--those having resin identification code number 3. We buy these bottles from all over the United States and reprocess them back into a packaging material called EcoVinyl®. I appear today to speak against the proposed boycott of vinyl packaging, Resolution No. 94-1940.

Vinyl packaging is used for a number of reasons. As a flexible material, it provides outstanding barrier properties for packaging meat and other perishables. As a rigid, it contributes to source reduction when molded as large clear bottles with handles that reduce the need for smaller bottles. It provides a cost-effective alternative for the small packager who has special packaging needs. In addition, less hydrocarbon-based non-renewable resources are used to make PVC than for most other packages.

That said, it appears the main concern of the Committee with respect to vinyl packaging is recycling. OxyChem also had this concern when we started our buy-back program in 1989. Our objective was, and is to encourage collection of PVC containers, provide a market for them when they are collected and to offer a recycle-content alternative for users of vinyl. Our rules are that material must be baled, it must be at least 75 percent PVC, and in loads of at least 10,000 lbs. In exchange for these considerations, we pay a minimum of $0.06 per pound at the recycler's door. Prices range to $0.13 per pound for purity of greater than 90 percent and loads over 20,000 lbs. I have brought literature that includes all the details of our program and information about some of the technology currently in use to make separating PVC and PET easier.

The resolution states, "PVC container contamination of more valuable plastics eliminates or reduces recycling opportunities." I believe my prices for purity are fully competitive with prices for other kinds of baled bottles at similar quantity and quality; however, I understand the problems caused by contamination. Specifically, PVC and PET cannot be processed together in the melt. PET is the biggest barrier to quality in PVC recycling; PVC is a problem to PET manufacturers as well, and in about the same concentrations.

For Oregon this is less of a problem since two-thirds of all PET bottles are soft drink bottles, and are covered by deposits. Of the clear "custom" bottles, about two-thirds are PET and one-third are PVC. This stream--which is only about 15% of the total bottle stream--is all that is in question. To address this need, industry organizations for vinyl and for PET have supported research in sorting methods and in enhancing markets for custom bottles of both types in Oregon. Let's review sorting technology first.

Automated sorting machinery is in use throughout the US, and it works. Most of the largest PET reclaimers use automated sorting in their operations. At least one reclaimer, Image Carpets, can

accommodate less-than-perfect PET because of automated sorting. Incidentally, Image is also my largest supplier of PVC. We would be unable to make EcoVinyl without such machinery in our production plants.

Automated systems are generally best suited to high-volume operations, but devices that assist manual sorters exist as well. Specifically, certain kinds of ultraviolet light enhance the distinction between numbers 1 and 3. This technique works so well that a manual sorter in Dallas uses only this system to obtain purity that is fully acceptable for the major PET recyclers. Other simplified inexpensive technology for manual sorting has been patented as well.

Plastics producers and users are helping to enhance the recycling rate of all clear containers in Oregon. The National Association for Plastic Container Recovery (NAPCOR) will soon kick off an initiative to recover "custom" PET containers. This program will allow small sorting entities to stage less-than-truckload amounts at a larger facility for combination into truckload shipments to existing markets. Detailed sorting education is part of the program. In addition, the American Plastics Council will be helping to assemble equipment for a "plastics recovery facility" in the Portland area that will include automated sorting of PVC. OxyChem has already agreed to buy all the PVC from this operation.

I have to admit that I have been somewhat frustrated in attempting to get "Number Threes" collected here in Oregon even though we have a number of suppliers in California. There are fourteen Oregonians on my mailing list in various cities, encompassing government, private industry and recyclers. I have even provided my information to OSPIRG, and asked specifically for their help in getting PVC collected, but without result. Perhaps I have only found the correct group tonight, by accident, so I will ask again.

I need these PVC bottles as raw material for my product. I would be pleased to purchase them and move them if you will help me get them collected. I would ask that you amend your resolution from "Threes Down" to "Threes In."

In the interest of time, I have not addressed all the "Whereas" points made in the resolution. I would be happy to do so by answering questions now or privately after this meeting. Thank you very much.

DISCUSSION OF "WHEREAS" POINTS IN RESOLUTION NO. 94-1940

Whereas, PVC packaging contains chlorine which is highly toxic and damaging to the environment...

In addition to carbon and hydrogen, PVC does contain chlorine; however, there are large differences in chemistry between elemental chlorine and materials that are made with chlorine. While table salt, sodium chloride, contains chlorine, it is not "highly toxic and damaging to the environment." The same can be said for numerous other chemicals, including many disinfectants and pharmaceuticals.

The US EPA and Environment Canada agree that the International Joint Commission's call for a phase-out of chlorine is not warranted. Some chlorine-containing compounds such as DDT and PCB's have been removed from commerce; however, it is not appropriate to remove all chlorine-containing materials on the same basis. If it were, penicillin would be banned based on the toxicity and environmental performance of mustard gas, sulfuric acid and other sulfur-containing chemicals.

Vinyl is neither toxic nor damaging to the environment. PVC is used to deliver blood stably and safely as blood bags, to deliver water efficiently as pipe and to protect groundwater from leachate as landfill liner.

Whereas, PVC is made of chemicals linked to cancer, birth defects, liver and kidney damage...

Vinyl chloride, the monomer from which PVC is made, was linked in the early 1970's to two diseases: acroosteolysis, a bone disease affecting the extremities and about 100 cases worldwide of angiosarcoma of the liver, a rare but not unknown form of liver cancer. Both diseases were found to occur in workers who were exposed to extremely high levels of the monomer, such as would be present when reactors were cleaned by hand.

This situation is, in fact, a triumph of how an industry can discover a problem and act to eliminate it. New methods and controls were put into place that reduced worker exposure by factors of 100 to 10,000. As a result, no new cases of cancer have been reported in workers whose tenure started since these controls were implemented nearly twenty years ago. Studies of vinyl fabrication facilities show little--and usually no--vinyl chloride exposure to workers. In all cases, concentrations of vinyl chloride are well below the OSHA limits.

Residual vinyl chloride in PVC has also been reduced by similar amounts. In 1988, the US Food and Drug Administration declared that it had no health and safety concerns about the use of food-grade PVC. Recently, Cesare Maltoni, the Italian scientist who discovered the animal link between PVC and liver cancer confirmed that if any problems with packaging existed they were solved. Maltoni performed extensive work on water bottled in PVC and found no animal effects.

Whereas, incineration disposal of PVC packaging produces hydrochloric acid, a corrosive air pollutant...

Chlorine in any form goes to hydrogen chloride when burned in an incinerator. This includes chlorine from vegetation, from paper, from leather and from inorganic sources as well as from PVC. Vinyl accounts for thirty to fifty percent of the chlorine in municipal solid waste. The remaining fifty to seventy percent of the chlorine (to say nothing of the sulfur and nitrogen that also give rise to acidic gases) necessitates the use of scrubbing equipment for any municipal solid waste incinerator.

Allegations that PVC in municipal solid waste causes production of dioxins in incinerators have been studied repeatedly and shown not to be true. In the best study done on a full-scale incinerator there was no difference in dioxin production whether PVC was removed from the feed or enhanced by a factor of four. These results were collected at a point upstream of air pollution controls so as to be assured of seeing an effect if it were present.

Whereas, PVC packaging has a recycling rate of less than one percent and may reduce Oregon's ability to meet the 1995 goal of recycling 25% of all rigid plastic containers...

PVC comprises less than five percent of bottles. The main barrier to increasing the recycling rate for PVC is collection, since markets exist. Even so, due to the small amount in the waste stream the overall amount of PVC recycled will not materially affect the recycling rate in Oregon; enhancement of collection, however, could increase the availability of recycled material enabling more packagers to incorporate recycled content.

Whereas, several European countries and Australia are phasing out PVC...

This is simply not true. The statement implies that there are laws restricting the use of PVC in Europe and Australia that would cause such a phaseout. In fact, there is exactly one law of this kind: in Switzerland the use of PVC for beverage containers is restricted. This resulted from two causes: the need to equip Swiss incinerators with modern pollution controls (which would have been required in any event), and the apparent desire to reduce imports of French bottled water so as to favor Swiss bottlers. As the retrofit is completed, negotiations to remove restrictions continue. No such laws exist in Australia.

On the other hand, there are numerous recycling programs in Europe and Australia aimed at PVC packaging and some of the anti-PVC rhetoric has been cooled by governments.

- Austria: The courts have ordered a stop to anti-PVC advertising as it was deemed groundless.
- Norway: After an extensive environmental impact review, the Environmental Ministry granted a new construction permit for PVC manufacture.
- The Netherlands: The Foundation for Dutch Publicity Codes determined that the Dutch Environment Ministry was unable to demonstrate that PVC should be avoided on environmental grounds. It went on to note that vinyl often scores better on environmental grounds than do traditional materials.
- France: the most recycled plastic packaging is PVC.
- Australia: Geon operates a bottle recycling program similar to OxyChem's in the United States.

TESTIMONY OF WILLIAM F. CARROLL, JR., PH.D.
BEFORE THE METRO COUNCIL
APRIL 14, 1994

My name is William Carroll, and I am Director of Commercial Development for Polymers and Plastics for Occidental Chemical Corporation in Dallas, Texas. I appeared before the Solid Waste Committee of the Council last week, and I am grateful to the Council for inviting me to appear today.

A copy of my testimony from last week has been entered into the record and should be before you, as is a copy of the literature I send to recyclers who inquire about our buy-back program for PVC--resin identification code number 3--bottles. In short, for the past five years we have been buying these bottles back from recyclers and paying very competitive prices as well as the freight to move them to our processors.

In addition to the details in my previous testimony, I would like to clarify some points raised last week. Councilor Wyers noted that she believed that a number of countries, including Australia and Sweden were phasing out vinyl for packaging. In the testimony I presented last week, specific notes are included regarding a number of countries, including Australia,but not Sweden.

In Sweden, a number of years ago, there was an agreement in the packaging industry to switch from vinyl to other materials for containers such as butter tubs. As you know, in the United States such containers are made of HDPE or PP--resin codes 2 and 5 respectively. This change was similar to many changes of packaging made regularly in the US for reasons of cost, marketing, package or product design and has no great significance.

Interestingly, at approximately the same time, a number of supermarket chains which had previously reduced the use of vinyl for environmental reasons reversed themselves. A good example is Marks and Spencer in the United Kingdom--they noted that vinyl is highly "environmentally friendly." The Swiss chain Migros noisily eliminated vinyl in the late '80's, but it has returned to the shelves of these stores because it could not be replaced efficiently or in an environmentally sound manner. They said, "It has outstanding properties not easily matched by alternatives."

Last week I noted two new programs: one by NAPCOR to aid in the recycling of Custom PET--resin code 1, and one by the American Plastics Council. Taken together with our buy-back program they present a number of ways to recycle the 15 percent of the bottle stream comprised of the mixed clear 1's and 3's you have probably seen.

NAPCOR will assist recyclers who sort #1's with education on methods, and will provide a staging point for less-than-truckload quantities to be combined for shipment to markets. Our program is also available to these recyclers, as they will be collecting some vinyl as well. In addition, the American Plastics Council will be building a plastics recovery facility in Oregon

which will be capable of sorting mixed 1's and 3's via automated methods. This facility should be operating in the fourth quarter pending receipt of the automated sorting equipment.

I should also review for you the programs which are expanding their stream of packages for recycling. On April 28 Lane County will kick off a program to recycle all rigid plastic containers--not just bottles. Vinyl is included.

When the plastics recycling facility is complete, 1's, 3's, 5's and 7's will be added to the Thriftway drop-off program. Incidentally, we have approached and received positive responses from operators of Portland's drop-offs with respect to including all bottles in the collection. In addition, we have asked BFI to remove all plastic bottles from the Metro stream that they currently process. These bottles--including number 3's--will also go to the PRF.

Finally, I am prepared today to make a special accommodation in our program to close one more gap for recyclers in the Metro area. For recyclers who choose not to sort 1's from 3's, I will revise my quality specifications and accept mixed bales of these materials. I will pay the recycler on the basis of the yield of 3's at my highest published price. This means that if a recycler sends me bales that are 30% vinyl, I will pay him 30 % of $0.12 for the entire bale, or about $0.04/lb. A bale must be at least 95% mixed clear 1's and 3's to qualify, and while I will provide transportation, it will be at my convenience for small loads to minimize fuel waste and emissions. This offer is effective immediately, and I will make accommodation at another sorting facility for bottles we receive prior to opening the plastics recycling facility.

On the other hand, recyclers may choose to sort PET using some of the simple methods NAPCOR can teach, save PVC for me and get paid for both. My specifications for material are typically far more liberal than those for most plastics. Please refer to my price/quality sheet.

The point of this program is to emphasize how serious OxyChem is about recovering vinyl. We have been doing this for five years and expect to continue. I commend Recycling Advocates for their desire to reduce waste and improve the utilization of secondary materials. I have that same desire. If recycling is the goal, then boycotting vinyl--the one material for which there is a nationwide buy-back program--will not help accomplish that goal. Furthermore, if the Council endorses such a boycott, it punishes an industry that acted to solve its own problems without the threat of regulation.

I ask you to consider a more moderate course which does not endorse the boycott.

TESTIMONY BEFORE METRO COUNCIL ON PVC BOYCOTT/BAN (April 14, 1994)

by Steve Engel
Waste Matters Consulting

My name is Steve Engel. I have a small company in Portland, Waste Matters Consulting, that specializes in designing and implementing solid waste management programs. We have done a number of projects for Metro, as well as for the City of Portland. Our emphasis is on cost-effectiveness studies -- what you get for what you pay, and how to improve that ratio.

One of my clients is the American Plastics Council -- the APC. I help the APC develop collection and processing programs. The APC did not ask me to speak to you on this issue. I decided on my own to do so -- as a person familiar with the results of packaging policies and laws, and as a resident of the Metro region who wants to prevent waste and harm where possible.

I had some reluctance to speak against this resolution. My chosen role is to be a fact-finder and logistics guy, not a lobbyist. And, frankly, Metro is also one of the foremost potential employers of my services. I have supported several of you in past and current campaigns, and I don't relish disputing with you.

But I want to urge this Council to look at some facts, and to weigh your action against them. I ask you to consider the following standards for your decision:

1. Is it justified by the facts?
2. Is it equitable?
3. Will it achieve the desired effect?
4. Will it do significant, unintended harm?
5. Is it an appropriate action for this agency?

I know you ask yourselves these questions every time you vote.

1. Is it justified by the facts? Bill Carroll has pointed out that PVC will not impair Oregon's ability to meet the 25% plastic container recycling goal. He has explained that bans cited in other countries are non-existent or based on narrow special interests; and he has pointed out that the market price paid for recycled PVC is competitive, to say the least, with any other plastic. Most importantly, he presents evidence that claims of PVC toxicity are out of date, no longer warranted, and not supported by other fact-finding bodies. I suggest that this Council has not yet had the time or opportunity to evaluate these opposing claims, and ought to give due consideration to Mr. Carroll's data.

2. Is it equitable? Are you about to penalize one material for problems that are equally or more seriously present in others? No one is proposing a boycott or ban on **waxed corrugated cardboard** -- nor should there be one, because it serves a need. Yet it creates costly problems for recycling when it ends up with other corrugated. And a far larger recycling volume is at stake than for plastics. **Juice boxes and milk cartons** are collected with corrugated cardboard by several curbside programs in the Metro area, and these packages create additional costs to separate. No objection, and none needed. **Ceramics** -- such as vases, plates and ovenware -- interfere with the recycling of container glass. **Green glass** is stockpiled high at Owens Brockway, with no end in sight and no market value any longer for the material -- but no measures are expected against wine or imported beers, the main sources of green glass. **Steel cans** must be separated from aluminum for recycling -- just as PVC and other resins now are separated at facilities in the U.S., and just as they will be separated at the plastics recycling facility soon to be installed in Oregon. **Aluminum caps** still present a difficulty for soft drink bottle recycling. Finally, no boycott or ban is -- or should be -- placed on **toilet paper, tissue paper, paper cups or paper towels,** even though they are not going to be recyclable at any time in the foreseeable future.

All these secondary materials constitute a far larger percentage of the waste stream than PVC packaging. More is at stake with them than with PVC; but a ban or boycott is not needed to resolve the problem, and it is not equitable to impose that type of sanction on PVC. Just because there's less of it.

3. Will it achieve the desired effect? The boycott or ban won't improve recycling of plastics or any other material. It isn't needed, it won't work, and it will create a black hole that sucks up government and industry efforts that could be spent far more usefully. In West Linn, collecting all plastic bottles resulted in recovery of the most common resin types at a higher rate than for other curbside programs in the area. All bottles collection also increased recovery of paper, metal and glass, because more people participated and set out more materials.

As for contamination of PET -- all soft drink bottles are made of PET. So PVC doesn't contaminate that stream. Non-soft drink PET containers are collected in only a few Oregon programs now. More PET programs will come on line here when the APC installs its plastics recycling facility, targeted for late 1994 -- and that facility will have sensors that auto-sort all resins.

The boycott/ban won't improve the environment or health, because, even with an improbably high level of compliance, it won't measurably change the waste stream. Plastic containers are about 3% of the waste stream, and PVC containers are 5% of that 3% -- a total 15 hundredths of one percent. PVC's corrosion resistance and gas impermeability will continue to make it a low-

weight, low-cost, durable and preferred material for pipe, construction products and many types of packaging.

As for the concept that a ban or boycott will educate the public about environmental issues -- it will *miseducate* them. It will mislead them into thinking that they are having a real impact. It will give them the temporary illusion that what they are doing is significant and sufficient. And when they become better informed, they will lose faith in their capability, and their government's, to make effective choices on the environment. None of us wants that to happen.

Finally, I want to remind you that the resolution calls for "the elimination of PVC containers." Recycling Advocates intends to seek a statewide ban, and it is likely they would use the success of this resolution as leverage to secure such a ban. Your support of the Recycling Advocates' proposal will be cited in publicity efforts, media coverage, voters' pamphlets and before the legislature. Bans -- this type of packaging ban -- have a miserable history. They inevitably become complex, expensive, ineffective, wasteful, and embarrassing. After years of wrangling in St. Paul, Minnesota, and Suffolk County, Long Island, bans enacted there still have not been implemented, because their need and legality and doability could not be demonstrated. The Styrofoam ban in Portland was the only one upheld that I know of. But it did not catch on anywhere else, and it did not really hasten a movement away from CFCs that already was nearly complete. And the Portland ban replaced a recyclable item with a non-recyclable one (in fact, two: we now often get two paper cups with our take-out coffee to keep our fingers from burning).

4. Will it do significant, unintended harm? If a ban is approved by this body or the State, it will create continuing and significant legal and administrative costs to your constituents without achieving in any way its desired effect. There is no capability in DEQ or Metro to enforce such a ban, and no priority could responsibly be given to doing so. Metro will be linked with the waste of time that will follow ban legislation -- actual or proposed. You may have to respond on this matter for years. So: no real benefits, high public costs, harm to the credibility of this or any other body; and weakening of the legitimate aims and moral authority of the environmental movement.

Also, many businesses have built their products and services around PVC. Blood bags and meat wrap are only two of the product packages that use PVC because it is the best available option. PVC window and door profiles and piping are two products made in this area with PVC because of its corrosion resistance. For many applications, PVC is essential, product-protecting, energy-saving and cost-saving. Those businesses and products will be called into question, they will be shadowed -- unfairly and inaccurately, and to no

purpose. It is so easy to say a harmful thing, and no one hears the retraction or qualification -- if one is ever offered.

5. Is it an appropriate action for this agency? You represent all the residents and businesses of this region, and you represent them to the rest of the world. You have remarkable new authority and responsibility for bringing us together behind important decisions for our future. This PVC boycott or ban won't help you do that. It will be divisive and distracting. It will tangle you in explaining why you endorsed a measure that is soon perceived as unjustifiable, unfair, ineffective, harmful to your consituents, and not appropriate to your priorities. I am certain that you have not had adequate time to review the facts, and that your certainty about the facts needs to be very strong to take this kind of action. With full acknowledgement that you did not have access to much of this information until the last week or so, I urge you to recognize an unnecessary quagmire.

People have every right to refuse to buy a product or package. I support that type of voting, that type of individual choice. But I would suggest that government needs to take a very disciplined look at its role in endorsing any type of market decision. Recycling Advocates is to be commended for raising the issue and for their unflagging concern about the impact of environmental choices. But I feel they have misunderstood the usefulness of this tactic. I hope you will not compound the error.