BEFORE THE METRO COUNCIL

FOR THE PURPOSE OF ESTABLISHING METRO COUNCIL SUPPORT FOR THE EXECUTIVE OFFICER TO EXECUTE CHANGE ORDER NO. 11 THAT ALLOWS TRANS INDUSTRIES TO INSTALL A FIBER BASED FUEL PROCESSING LINE	))))))	RESOLUTION NO. 93-1783 Introduced by: Rena Cusma, Executive Officer

WHEREAS, Metro and Trans Industries entered into an Operations Agreement for Metro Central Station on December 8, 1989 entitled "1989 Metro Transfer Station Operation Agreement"; and

WHEREAS, Trans Industries has proposed to install a Fiber Based Fuel (FBF) processing line at no cost to Metro; and

WHEREAS, Metro will save money since the FBF proposal will cost less than landfilling; and

WHEREAS, The Metro Region's recovery rate will increase and the amount of waste landfilled will decrease as Trans Industries anticipates recovering approximately 30,000 tons per year of FBF; and

WHEREAS, Metro has the first option to purchase the FBF processing line, which will not be exercised without Council action; and

WHEREAS, Metro is encouraging Trans Industries to follow the State hierarchy of recycling over energy recovery by paying the full avoided costs for recycled mixed paper and a reduced avoided cost for FBF; and

WHEREAS, Smurfit has a new permit that allows it to substitute 13.7% of its boiler fuel with FBF due in part to rising costs of forest based fuel, and natural gas and is actively seeking a supplier of FBF; now, therefore,

BE IT RESOLVED, That the Metro Council supports issuance of Change Order No. 11 that allows Trans Industries to install a Fiber Based Fuel processing line at Metro Central Station.

ADOPTED by the Metro Council this 13th day of May, 1993.

Judy Wyers

Judy Wyers, Presiding Officer

CHANGE ORDER SUMMARY

CONTRACTOR: Trans Industries

PROJECT: Metro Central Station - Operations

PURPOSE: Fibre Based Fuel Processing Line

CONTRACT NO.: 901584 **BUDGET NO.** 531-310253-526610-75000

DEPARTMENT: Solid Waste **FUND NAME** Operating

THIS REQUEST IS FOR APPROVAL OF CHANGE NUMBER: 11

1. The original contract sum was	$33,264,000.00
2. Net change by previously authorized change order	$<1,453,376.00>
3. The contract sum prior to this request was	$31;810,624.00
4. Total amount of this change order request	$0.00
5. The new contract sum, including this change order	$31,810,624.00
6. The contract sum paid in FY 91-92	N/A
The contract sum paid in FY 92-93	N/A
7. Fiscal Year appropriation for FY 92-93	N/A
Line item name: Disposal Operations	
Estimated appropriation remaining as of	N/A

8. Start Date: 3/1/93 Expire Date: 10/1/96

REVIEW AND APPROVAL:

Jim Watkins	3-12-93		
Division Manager, Solid Waste Department	Date	Fiscal Review	Date
Director, Solid Waste Department	Date	Budget Review	Date
	23 Mar 93		3-15-93
Director, Regional Facilities	Date	Legal Review	Date

VENDOR # 3021

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CHANGE ORDER NO. 11
METRO CONTRACT NO. 901584

MODIFICATION TO THE CONTRACT BETWEEN
METRO AND TRANS INDUSTRIES, ENTITLED
"1989 METRO TRANSFER STATION OPERATION AGREEMENT"

PROJECT:	Metro Central Station Operations
METRO POC:	Jim Watkins
CONTRACTOR POC:	Ralph Orrino
COMPLETION DATE:	October 1, 1996
SUBJECT:	Installation and Operation of a Fiber Based Fuel Processing Line

This agreement is dated as of the last signature date below and is entered into between Metro and Trans Industries (Contractor), pursuant to the Metro Transfer Station Operation Agreement made and entered into December 8, 1989.

Purpose

The purpose of this modification is to allow the Contractor to replace the Commercial Processing Line at Metro Central with a processing line capable of pelletizing feedstock into fiber based fuel cubes. The fiber based fuel cubes can be used as a supplement for hog fuel currently burned in industrial boilers.

Scope of Work

1. The Contractor shall have the option to purchase and install a Rader Model bag breaker on MSW #1.

2. Within seven months of the execution of this Change Order, the Contractor shall remove the Commercial Processing Line (including the removal and resurfacing of the conveyor pit used to feed the Line) and shall purchase and install a Fiber Based Fuel (FBF) line capable of processing feedstock from MSW #1 into cubes at a minimum rate of 15 tons per hour. The FBF line shall consist of a KWS Magnetic Separator, a Jeffrey 680 Shredder, a Warren Baerg Tri Cuber, Cube Holding Bins, and electrical controls or approved equals. If contractor has not completed the above installation within the seven month period Metro has the option of terminating this Change Order.

3. Contractor shall obtain Metro review and approval of the detailed specifications and drawings for this work before it is performed. Metro shall receive a full set of record drawings stamped by a professional engineer licensed in the State of Oregon, detailing the facility modifications and additions associated with this change order, prior to start of work.

Additional Terms

1. The salvage value of the Commercial Processing line is an agreed upon value of $70,000. The Contractor is authorized to sell any component of the processing line or use the components in the assembly of the new FBF Line.

2. The cost of completing the above Scope of Work shall not exceed $1,560,000.00 [$1,630,000.00 less the salvage value of the Commercial Line ($70,000)]. If the shredder is not installed the above cost shall be reduced by $210,795 and if the bag breaker is not installed the above cost shall be reduced by $180,000. If neither the bag breaker nor the shredder is installed, the cost of completing the Scope of Work shall not exceed $1,169,205.

3. The Contractor will receive a partial Avoided Cost for all Recovered Materials sold as FBF in accordance with Paragraph 8.2 of the Operation Agreement. A partial Avoided Cost is defined as $34.05 for each ton of recovered FBF up to and including 30,000 tons in a Contract Year and $25.69 for each recovered ton above 30,000 tons in a Contract year. A Contract Year is a 12 month period during the Term, commencing October 1.

4. The values of the partial Avoided Costs, namely $34.05 and $25.69, will be adjusted in accordance with Change Order No. 9 to the Operations Agreement, commencing with the adjustment occurring as of 4/1/93. The percent increase in the Avoided Cost, based on Change Order No. 9, will be used to similarly adjust the partial Avoided Costs for FBF.

5. If the average monthly delivered price for FBF received by the Contractor exceeds $14.75 per bone dry ton, Metro shall receive 35% of the difference between the price received and $14.75 per ton for each ton delivered.

6. Metro has the option to purchase all equipment installed in accordance with the above Scope of Work at any time for the following amounts (based on cost substantiation): $1,560,000.00 if all of the equipment is installed, $1,349,205 if all but the shredder is installed, $1,380,000 if all but the bag breaker is installed, and $1,169,205 if all but the shredder and bag breaker is installed. These values shall be reduced monthly on a ten-year straight line depreciation schedule from the start of operations to the date of purchase. The start up of operation shall be the first day of operation in which marketable FBF is processed excluding initial shakedown not to exceed 7 days.

7. If Metro exercises its right to purchase under the terms of this Agreement, all terms of this Agreement are subject to renegotiation. If Metro does not exercise its option to purchase prior to or at termination of the Operation Agreement, Contractor shall remove the FBF processing line, unless Metro agrees in writing to allow the equipment or any part of it to remain on-site. If the line is removed, the entire line shall be removed; the floor shall be restored to a smooth, level condition, consistent with the thickness and strength of adjacent slabs; all bolts shall be removed and bolt holes properly grouted; and all electrical wiring and controls shall be in a safe condition, in conformance with local codes. Contractor may, at its discretion, remove electrical controls necessary to operate the FBF line.

8. At any time prior to the Contractor's completion of this work, Metro has the option of terminating the Change Order. Upon termination, Metro will reimburse Contractor's actual and verifiable costs.

9. Except as modified herein, all other terms and conditions of the original agreement and previous change orders remain in full force and effect.

TRANS INDUSTRIES	METRO
_____	_____
Signature	Signature
Ralph Orrino - General Manager	_____
	Authorized Representative
Date:_____	Date:_____

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STAFF REPORT

FOR THE PURPOSE OF ESTABLISHING METRO COUNCIL SUPPORT FOR THE EXECUTIVE OFFICER TO EXECUTE CHANGE ORDER NO. 11 THAT ALLOWS TRANS INDUSTRIES TO INSTALL A FIBER BASED FUEL PROCESSING LINE

Date: March 23, 1993 Presented by: Jim Watkins

FACTUAL BACKGROUND AND ANALYSIS:

Energy recovery through combustion of waste has for many years been used to reduce the volume of waste going to landfills and to convert portions of the solid waste stream to useful forms of energy. One of the more recent technologies is a fiber based fuel (FBF) process that consists of separating the combustible fraction of solid waste from the total waste stream, shredding the combustible fraction, and then compressing the materials into small cubes or pellets.

Pelletization for fuel production began with compressing sawdust into fire logs and more recently into pellets for industrial boilers and pellet stoves. However, with the dwindling supply of sawdust and hog fuel there has been an increased interest in pelletizing the combustible portion of the waste stream.

Wastech has long planned an expansion to their OPRC facility that included the ability to produce FBF. The feed stock was to be primarily low grade waste paper that could not be recycled by other methods. The waste reduction goal of 56% in the Regional Solid Waste Management Plan assumed that 3% would occur from FBF production at OPRC. Without the expansion, a market exists for a slightly more contaminated feed stock that would include mixed paper, film plastic, waxed cardboard, box board and a small percentage of water as a bonding agent. Due to the nature of the material, it is necessary to shred and pelletize the fiber based feed stock as pellets are easier to handle, transport and store in a densified form.

Metro is proposing to issue a Change Order to allow Trans Industries to install a FBF processing line at Metro Central that will provide the Region with the following summary of benefits:

- The capability to produce FBF at no financial risk to Metro, as Trans Industries will finance the costs.
- Metro will save money since the FBF proposal will cost less than landfilling.
- The Metro Region's recovery rate will increase and the amount of waste landfilled will decrease as Trans Industries anticipates recovering approximately 30,000 tons of FBF. This conforms to the State recycling hierarchy, which gives priority to energy recovery over landfilling of solid waste (ORS 459.015(2)).

- Metro is encouraging Trans Industries to follow the state hierarchy's priority of recycling over energy recovery by paying the full avoided costs for recycled mixed paper and a reduced avoided cost for FBF. This results in financially favoring mixed paper recycling over FBF, but allows the marketing of pellets for that component of the wastestream that cannot be marketed.

- Smurfit has proven to DEQ that FBF is an acceptable alternative to hog fuel based on a test burn using FBF which did not result in any air emission parameters exceeding allowable levels. As a result of that burn, Smurfit has a new permit that allows them to substitute 13.7% of their hog fuel with FBF and they are actively seeking a supplier.

EXISTING PELLETIZING OPERATIONS

The following midwest facilities that are currently pelletizing relatively dry and uncontaminated fiber based material were visited by Metro staff. Also mentioned is a facility in British Columbia which provided the pellets for the test burn at Smurfits that will be discussed later. All of these facilities are producing fuel by segregating it from the municipal wastestream for burning in existing boilers. None of them are producing fuel for "Mass Burn" facilities:

XL Facility, Crestwood, Illinois

XL is a mixed waste processing facility that processes 300-400 TPD and has been producing fuel for over a year. Twenty-three percent of the incoming waste is pelletized using a densifier that can process 4-5 tons per hour. The fuel is burned along with high sulfur coal at a proportion of ten percent.

Reuter Facility, Eden Prairie, Minnesota

The Reuter facility is a mixed waste facility that processes 560 TPD. Approximately 225 tons are converted to fuel, mostly in fluff form. Currently, the plant is producing pellets at a rate of 4-5 TPH.

E-Z Recycling Co., Sioux Center, Iowa

This plant makes fuel pellets from waxed cardboard box waste generated by the meat packing industry and egg carton flats. For four years this facility has been selling pellets to a College and high school as boiler feed for hot water and space heating, which together consume approximately 1,850 tons of fuel pellets per year.

Wastech Services LTD

Wastech completed a pelletizer facility in Coquitlam, British Columbia, which uses post-consumer commercial mixed paper as its feedstock. The facility became fully operational in 1989, and is supplying paper pellets to CBR cement-Tilbury Plant which co-fires the pellets with coal.

PROPOSAL

Trans Industries, the contract operator of Metro Central Transfer Station, has approached Metro regarding the possibility of installing an FBF processing system. Trans Industries has explored the use of existing processing lines to produce a feedstock for a pelletizer. The MSW #1 processing line appears to be suited for the task, consisting of primary and secondary disc screens, rotary air separators, an air knife and picking conveyors.

Trans Industries would pre select high fiber loads for processing on MSW #1 and depending on the contamination level and market prices for mixed paper, either bale the processed material or divert the material to the pelletizer. When processing high fiber loads for baling as mixed paper all the rejects such as phone books, magazines, waxed cardboard and film plastic will be hand-picked or mechanically diverted from the mixed paper for processing as FBF.

To make room for the pelletizing operation Trans Industries would remove the commercial waste line which is next to the wood processing line. The commercial line was designed to target high grade commercial loads for office paper, OCC, wood, newsprint and scrap paper, however the type and quality of loads needed to run the line have never materialized. To date the commercial line has not been used. By locating the Pelletizer next to the wood line, Trans Industries is able to use the wood lines truck loading system for both pellets and hog fuel thus minimizing capital costs.

Trans Industries has proposed that they provide all of the capital and labor costs to install an FBF processing line. The estimated cost of the project is $1.63 million. Metro would reduce the avoided cost paid to Trans Industries by $2.64 per ton for the first 30,000 tons per year of FBF sold. For every ton sold over 30,000 tons Metro will reduce the avoided cost $11.00 per ton. Additionally, if the revenue value exceeds $14.75 per ton, Metro will receive 35% of the revenue in excess $14.75. Avoided cost is defined as the unit cost per ton that Metro incurs to transport and dispose of a ton of waste.

Metro will have first option to purchase the FBF line as long as Trans Industries remains the operator of the facility. If Trans Industries does not successfully rebid the operations contract, Metro has the option of purchasing the equipment or allowing Trans Industries to remove the equipment. The purchase price will be reduced monthly on a ten-year straight line depreciation schedule. The ten year period will begin once the system enters beneficial service.

POTENTIAL COST SAVINGS

If Trans Industries processes 30,000 tons in one year Metro would save $79,200 in reduced avoided cost payments and represents more than 1,000 fewer truckloads of waste transported to the Columbia Ridge Landfill each year. Each additional 1,000 tons of FBF sold will save Metro

an additional $11,000. Staff has not negotiated further reductions in avoided costs if Metro were to own the FBF processing equipment, however additional per ton savings would be required to offset debt service and to reflect the Contractor's reduced risk.

STATE RECYCLING HIERARCHY

The first policy of Metro's Waste Reduction Chapter in the Solid Waste Management Plan states that The Solid Waste Management System shall achieve the maximum feasible reduction of Solid waste being landfilled, in accord with the state hierarchy under ORS 459.015. The statute establishes a hierarchy for managing waste which requires that if technically and economically feasible, management methods must:

- First reduce the amount of waste generated
- Second, reuse the material for the purpose for which it was originally intended
- Third, recycle material that cannot be reused
- Fourth, recover energy
- Last, landfill wastes that cannot be handled in another way

By reducing the avoided cost payments to Trans Industries for FBF, Metro is encouraging Trans Industries to follow the state hierarchy of recycling over energy recovery by increasing the price differential between recycling mixed paper and processing FBF. Trans Industries will not only receive the full avoided cost if they recycle mixed paper, it also costs less to process mixed paper that is relatively free from contamination compared to FBF, and the sale price is currently more for mixed paper than FBF.

IMPACT OF NEW RECYCLING PROGRAMS

Staff has investigated the question of whether the addition of curb-side recycling of mixed paper and other new recycling will reduce the quantities of fiber based material at Metro Central to an unprofitable level for FBF. There are two local programs with operating experience at collecting mixed waste paper curbside that we investigated. The program's investigated were Clark County's three bin program in which they are collecting mixed waste paper and a study in Seattle in which 137 households were surveyed for recovered materials.

Based on the above studies, it appears that collecting mixed paper at the curb could reduce the available paper at Metro Central by 8,800 to 16,800 tons per year.

It is estimated that by 1995 Metro Central will be receiving 308,500 tons per year allowing for a reduction in tonnage due to the Wilsonville transfer station. Based on the 1989/90 Waste Characterization Study, St Johns Landfill (which was replaced by the Metro Central Transfer Station) had 39.4% paper products and 10.6% plastic. Staff reduced the paper product

percentage to 29.3% because only waxed corrugated would be targeted for FBF. The plastics percentage was reduced to 4.7% because only film plastic will be targeted for FBF, for a combined total of 34%. The reason only film plastic has been targeted is that Smurfit does not want any hard or chlorinated plastics in the feed stock in order to stay in compliance with their DEQ permit for air emissions and ash content.

Assuming that 308,000 tons are delivered to Metro Central, that 34% of the waste stream is paper and film plastic potentially available for FBF and that 50% of this fraction is recoverable, (which is conservative), approximately 52,000 tons of FBF feed stock is available per year. Trans Industries estimates that only 32,000 tons are necessary to justify the installation of an FBF process. Therefore even with the potential reduction of available feedstock due to curbside collection of mixed paper, there appears to be adequate quantities of FBF feed stock to support this operation.

POTENTIAL USERS

Currently Trans Industries is negotiating with Smurfit Newsprint Corporation to burn the FBF in their No. 10 boiler at their Newberg, Oregon facility. Smurfit has a new permit (No. 36-6142) issued by DEQ on November 25, 1992, which incorporates the FBF permit developed from the FBF trial work completed in late 1989. The 1989 trials took selected materials from the waste stream going to Wastech's OPRC facility. The raw materials were transported to Wastech's densifying operation in Vancouver, B.C., and then returned to Newberg for the trial.

The emission test result showed that all parameters were within the existing permitted tolerances during the test burn. The new permit is based on maintaining air emissions equal to or better than those experienced during the trial. It should be noted that in 1991 (after the test burn), a $5 million electrostatic precipitator was installed on the No. 10 boiler which will only improve their ability to comply with the air permit specifications. An electrostatic precipitator is a state-of-the-art pollution control device that is highly effective at removing particulates from the boiler exhaust gases.

Smurfit's new permit allows them to burn hogged fuel, natural gas, No.6 fuel oil and FBF (less than or equal to 13.7% of which 1% can be tire derived fuel). They currently burn approximately 5,000 dry tons per week of which Trans Industries is proposing to supply approximately 500 dry tons per week which will supplant the other types of fuel that are currently being burned..

SOLID WASTE POLICY AND TECHNICAL COMMITTEES' RECOMMENDATION

The Solid Waste Policy and Technical Committee reviewed the proposal presented by staff to allow Trans Industries to install a FBF operation at Metro Central and unanimously approved the project.

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SOLID WASTE COMMITTEE REPORT

CONSIDERATION OF RESOLUTION NO. 93-1783, FOR THE PURPOSE OF ESTABLISHING METRO COUNCIL SUPPORT FOR THE EXECUTIVE OFFICER TO EXECUTE CHANGE ORDER NO. 11 THAT ALLOWS TRANS INDUSTRIES TO INSTALL A FIBER BASED FUEL PROCESSING LINE

Date: May 6, 1993 Presented by: Councilor

Committee Recommendation: At its April 20 meeting, the Committee voted 3-2 to send Resolution No. 93-1783 to the Council without recommendation. Voting in favor: Councilors Buchanan, McLain and Washington. Voting against: Councilors McFarland and Wyers.

Committee Issues/Discussion: The Committee received an informational briefing on the proposed fiber-based fuel project at its March 16 meeting. Following introduction of the resolution, hearings were held on April 15 and April 20.

Based on presentations by department staff, the principal aspects of the projects are as follows:

-- Trans Industries, the current operator of the Metro Central Station, is requesting permission to install a fiber-based fuel processing line and make related changes in station operations to produce and market boiler fuel pellets. The estimated cost of the project is $1.63 million. All capital, installation and operational costs would be paid by Trans Industries.

-- The primary feedstock would be mixed paper disposed of at the station that Trans Industries determines cannot be economically recycled. Plastic film (less than 10% of the total feedstock) also would be processed into pellets. It is estimated that up to 50,000 tons of material could be processed annually.

-- Pellets produced at the station would be sold to Smurfit in Newberg. Smurfit is authorized under its DEQ permit to burn up to 13.7% pelletized fuel in one of the boilers at the facility.

-- Under an agreement with Trans Industries, Metro would have the right to buy the pellet processing line. Metro could exercise this right at any time.

-- Under this agreement, Metro would reduce its avoided cost payment to Trans Industries by $2.64/ton for the first 30,000 tons of material processed into pellets. Avoided cost payments for any additional mateiral would be decreased by $11/ton. These amounts represent a disposal cost saving to Metro. For example, if 30,000 tons of material were processed, Metro's disposal cost savings would be $79,200. In addition, if the sale price for the pellets exceeds $14.75/ton, Metro will receive 35% of the excess amount.

The committee heard substantial testimony both in favor and in oppostion to the project. The following is a summary of the arguments in favor and in oppostion.

Arguments in favor. Those who support the project made the following arguments:

-- The project will process material that would otherwise be landfilled into a useful product that is higher on the state recycling hierarchy.

-- Metro will economically benefit from a reduction in avoided cost payments

-- Trans Industries is responsible for all costs associated with the installtion of the project equipment.

-- Metro would have no financial obligation, unless it chooses to purchase the equipment. Such a purchase would be financed by the issuance of revenue bonds. Staff indicated that it has no intention of purchasing the equipment unless Trans Industries can demonstrate that it will be economically and environmentally viable.

-- Smurfit intends to obtain a source of pelletized fuel. If Metro does not agree to provide a fuel source, department staff expressed concern that material may be diverted from the transfer stations to other processors in the region who would provide Smurfit with a source of fuel pellets. Staff noted that if this occurs, lost revenue could be substantial.

-- Smurfit has obtained the necessary environmental permits from DEQ to burn pelletized fuel.

-- Trans Industries will be encouraged to recycle mixed paper whenever it is economically feasible, because they will receive the full avoided cost payment if the material is recycled.

-- Smurfit contended that it would not burn any environmentally unsound material and run the risk of losing its state air quality permit.

Arguments in opposition. Those testifying in opposition to the project offered the following arguments:

-- While energy recovery is higher on the state hierarchy than landfilling, Metro should be directing its efforts to establishing effective recycling and reuse programs for mixed waste paper. If recycling of mixed waste paper significantly increases, will there be a sufficient feedstock for the pelletizer.

-- The avoided cost price differential is not sufficient to encourage Trans Industries to recycle mixed waste paper.

-- If Metro purchases the pelletizer equipment and the marketplace changes to make the resale or recycling of mixed paper more economical than pelletizing, Metro may be stuck paying off bonds on outdated and unused equipment.

-- The plastic film in the pellets may contain Polyvinyl chloride-based plastics that are environmentally dangerous to burn, including the potential for producing dioxin.

-- Some inks and papers may contain heavy metals or chemicals that could be released into the atmosphere when burned.

-- Some questioned whether the pellets produced at Metro Central would be made from the same type of material as the pellets that were test-burned at Smurfit. The DEQ permit was based on the results of this test burn.

-- Some questioned the adequacy of the testing program required under the DEQ permit.

Oregon Department of Environmental Quality

Air Quality Division
811 S.W. Sixth Avenue
Portland, Oregon 97204

FAX: (503) 229-5675

Facsimile Transmittal Form

Date: 4/6 Time: 11⁰⁰

ATTN: Judy Wyers

To (company): METRO

Receiver's Fax Number: 273-5589

From: Jill Fuhrer

Sender's Phone Number: 229-5749

Contact Person:

Total Pages (including cover sheet): 2

Remarks/Comments: There ~~is~~ are 2 large files on FBF for Smurfit. Please send someone to look through them. I am afraid I will not have time to do it today.

(14) "Parts Per Million (ppm)" means parts of a contaminant per million parts of gas by volume on a dry-gas basis (1 ppm equals 0.0001% by volume).

(15) "Person" means individuals, corporations, associations, firms, partnerships, joint stock companies, public and municipal corporations, political subdivisions, the state and any agencies thereof, and the federal government and any agencies thereof.

(16) "Primary Combustion Chamber" means the discrete equipment, chamber or space in which drying of the waste, pyrolysis, and essentially the burning of the fixed carbon in the waste occurs.

(17) "Secondary (or Final) Combustion Chamber" means the discrete equipment, chamber, or space in which the products of pyrolysis are combusted in the presence of excess air such that essentially all carbon is burned to carbon dioxide.

(18) "Solid Waste" means refuse, more than 50 percent of which is waste consisting of a mixture of paper, wood, yard wastes, food wastes, plastics, leather, rubber, and other combustible materials, and noncombustible materials such as metal, glass, and rock.

(19) "Solid Waste Facility" means an incinerator which is operated or utilized for the disposal or treatment of solid waste including combustion for the recovery of heat, and which utilizes high temperature thermal destruction technologies.

(20) "Standard Conditions" means temperature of 68 degrees fahrenheit (15.6 degrees Celsius) and a pressure of 14.7 pounds per square inch absolute (1.03 kilograms per square centimeter).

(21) "Startup/Shutdown" means the time during which an air contaminant source or emission control equipment is brought into normal operation and normal operation is terminated, respectively.

(22) "Transmissometer" means a device that measures opacity and conforms to EPA Specification Number 1 in Title 40 Code of Federal Regulations, Part 60, Appendix B.

PLASTIC + FILM 29 ITEMS UnCover

TITLE(s): Plastics Recycling.
Summary: A new study into the economic and environmental benefits of recycling plastic film which has been conducted by Nottingham University, plus brief news items about plastics.

In: Warmer bulletin.
FEB 01 1993 n 36
Page: 12

TITLE(s): Residential plastic film recycling.
Summary: A successful demonstration project becomes a citywide initiative in Peterborough, Ontario.

In: Resource recycling : North America's recycling
MAY 01 1992 v 11 n 5
Page: 125

TITLE(s): Union Carbide opens multiplastics recycling plant in New Jersey that annually will process 54 million lb of plastic film and bottles from curbside recycling programs.

In: Chemical and engineering news.
FEB 17 1992 v 70 n 7
Page: 31

AUTHOR(s): DiPietro, Robbe
TITLE(s): Manufacturer Converts Recovered Film Plastic.

In: Biocycle.
DEC 01 1991 v 32 n 12
Page: 68

AUTHOR(s): VandenBerg, Nancy
TITLE(s): Plastic Film Recycling.
Summary: This report describes types of material, processing methods and what needs to be done now to

increase recovery of film plastics.

In: Biocycle.
DEC 01 1991 v 32 n 12
Page: 67

TITLE(s): Dow Chemical enters a plastic film recycling venture.
Polysar brings rubber expansion onstream in a soft market.

In: Chemical week.
OCT 16 1991 v 149 n 11
Page: 20

AUTHOR(s): Lora, E. Silva
Soler, P. Beaton
TITLE(s): Experimental Research and Mathematical Modelling of Bagasse
Pellet Combustion.

In: The International sugar journal; a technical an
SEP 01 1992 v 94 n 1125
Page: 217

AUTHOR(s): Banaee, Jila
Larson, Richard A.
TITLE(s): Effects of Additives on the Formation of Organochlorine Compounds During the Combustion of a Chlorine-Containing Polymer.

In: Waste management.
1993 v 13 n 1
Page: 77

AUTHOR(s): Kolluri, R.
Altwicker, E.
TITLE(s): A Model to Analyze Formation of Dioxins in the High
Temperature Regions of Municipal Solid Waste Incinerators.

Summary: This paper presents a comparison between model predictions and actual data for dioxin formaton in the region between secondary combustion chamber and the air pollution control device in municipal solid waste incinerators.

In: Journal of the air & waste management associatio

DEC 01 1992 v 42 n 12
Page: 1577

AUTHOR(s): Lindbauer, R.L.
Wurst, F.
Prey, T.
TITLE(s): Combustion dioxin suppression in municipal solid waste incineration with sulphur additives.

In: Chemosphere.
1992 v 25 n 7 / 10
Page: 1409

AUTHOR(s): Vogg, H.
Hunsinger, H.
Merz, A.
TITLE(s): Influencing the production of dioxin/furan in solid waste incineration plants by measures affecting the combustion as well as the flue gas cleaning systems.

In: Chemosphere.
1992 v 25 n 1 / 2
Page: 149

AUTHOR(s): Hahn, J.
TITLE(s): Technologies for dioxin control at municipal waste combustors (MWC) beyond good combustion practices (GCP) and dry scrubbers/fabric filters (DS/FF).

In: Chemosphere.
1992 v 25 n 1 / 2
Page: 57

AUTHOR(s): Lora, Silva E.
Soler, Beaton P.

TITLE(s): Experimental research and mathematical modelling of bagasse pellet combustion

In: International sugar journal.
SEP 01 1992 v 94 n 1125
Page: 217

18181 S.W. Kummrow Rd.
Sherwood, OR 97140-9164
April 5, 1993

Metro Council
For the hearing of April 6, 1993

Dear Council members:

In 1987 and 1988, I had the great pleasure as serving as an expert on the Health Impact Review Panel convened by the Metropolitan Service District to consider a waste to energy conversion facility then proposed for the St. Helens region. I continue to be involved in incineration issues. I am writing this letter in response to a proposal regarding installation of a fiber based fuel production facility on your solid waste processing line. Unfortunately, because of your early meeting time, I am unable to attend the meeting. For those of us with a daytime work schedule, evening meetings would be much preferred.

The proposal seems well thought out based on the experience of several similar facilities exist in other regions. The description of the facilities examined as part of this proposal does not suggest that plastic films are generally included in the fiber based fuel pellets and two facilities described are apparently dealing **only** with paper.

There are a number of positive points in the proposal. First, you have endeavored to prevent loss of recyclable materials by creating a fee structure that favors recycling whenever possible. Second, the fuel pellets are to be burned in Newberg at the Smurfit Newsprint Corporation which already has a permit that would allow the use of a limited amount of pellets of low toxin content. Third, the pellets will be produced out of non-recyclable paper products such as waxed cardboard but will include an estimated 13.8% of film plastic. This particular plastic is allowed because it has little or no chlorine in its structure and thus is not expected to significantly increase the output of polychlorinated biphenyl compounds including 2,3,7,8 tetrachlorodibenzo-p-dioxin.

As you are probably aware, the U.S. Environmental Protection Agency is re-evaluating the current standards for dioxin release into the environment. In August 1992 Linda Birnbaum, the leading dioxin researcher with the EPA stated "We would say that for at least some dioxin responses, there's no evidence of any kind of threshold, which I think is very important. A year ago we thought there was." The new standards will be much more stringent than in the past.

It is thus critical to minimize the likelihood of introducing significant amounts of chlorine into the fiber based fuel. This is also a requirement for Smurfit. A detailed review of the various plastic films in use in our area would seem justified to insure that no potentially problematic films are likely to get into the pellets. If there are significant risks of chlorine contamination, it perhaps would be better to stick with paper products and keep all film out of the pellets.

This proposal seems to be well thought out and Metro appears to be assiduously trying to make this facility the best possible. The additional research and possibly small change in the input stream will result in a facility that Oregon can be proud of.

Regards,

Thomas B. Stibolt, Jr., M.D.
Specialist, Pulmonary Disease

3700 N.W. Columbia
Portland, OR 97229
April 6, 1993

Solid Waste Committee and
Metro Council

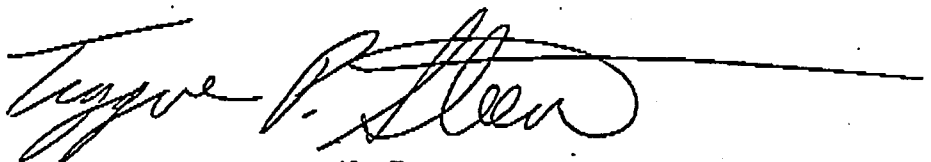
Dear Representatives:
This letter addresses my concerns and questions relating to a current proposal to install a pelletized fiber based fuel production facility in association with your solid waste processing line, under resolution # 93-1783. I respond based on my advanced degrees in biology and environmental toxicology as well as my co-chairmanship of the Health Impact Review Panel for the trash incineration facility proposed for Columbia County, Oregon.

Due to the short notice and day meeting time, I am submitting this short letter. From the information I have been able to consider, including the staff report on this resolution, there are some important strengths and potential weaknesses in this proposal. Clearly before proceeding, it would be prudent to understand and deal with the weakness related questions below.

On the plus side: 1) Your effort to minimize loss of recyclable materials to simple burning is commendable. 2) The fuel pellets are to be primarily fiber based, with fiber based on wood and non-recyclable paper fibers. 3) You have done some test runs in preparation for this decision, so there is at least some rough indication of the feasibility of this project. 4) There will be an effort to exclude highly chlorinated plastics by using plastic films only.

Concerns: 1) the test runs did not include the full range of materials to be used for the proposed pellets; thus before proceeding, a fully realistic test series should be done. The additional tests should include appropriate analysis for heavy metals from printing inks (Cr, Cd, Cu) and organics produced during combustion, including chlorinated biphenyls, furans, and dioxins. 2) A better assessment of the likely plastic content of the pellets is needed, including both qualitative and quantitative estimates. If there is a significant risk of including much chlorinated plastic (especially PVC) in the pellets, then serious consideration should be given to limiting the inputs to wood and paper, with only incidental plastic contaminants being included. 3) My key concern is the issue of chlorinated organic production (biphenyls, furans, and dioxins).

In summary, it appears that this proposal may have merit. However, since some significant questions remain, it would be prudent to proceed slowly, gather more information, and do additional tests.



Trygve P. Steen, Ph.D.
Department of Biology, Portland State U.

March 26, 1993

Judy Wyers
Metro
2000 SW First
Portland, OR 97201

Dear Judy:

I do not want Metro to support a fiber-based fuel facility. I realize that fuel from paper and plastic is not as bad as fuel from mixed garbage, but it is still energy recovery which is lowest on the solid waste heirarchy next to landfilling.

The staff report says that phone books, magazines, and waxed cardboard would be made into fuel. When prices are low for mixed paper, it also would be pelletized. I object to paper being made into fuel. If it can't be recycled, it should be composted.

Please eliminate this payment from the budget.

If you can't eliminate it from the budget, set a new policy on paying diversion credits. Here's an example. Pay $45/ton for reuse. Pay $38/ton for recycling. Pay $30/ton for composting. Pay $22/ton for fuel.

Yours truly,

Jeanne Roy

Jeanne Roy

Association of Oregon Recyclers

April 5, 1993

Jim Watkins
Solid Waste Engineering & Analysis Mgr.
Metro
2000 SW First Ave.
Portland, OR 97201

Dear Jim,

The Board of the Association of Oregon Recyclers (AOR) has considered your request for an endorsement of the fiber-based fuel operation at Metro Central Transfer Station. After a discussion involving the members in attendance at the March 29 Board meeting, the Board voted 5-0 to endorse the project.

The Board's endorsement comes with requests and concerns as expressed by Rob Guttridge, AOR Chair:

1) The AOR Board would like the opportunity to review the performance of the operation after it has been in place for a year. It is our understanding that Metro Council and staff will also be reviewing the process prior to making a purchasing decision;

2) AOR is concerned regarding the incentive to recycle. We urge you to place recycling ahead of burning and preserve the incentive to recycle regardless of varying economic conditions that may affect markets for recyclable materials.

Thank you for asking AOR to be a part of the decision-making process, and please keep us posted as to the progress of the project.

Sincerely,

Rob Guttridge

Rob Guttridge
AOR Chair

1

Smurfit Newsprint
Newberg Mill

FBF Testing

Material %	Average	7.06.89	8.10.89	11.14.89 10:30am	11.15.89 Noon	11.15.89 2:00pm	11.16.89 9:00am
Paper	75.33	60.72	81.08	73.90	80.20	74.70	81.40
Cardboard	19.84	34.44	15.68	18.50	16.30	19.70	14.40
Wood	1.00	1.08	.65	1.70	.00	2.00	.60
Soft Plastic	1.38	1.76	.80	2.40	2.10	.40	.80
Hard Plastic	1.20	1.71	1.41	.30	1.20	1.50	1.10
Metal	.28	.02	.16	.00	.00	.00	1.50
Rubber & Styrafoam	.13	.16	.12	.00	.00	.30	.20
Glass	.02	.11	.03	.00	.00	.00	.00
Nylon	.01	.00	.08	.00	.00	.00	.00
Carpet	.52	.00	.00	3.10	.00	.00	.00
Dirt	.22	.00	.00	.10	.00	1.20	.00
Cloth	.07	.00	.00	.00	.20	.20	.00
Putrescibles	.00	.00	.00	.00	.00	.00	.00
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
% Oven Dry		93.86					
% Ash		8.83					

} ave 96.2%

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY

FAX Transmittal Memorandum

No. of Pages: 8 + Cover
Date: April 6, 1993

To:	Judy Wyers	**From:**	Linda hayes
Phone:	221-1646	**Phone:**	229-6823
FAX:	273-5589	**FAX:**	229-6823

This fax contains resin sales by use in 1992 as reported in Modern Plastics, Januray 1993 issue. Please note the summary table under film packaging. I hope this helps you, please call me if you need any other information.

If you have trouble reading any of this just call me.

See pg. 90 for pkg. film summary. although film is used for other purposes than packaging.

1992 resin sales signal a rebound

The business climate for processors appears to be favorable for 1993. Judging from the strength of U.S. resin sales last year, the economy may finally be in recovery after three years of sluggishness. Resin supply will be ample through the year, and most prices, consequently, should remain low.

As the table on this page indicates, total resin volume last year rose 7.3% from 1991, making 1992 the first year of meaningful growth since 1988. Sales of key commodity thermoplastics, however, outperformed the industry average: Domestic demand for HDPE rose 10.4% from 1991, for example, and PP was up 10.6%. ABS and PVC demand soared by 20.8% and 14.5%, respectively. The overall picture for the U.S., Canada, and Mexico is detailed in the tables that follow.

The information from which the tables were developed was compiled by MODERN PLASTICS editors with the cooperation of industry sources. The monthly resin production and sales reports prepared by Ernst & Young for SPI's Committee on Resin Statistics were a research basepoint. For reprints of the tables, contact Reprints Dept., MODERN PLASTICS, 1221 Sixth Ave., New York, NY 10020; 212/512-3607.

Material	Million lb. 1991	1992
ABS	1125	1285
Acrylic	625	626
Alkyd	315	320
Cellulosics	79	81
Epoxy	490	470
Nylon	556	595
Phenolic	2663	2957
Polyacetal	140	146
Polycarbonate	601	662
Polyester, thermoplastic (PBT, PCT, PET)	2541	2742
Polyester, unsaturated[a]	1081	1192
Polyethylene, high density	9345	10,434
Polyethylene, low density[b]	11,492	12,307
Polyphenylene-based alloys	195	204
Polypropylene and copolymers	8326	8502
Polystyrene	4895	5197
Other styrenics[c]	1219	1298
Polyurethane	3147	3330
Polyvinyl chloride and copolymers	9215	10,053
Other vinyls[d]	178	177
Styrene acrylonitrile (SAN)	114	112
Thermoplastic elastomers	614	655
Urea and melamine	1658	1737
Others	345	358
Total	60,959	65,440

a: Resin only.
b: Includes LDPE, LLDPE, and EVA.
c: Excludes ABS and SAN.
d: Polyvinyl butyral, polyvinyl formal, and polyvinylidene.

Resin	Million lb. Domestic demand[a] 1991	1992	Imports[b] 1991	1992	Exports 1991	1992	Sales of domestic resin[c] 1991	1992
LDPE[d]	10,577	11,411	869	945	1755	1605	11,463	12,701
HDPE	8756	9674	462	530	1051	1290	9345	10,434
PP	6883	7617	104	135	1547	1020	8326	8502
PVC	7829	8966	107	236	1493	1323	9215	10,053
PS[e]	4601	4871	61	125	294	326	4895	4871
ABS	1054	1274	106	179	177	190	1125	1285

a: Equals number in U.S. market tables plus import minus export. Exceptions are LDPE and PS, imports of which are included in consumption figures in line with SPI reporting practices.
b: Data provided by U.S. Commerce Dept. and McGraw-Hill's DRI, Lexington, MA.
c: Includes export sales.
d: Includes LLDPE and EVA.
e: Includes EPS.

U.S. resin sales by process and market

Market	Million lb. 1991[a]	1992
Extrusion		
Appliances	148	159
Construction: pipe	104	119
Leisure products	17	20
Luggage	7	8
Packaging	5	6
Recreational vehicles[b]	23	27
Other[c]	64	70
Total extrusion	368	409
Injection Molding -		
Appliances	64	74
Business machines[d]	55	62
Construction		
Pipe fittings	16	20
Other	6	8
Consumer electronics	19	20
Furniture	6	7
Luggage	2	2
Recreation	18	20
Telecommunications		
Telephone handsets	19	22
Other	5	7
Transportation[e]	223	269
Other injection molding	85	101
Total injection molding	518	612
Modifiers[f]	42	48
Other uses	20	26
Export	177	190
Grand total	1125	1285

a: Some 1991 figures revised in light of new information.
b: Includes mobile homes, etc.
c: Much of this is custom sheet.
d: Including calculators.
e: Includes mobile homes.
f: For use with other resins in extrusion and injection molding.

Market	Million lb. 1991 Cast sheet	1991 Mold./ extr.	1992 Cast sheet	1992 Mold./ extr.
Building	120	79	114	80
Consumer	15	14	16	15
Industrial	50	34	46	36
Signs	10	7	10	10
Transp.	37	36	34	34
Total	232	170	220	175

Market	Million lb. 1991	1992
Extrusion		
Coating	76	81
Film	682	702
Wire & cable	60	62
Other	10	11
Total extrusion	828	856
Injection molding	48	54
Adhesives	112	121
Other	20	23
Export	108	102
Total	1116	1156

a: Poundage in table is broken out from general LDPE table.

Market	Million lb. 1991	1992
Extruded film and sheet for industrial use[a]	15	15
Cast film (nonphotographic)	10	10
Consumer furnishings[b]	5	5
Automotive	1	1
Brush handles	9	9
Medical	4	4
Optical	8	7
Packaging	4	4
Tool handles	15	15
Toys	2	2
Writing instruments	2	2
Other	5	7
Total	79	81

a: Face shields, glazing, signs.
b: Table trim, window-blind wands, pricetag holders, etc.

Market	Million lb. 1991[a]	1992
Blow molding		
Bottles		
Liquid food[b]	997	1066
Household chemicals	889	970
Motor oil	195	214
Pharmaceutical cosmetics	230	263
Drums (15 gal. & larger)	210	242
Fuel tanks (all types)	58	78
Tight-head pails	84	91
Toys	70	76
Housewares	56	60
Other blow molding	223	253
Total blow molding	3012	3313
Extrusion		
Coating	53	58
Merchandise bags	204	219
Tee shirt sacks	299	380
Trash bags		
Institutional	178	203
Consumer	24	30
Food packaging[c]	128	163
Deli paper	30	33
Multiwall sack liners	62	73
Other	86	96
Pipe		
Corrugated	118	131
Water	102	109
Oil & gas production	70	76
Industrial/mining	63	67
Gas	118	129
Irrigation	40	42
Other	162	184
Sheet (over 12 mil)	305	392
Wire & cable	131	147
Other extrusion	43	48
Total extrusion	2216	2580

Market	Million lb. 1991[a]	1992
Cast sheet[b]	232	220
Molding and extrusion compounds	170	175
Special grades[c]	79	85
Coatings	95	96
Other[d]	49	50
Total	625	626

a: Some figures revised in light of new information.
b: Includes imports.
c: Impact modified, etc.
d: Emulsion polymers, transesterification resins, etc.

Market	Million lb. 1991	1992
Bonding and adhesives	27	29
Flooring, paving aggregates	32	32
Protective coatings	198	202
Reinforced uses		
Electrical laminates	48	50
Other	29	28
Tooling, casting, molding	25	25
Export	96	72
Other	35	32
Total	490	470

Injection molding		
Industrial containers		
Dairy crates	80	72
Other crates, cases, pallets	145	146
Pails	519	522
Consumer packaging		
Milk-bottle caps	33	38
Other caps	62	73
Dairy tubs	149	159
Ice-cream containers	94	97
Beverage-bottle bases	122	123
Other food containers	62	68
Paint cans	33	32
Housewares	176	166
Toys	104	124
Other injection	109	122
Total injection molding	1688	1742
Rotomolding	80	93
Export	1051	1290
Other[d]	1298	1416
Grand total	9345	10,434

a: Some 1991 figures revised in light of new information.
b: Includes milk and water bottles.
c: Bags and box liners.
d: Resold resin and resin used for blending and compounding.

Market	Million lb. 1991[b]	1992[b]
Packaging, food		
Baked goods	367	394
Candy	62	69
Dairy	89	96
Frozen food	132	143
Meat, poultry, seafood	247	263
Produce	186	193
Packaging, retail carryout bags		
Tee-shirt sacks[c]	184	192
Other merchandise bags[d]	180	188
Grocery wetpack	88	96
Self-service bags[e]	97	103
Garment bags[f]	142	149
Packaging, other		
Heavy-duty sacks[g]	153	155
Industrial liners[h]	196	204
Rack and counter bags	220	227
Multiwall sack liners	49	55
Shrink wrap, pallet	46	50
Shrink wrap, other[i]	147	159
Stretch wrap	617	669
Textile	190	196
Packaging, misc.		
Food, nonfood	528	563
Total packaging	3920	4160
Nonpackaging		
Agriculture	222	221
Diaper backing	238	242
Household	181	183
Industrial sheeting[k]	242	245
Nonwoven disposables	54	57
Trash bags[l]	1356	1432
Miscellaneous	344	354
Total nonpackaging	2637	2734
Grand total	6557	6894

a: Includes conventional LDPE, LLDPE, and EVA.
b: Includes imports, in line with procedures of the Society of the Plastics Industry's Committee on Resin Statistics.
c: Grocery and nongrocery applications.
d: Handle, drawstring, and other types.
e: Includes perforated rollstock - e.g., for produce.
f: New-clothes bags and bags used by laundries or dry cleaners.
g: All-plastic sacks.
h: Drum, bin, and box liners.
i: For overwrapping or bundling.
j: Food and storage bags and wraps.
k: Construction and industrial rollstock.
l: For home, institutional, or industrial use.

Market	Million lb. 1991[b]	1992
Blow molding	17	24
Extrusion		
Coating	10	12
Film (12 mil & under)		
Packaging	1408	1531
Nonpackaging	1475	1619
Pipe[c]	45	60
Sheet	53	88
Wire & cable	133	161
Other	16	17
Total extrusion	3140	3488
Injection molding	524	548
Rotomolding	204	219
Export	473	452
Other[d]	577	682
Grand total	4935	5413

a: Poundage in this table is broken out from poundage in general LDPE table. In line with procedures used by the Society of the Plastics Industry's Committee on Resin Statistics, it includes LLDPE imports of 669 million lb. in 1991 and estimates of 745 million lb. for 1992.
b: Some 1991 figures revised in light of new information.
c: Includes conduit and profile.
d: Chiefly for compounders and resellers.

Market	Million lb. 1991	1992
Blow molding	84	104
Extrusion		
Coating	786	816
Film (12 mil & less)		
Packaging	3920	4150
Nonpackaging	2636	2734
Pipe[b]	134	162
Sheet	138	177
Wire & cable	350	390
Other	148	161
Total extrusion	8112	8590
Injection molding	831	940
Rotomolding	334	357
Export	1755	1605
Other[c]	1216	1420
Grand total	12,332	13,016

a: In line with procedures used by the Society of the Plastics Industry's Committee on Resin Statistics, data include LDPE, LLDPE, and EVA imports of 669 million lb. in 1991, and estimates of 945 million lb. in 1992.
b: Also conduit, profiles.
c: Resin sold to resellers, compounders, and for all other uses.

Market	Million lb. 1991	1992
Extrusion		
Filaments	19	20
Film	65	70
Sheet, rod, tube	30	31
Wire & cable	36	39
Total	150	160
Molding		
Appliances/power tools	18	18
Consumer products	29	30
Electrical/electronics	44	51
Industrial	45	50
Transportation	139	148
Total	275	297
Export	77	80
Other	54	58
Grand total	556	585

Market	Million lb. 1991[a]	1992
Bonding and adhesive resins for:		
Coated and bonded abrasives	24	27
Fibrous and granulated wood	260	290
Friction materials	40	48
Foundry and shell moldings	81	83
Insulation materials	346	395
Laminating		
Building	54	58
Electrical	27	28
Furniture	21	23
Other	55	67
Plywood	1320	1465
Molding compounds	160	173
Protective coatings	16	17
Export	17	18
Other	242	265
Total	2663	2957

a: Some figures revised in light of new information.

Market	Million lb. 1991	1992
Appliances	26	29
Closures	11	12
Electrical/electronics	61	64
Housewares	36	36
Industrial	7	7
Transportation	15	15
Other	4	4
Total	160	167

Market	Million lb. 1991	1992
Appliances/power tools	12	13
Consumer products	29	29
Electrical/electronics	4	4
Industrial	35	37
Plumbing and hardware	12	13
Transportation	33	35
Export	5	5
Other	10	10
Total	140	146

Market	Million lb. 1991	1992
Appliances	50	52
Business equipment	28	29
Electrical/electronics	30	37
Glazing	105	107
Information storage	18	20
Packaging	19	21
Recreation	44	46
Transportation	50	64
Export	200	221
Other[b]	57	65
Total	601	662

a: Includes PC used in blends and alloys.
b: Includes industrial uses, lighting, signs, film, etc.

Market	Million lb. 1991	1992
Reinforced polyester		
Molded, filament-wound, pultruded, etc.	620	725
Sheet, flat and corrugated	166	180
Surface coating	18	16
Export	19	34
Other[b]	258	237
Total	1081	1192

a: Resin only.
b: Autobody putty, cultured marble, wood substitution, etc.

Market	Million lb. 1991	1992
Aircraft/aerospace	36	31
Appliances/business equipment	84	88
Construction	337	387
Consumer	120	122
Corrosion-resistant products	329	299
Electrical	50	53
Marine	221	243
Transportation	185	192
Other	45	52
Total	1407	1467

a: Includes resin, reinforcement, and all compound and composite ingredients.

Market	Million lb. 1991	1992
Appliances	8	9
Consumer/recreation	10	10
Electrical/electronics	45	52
Industrial	29	28
Transportation	52	62
Export	20	21
Other[b]	37	31
Total	201	213

a: Engineering grades of polybutylene terephthalate (PBT), polyethylene terephthalate (PET), and polycyclohexane dimethylene terephthalate (PCT), including polymer used in blends and alloys.
b: Includes novelties, pens, toys, etc.

Market	Million lb. 1991	1992
Blow molding		
Soft-drink bottles	793	868
Custom bottles[a]	403	475
Extrusion		
Film[b]	550	560
Magnetic recording film	90	92
Ovenable trays	50	54
Coating for ovenable board	13	13
Sheeting (for blisters, cups, food trays, etc.)	87	97
Strapping	36	38
Exports	318	332
Total	2340	2529

a: Includes cosmetics, toiletries, pharmaceuticals, food, liquor.
b: Merchant and captive film, excluding magnetic recording film.

Market	Million lb. 1991	1992
Appliances/power tools	38	35
Business equipment	30	28
Electrical/electronics	25	27
Industrial	12	13
Plumbing and hardware	5	8
Transportation	40	44
Export	34	37
Other[a]	11	12
Total	195	204

a: Includes leisure products and miscellaneous consumer items.

Market	Million lb. 1991[a]	1992
Blow molding		
Medical containers	52	55
Consumer packaging	86	89
Total blow molding	138	144
Extrusion		
Coating	19	21
Fibers & filaments	2088	2334
Film (up to 10 mil)		
Oriented	518	552
Unoriented	144	154
Pipe & conduit	25	28
Sheet (over 10 mil)	128	141
Straws	52	56
Wire & cable	30	32
Other extrusion	28	33
Total extrusion	3032	3351
Injection molding		
Appliances		
Major	117	126
Small	53	61
Furniture	108	117
Housewares	273	296
Luggage & cases	12	14
Medical	180	190
Packaging		
Closures	436	475
Containers	212	235
Toys & novelties	54	66
Transportation		
Battery cases	70	72
Other	195	233
Other injection molding	248	270
Total injection	1958	2157
Export	1547	1020
Other[b]	1651	1830
Grand total	8326	8502

a: Some 1991 figures revised in light of new information.
b: Chiefly resold material and material used for blending and compounding.

Market	Million lb. 1991[a]	1992[b]
Molding (solid PS only)		
Appliances/consumer electronics		
Air conditioners	25	27
Refrigerators & freezers	52	62
Small appliances	30	35
Cassettes, reels, etc.	248	266
Radio/TV/stereo cabinets	134	156
Other	7	9
Furniture & furnishings		
Furniture	27	32
Toilet seats	9	9
Other	8	11
Toys & recreational		
Toys	112	120
Novelties	40	45
Photographic	48	65
Other	6	7
Housewares		
Personal care	66	72
Other	80	86
Building & construction	44	49
Misc. consumer & industrial		
Footwear (heels)	6	7
Medical	76	83
Other	12	15
Packaging & disposables		
Closures	84	94
Rigid packaging	79	85
Produce baskets	20	21
Tumblers & glasses	70	76
Flatware, cutlery	83	88
Dishes, cups, bowls	50	55
Blow molded items	8	9
Other injection	90	98
Total molding	1514	1672
Extrusion (solid PS only)		
Appliances/consumer electronics		
Refrigerators & freezers	92	106
Other	41	42
Furniture & furnishings	28	29
Toys & recreational	38	39
Housewares	63	60
Building & construction	60	58
Misc. consumer & industrial	63	62
Packaging & disposables		
Oriented film & sheet	263	270
Dairy containers	158	155
Vending & portion cups	283	290
Lids	126	130
Plates & bowls	46	48
Other extrusion, solid PS	226	230
Extrusion (foam PS)		
Board	162	166
Sheet		
Food-stock trays	196	200
Egg cartons	58	52
Single service		
Plates	151	154
Hinged containers	103	105
Cups (nonthermoformed)	46	50
Other foam sheet[c]	32	34
Total extrusion	2235	2280
Expandable bead (EPS)		
Billets		
Building & construction	223	228
Other	46	50
Shapes		
Packaging	94	104
Other	44	47
Cups & containers	148	153
Loose fill	76	82
Total expandable bead	631	664
Export	294	326
Other[d]	221	255
Grand total	4895	5197

a: Some 1991 figures revised in light of new information.
b: Data, in line with procedures used by The Society of the Plastics Industry, include imports.
c: Auto headliners, miscellaneous single-service and nonthermoformed items.
d: Chiefly resold and blending resin.

Market	Million lb. 1991[a]	1992
Flexible foam		
Bedding	165	169
Furniture	584	599
Rug underlay	340	373
Transportation	406	436
Other[b]	109	124
Total	1604	1701
Rigid foam		
Building insulation	440	437
Home/commercial refrigeration	142	166
Industrial insulation	73	76
Packaging	65	74
Transportation	35	46
Other[c]	51	64
Total	806	863
RIM elastomers		
Transportation	120	123
Other	70	72
Total	190	195
Cast elastomers	60	64
All other[d]	487	507
Grand total	3147	3330

a: Some figures revised in light of new information.
b: Includes textile laminates, packaging, etc.
c: Includes marine flotation, etc.
d: Includes sealants, adhesives, coatings, etc.

Market	Million lb. 1991	1992
Calendering		
Building & construction		
Flooring	189	208
Paneling	30	33
Pond/pool liners	66	70
Roof membranes	30	33
Other building	11	15
Transportation		
Auto upholstery/trim	39	39
Other upholstery/trim	17	17
Auto tops	6	8
Packaging: sheet	121	125
Electrical: tapes	13	14
Consumer & institutional		
Sporting/recreation	22	22
Toys	22	22
Baby pants	4	4
Footwear	22	22
Handbags/cases	19	19
Luggage	19	19
Bookbinding	4	4
Tablecloths, mats	17	17
Hospital & healthcare	48	55
Credit cards	30	30
Decorative film (adh.-back) PVC	13	13
Stationery, novelties	6	6
Tapes, labels, etc.	30	30
Floppy-disk jackets	33	37
Furniture/furnishings		
Upholstery	68	68
Shower curtains	17	17
Window shades, blinds, awnings	14	17
Waterbed sheet	4	4
Wallcovering	55	59
Other calendering	19	22
Total calendering	988	1049
Extrusion		
Building & construction		
Pipe & conduit		
Pressure		
Water	1080	1248
Gas	28	35
Irrigation	167	200
Other	44	57
Drain/waste/vent	509	612
Conduit	502	524
Sewer drain	714	870
Other	59	59
Siding accessories	793	1007
Window profiles		
All-vinyl windows	97	130
Composite windows	112	149
Mobile home skirts	13	15
Gutters & downspouts	22	26
Foam moldings	33	37
Weatherstripping	35	37
Lighting	28	30
Transportation		
Vehicle floor mats	11	15
Bumper strips	4	4
Packaging		
Film PVC	240	244
Sheet	41	44
Electrical		
Wire & cable	359	418
Consumer & institutional		
Garden hose	52	55
Medical tubing	74	79
Blood/solution bags	74	79
Stationery/novelties	17	15
Appliances	30	35
Other extrusion	24	26
Total extrusion	5162	6050
Injection molding		
Building & construction		
Pipe fittings	216	224
Other building	11	11
Transportation		
Bumper parts	6	6
Electrical/electronics		
Plugs, connectors, etc.	50	59
Appliances, business machines	74	81
Consumer & institutional		
Footwear	30	35
Hospital & healthcare	44	48
Other injection	13	17
Total injection molding	444	481
Blow molding		
Bottles	202	194
Compression molding		
Sound records	2	1
Dispersion molding		
Transportation	41	44
Packaging closures	41	44
Consumer & institutional		
Toys	17	17
Sporting/recreation	22	22
Footwear	11	8
Handles, grips	11	11
Appliances	22	24
Industrial		
Traffic cones	6	6
Adhesives, etc.		
Adhesives	11	11
Sealants	6	6
Miscellaneous	15	15
Other dispersion	17	17
Total dispersion molding	220	222
Dispersion coating		
Building flooring	134	160
Transportation		
Auto upholstery/trim	8	6
Other upholstery/trim	4	4
Anticorrosion coatings	15	11
Consumer & institutional		
Apparel/outerwear	8	6
Luggage	6	6
Tablecloths, mats	8	6
Hospital & healthcare	22	22
Furniture/furnishings		
Upholstery	19	17
Window shades, blinds, awnings	19	19
Wallcoverings	17	17
Carpet backing	15	13
Other	19	17
Total dispersion coating	294	304
Vinyl latexes		
Adhesives/sealants	70	70
Compounders & resellers	341	359
Export	1492	1323
Grand Total	**9215**	**10,053**

a: Some 1991 figures revised in light of new information.

Material[a]	Million lb. 1991	1992
Nylon	173	183
Polycarbonate	65	70
Polyester	187	195
Polypropylene	205	220
Styrenics[b]	51	51
Other[c]	38	38
Total	719	757

a: Includes reinforcements and all other compound ingredients.
b: Includes SMA, ABS, SAN, etc.
c: Includes modified PPE, PPS, LCP, ketones, etc.

Market	Million lb. 1991	1992
Appliances	10	11
Automotive	6	6
Batteries (nonautomotive)	4	4
Compounding	12	11
Housewares	21	22
Packaging, molded	12	13
Other	18	19
Export	31	26
Total	114	112

Type	Million lb. 1991[a]	1992
Styrenics[b]	305	330
Thermoplastic polyurethanes[c]	61	64
Olefinics	156	163
Polyesters	40	42
Alloys	40	43
Other[d]	12	13
Total	584	655

a: Some figures revised in light of new information.
b: Figures are for total weight of TPE compound.
c: Includes adhesives, sealants, and coatings.
d: Includes amides, etc.

U.S. resin sales to major markets

Market	Million lb. 1991[a]	1992
Bonding and adhesive resins for:		
Fibrous and granulated wood	1243	1323
Laminating	15	24
Plywood	61	59
Molding compounds	74	79
Paper treatment and coating resins	55	50
Protective coatings	136	138
Textile treatment and coating resins	24	19
Export	28	25
Other	22	20
Total	1658	1737

a: Some figures revised in light of new information.

Market	Million lb. 1991[a]	1992
Closures	2.8	3.4
Electrical	49.0	52.0
Other	0.8	1.2
Total	52.6	56.6

a: Some figures revised in light of new information.

Market	Million lb. 1991[a]	1992
Buttons	1.4	1.9
Dinnerware	17.2	17.5
Electrical	0.8	0.8
Ashtrays	1.5	1.5
Other	0.4	0.4
Total	21.3	22.1

a: Some figures revised in light of new information.

Market	Million lb. 1991	1992
ABS	212	233
Acrylic	10	11
Cellulosics	2	2
Epoxy	8	8
Nylon	18	18
Phenolic	26	29
Polyacetal	12	13
Polycarbonate	50	52
Polyester, reinforced	84	88
Polyester, thermoplastic	8	9
Polyethylene	22	24
Polyphenylene-based alloys	38	35
Polypropylene	170	187
Polystyrene	240	272
PUR foam	142	166
Polyvinyl chloride	126	140
Styrene acrylonitrile	10	11
Other	41	43
Total	1219	1341

Market	Million lb. 1991	1992
Decorative laminates		
Phenolic	54	58
Urea and melamine	15	24
Flooring[a]		
Epoxy	32	32
PVC	338	381
Urethane foam (rug underlay)	340	373
Glazing and skylights		
Acrylic	120	114
Reinforced polyester	24	27
Polycarbonate	105	107
Insulation		
Phenolic (binder)	346	395
Polystyrene foam	223	228
PUR foam (rigid)	440	437
Lighting fixtures		
Acrylic	40	40
Cellulosics	5	5
Polycarbonate	12	14
Polystyrene	52	52
PVC	28	30
Panels and siding		
Acrylic	20	19
Butyrate	5	5
PVC	793	1007
Reinforced polyester	99	108
Pipe, fittings, conduit		
ABS	120	139
Epoxy (coatings)	15	15
HDPE	673	738
LDPE	134	162
Polypropylene	25	28
Polystyrene	60	58
PVC	3319	3829
Reinforced polyester	126	122
Profile extrusions[b]		
PVC (incl. foam)	340	424
Polyethylene	16	17
Polystyrene	22	22
Plumbing		
Acetal	12	13
Acrylic	37	38
Polyester, thermoplastic	7	8
Polyphenylene-based alloys	5	8
Polystyrene	19	20
Reinforced polyester	88	94
Resin-bonded woods		
Phenolic	1580	1755
Urea and melamine	1304	1382
Vapor barriers		
LDPE	242	245
PVC[c]	96	103
Wall coverings		
Polystyrene	28	29
PVC	55	59
Total	11,414	12,764

a: Excluding bonding or adhesive materials.
b: Including windows, rainwater systems, etc.
c: Including swimming-pool liners.

Market	Million lb. 1991	1992
ABS	98	111
Cellulosics	3	3
Epoxy (electrical laminates)	48	50
Nylon (incl. wire and cable)	80	90
Phenolic	88	92
Polyacetal	4	4
Polycarbonate	30	37
Polyester, reinforced	50	53
Polyester, thermoplastic	45	52
Polyethylene, HD[b]	131	147
Polyethylene, LD[b]	350	390
Polyphenylene-based alloys	25	27
Polypropylene[b]	30	32
Polystyrene	430	473
Polyvinyl chloride	424	492
Styrene acrylonitrile	4	4
Urea	49	52
Other	56	57
Total	1945	2165

a: Excludes transportation.
b: Wire and cable.

Material[b]	Million lb. 1991 Cars, vans, light trucks	1991 Other[c]	1992 Cars, vans light trucks	1992 Other
ABS	221	25	300	28
Acrylic	60	25	55	15
Nylons[d]	129	10	135	13
Phenolic	13	2	17	4
Polyacetals	32	1	34	1
Polycarbonate	43	7	52	8
Polyester, elastomer	18	2	21	3
Polyester, thermoplastic	46	6	51	11
Polyester, unsaturated	145	40	148	42
Polyethylene	188	18	199	24
Polyphenylene-based resins	38	2	44	4
Polypropylene[e]	240	25	256	29
Polypropylene, EPDM-modified	68	–	70	–
Polyurea	7	–	7	–
Polyurethanes[f]	505	50	535	61
Polyvinyl chloride	150	22	155	23
SMA	54	–	55	–
Other[g]	55	7	64	11
Total	2012	264	2198	277

a: Includes Canada.
b: Includes all resin components of compounds, alloys, and blends; also, all reinforcements, fillers, and other additives.
c: Heavy trucks and trailers, rail equipment, aircraft, etc.
d: Includes reprocessed resin.
e: Includes battery cases.
f: Includes foam, RIM materials, etc.
g: Includes alkyd, butyral, epoxy, ionomer, polyetherimide, polysulfone, styrenic elastomers, etc.

Market	Million lb. 1991	1992
ABS	6	7
Melamine	23	19
Phenolic		
Decorative laminates	21	23
Plywood	70	71
Polyester, unsaturated[a]	6	7
Polyethylene	22	24
Polypropylene	108	117
Polystyrene	72	81
Polyurethane		
Flexible foam	584	599
Rigid foam	23	24
Polyvinyl chloride[b]	87	85
Other	17	17
Total	1039	1074

a: Resin only.
b: Upholstery.

Market	Million lb. 1991	1992
ABS	35	36
Cellulosics	2	3
Polyethylene, HD	174	200
Polyethylene, LD	175	183
Polypropylene[a]	54	68
Polystyrene	190	204
Polyvinyl chloride	39	39
Other[b]	105	108
Total	774	841

a: Includes novelties. b: Chiefly performance resins.

Market	Million lb. 1991	1992
Melamine	19	19
Phenolic	36	36
Polyethylene, HD	232	226
Polyethylene, LD	450	461
Polypropylene	273	296
Polystyrene[a]	247	257
Polyvinyl chloride[b]	189	195
Styrene acrylonitrile	21	22
Other	65	66
Total	1532	1578

a: Excludes foam. b: Includes wallcoverings.

Market	Million lb. 1991	1992
Closures		
Phenolic	11	12
Polyethylene, HD	95	111
Polyethylene, LD	33	34
Polypropylene	436	475
Polystyrene	210	224
PVC	41	44
Urea	3	3
Total	829	903
Coatings		
Epoxy	36	37
EVA copolymer	76	81
Polyethylene, HD	53	58
Polyethylene, LD	786	816
Polypropylene	19	21
Polyvinyl acetate	48	49
PET	13	13
PVC	24	26
Other	96	97
Total	1151	1198
Containers		
ABS	5	7
Cellulosics	4	4
Polycarbonate	19	21
Polyethylene, HD		
Blow molded		
Up to 2 gal.	2311	2513
2 gal. or more	210	242
Injection molded[b]	1204	1219
Polyethylene, LD		
Blow molded	84	104
Injection molded	230	253
Polypropylene		
Blow molded	138	144
Extruded	47	64
Injection molded	212	235
Thermoformed	58	62
Polystyrene		
Blow molded	8	9
Molded		
Solid	149	161
Foam	94	104
Thermoformed		
Foam	505	510
Impact	441	445
Oriented sheet	30	33
PVC		
Blow molded	202	194
Thermoformed	41	44
SAN, molded	12	13
Thermoplastic polyester (PET)		
Blow molded	1196	1343
Thermoformed	137	161
Other	91	93
Total	7661	8195
Film		
Polyethylene, HD	661	795
Polyethylene, LD	3920	4150
Polypropylene		
Oriented	518	552
Unoriented	144	154
Polystyrene	233	237
PVC	240	244
Other	110	112
Total	5826	6244
Grand total	15,467	16,540

a: Does not include adhesives.
b: Includes bases for PET bottles.

PKG. only