



TPSA

Feb 23rd 2010

Envision Plastics  
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The Technology Leader in  
Recycled Polyolefin Resins



The only FDA approved,  
food grade HDPE PCR  
in North America



High speed, high output,  
custom color sorted HDPE PCR.  
Don't just recycle the plastic,  
recycle the color.



# Points of Discussion

- Who is Envision Plastics
- A little Plastics Recycling History
- Points of discussion around stewardship and implementing a recycling program
- Conclusions

# About Envision Plastics

- Started in June 2001 by entrepreneurs, Massoud Rad and Parham Yedidsion
- Bought FCR's Plastics Recycling business in Reidsville, NC, from Casella Waste, and Union Carbide's Plastic Recycling business in Bound Brook, NJ
  - Combined these two businesses in Reidsville, NC.
    - Upgraded and expanded the Reidsville FCR plant and integrated the Union Carbide equipment
- Bought a USPL plant in Chino, CA and converted it to HPDE plastic recycling
- Envision is the only plastic recycler with national procurement and supply scope



# What makes Envision Unique?

- Prisma™ Color sort Technology
- Ecoprime™ Resin that has a Non objection Letter from FDA for direct food contact
- Bi Coastal
- Over 100 years experience in the plastic industry.

# Process Cycle



# Oregon Bottle Bill

- Passed in 1971
- Mainly targeted Aluminum Cans



- PET soft drink bottles first appear in 1976

# 1987 – MOBRO 4000

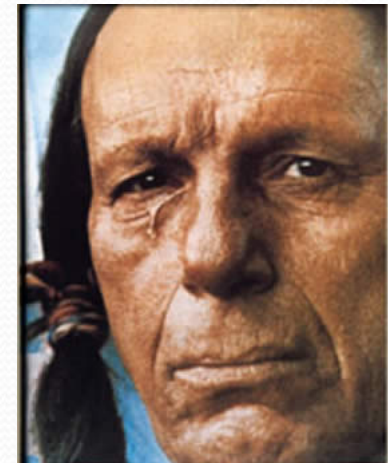
- “We are running out of landfill space”



The World Changed

# MOBRO

- The 'Poster Child' of the solid waste environmental movement
- Actually, a poor business deal gone bad
- But, it sparked a movement within a movement.



# More Bottle Bills

- By 1983, 8 more states.
- The critical mass for PET recycling was met as the PET soft drink bottle was successful.
- Early PET reclaimers included St. Jude Polymer in Pennsylvania, Puretech in New York, Clean Tech in Michigan, and Wellman. Wellman was the largest PET reclaimer, making fiber.

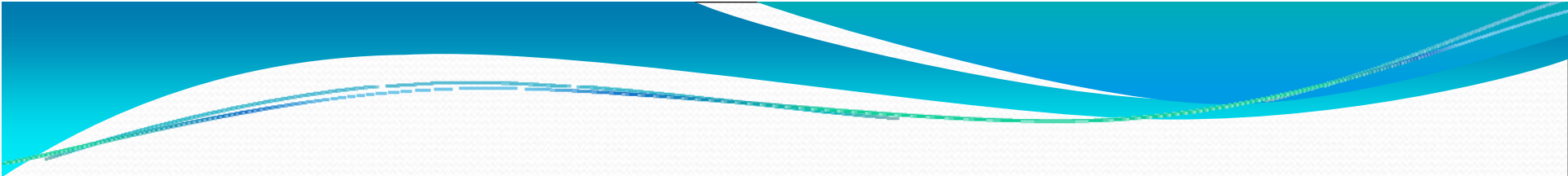
# Post MOBRO

- California and New Jersey passed legislation which prompted the PET and bottle industry to form **NAPCOR** to promote recycling.
- The PET reclaimers grew in number and capacity, always short of raw material.
- In 1988 the **Council for Solid Waste Solutions** formed to promote plastics and recycling.



## A Shortage of prime HDPE due to 1988 Phillips fire helps HDPE Recycling to enter the picture

- Very small recyclers attempt to recycle HDPE
- First Post Industrial
- Drop off centers
- Mainly to support plastic pipe and to recycle post industrial.
- Consumers wanted their empty plastic bottles recycled. The point of guilt was when a plastic bottle was empty. Was it going to be recycled or trashed?



Consumer product companies made it a priority to have their plastic packages collected and recycled.

Their second priority was to have recycle content in their packaging



# HDPE

Recycling of High Density Polyethylene (HDPE) consumer product packaging is about 21 years old now. The first 7 years was a period of intense technical development. The 2<sup>nd</sup> 7 years has been a period of commercialization and consolidation of these technologies. Currently, the industry has matured. The environment and market drivers have greatly changed through these phases.

## The First Seven years created Large Results

- Recycling of HDPE grew from nothing to ½ billion pounds in 1996.
- Collections grew to 25% of the consumer products HDPE bottles
- 25% Recycle content became standard in most non-Food consumer packaging.
- Other markets were developed: Pipe, Flower pots, Film & Sheet and plastic lumber.
- Recycling processing capacity grew to over 1 billion pounds per year. Capacity utilization was only 47%.



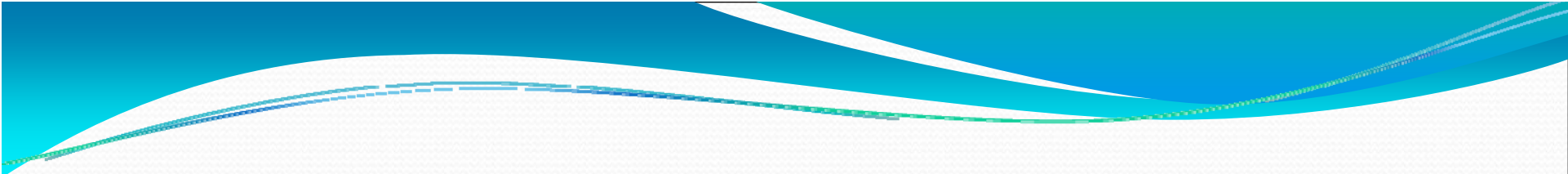
# The Technical Developments:

- Bale Specifications
- Better bale breakers and grinders
- Sink/float
- Air classification
- Improved washing equipment
- Color sortation of bottles and washed flakes
- Improved extrusion
- PCR pellet specifications
- Trilayer blow Molding
- Resin blends
- Infrared sortation technology



# It all gets started

- Communities developed collection programs and Material Recovery Facilities(MRF's)
- Resin Producers invested large amounts of resources to develop the technologies necessary to recycle used HDPE Packaging
- They built commercial demonstration facilities, and worked together with the consumer product companies and their blow molders to incorporate Recycled HDPE into new consumer packaging



The whole HDPE Post Consumer Recycle (PCR) chain worked together from the curbside collection, to the MRFs, the Recycle Processors, the Virgin Resin Suppliers, to the Blow Molders and the Consumer Product Companies.



# Policy

- Policy drove these large results.
- California Recycled Content
- Florida ADF
- Oregon Recycled Content
- Pay as you throw
- Ricra 1991 Federal mandate to states to have a landfill reduction plan which caused most to create recycling percentage goals.



## Where do feed stocks for HDPE bottles currently come from?

- MRF operators and Municipalities which come from mainly curbside collection (MRF's are Multi Recovery Facilities)
- Drop off centers
- Some industrial feed stocks from current customers
- Some open bid suppliers
- Most materials come in baled as compressed 4'X6' bottles but some come in as regrind from Prf's (Plastic Recovery facilities who sort and grind)

## Notes to consider Regarding HDPE Bottles

- HDPE recycling grew up without deposits.
- HDPE recycling benefited from uniform milk bottles  
“if it has a handle, it is HDPE”
- HDPE recycling is the product of curbside recycling.
- HDPE has no vertical integration with the primary resin suppliers as other recycling commodities do.

# First HDPE Recyclers 1988-1992

- Partek had first color sort
- United Resource Recovery (Hancor Plastic Pipe)
- Eaglebrook(Second auto whole bottle sort)
- Poly Anna (made recycling bins)
- North American Recycling New Jersey Tom Tomesek's(First Auto Sort for whole bottles)
- Wheaton Plastics Recycling
- Trimax Lumber
- Envirothene
- IEM Plastics Flower pots
- USA Polymers

## Second Tear 1991-1994

- Union Carbide
- Phillips Recycling
- Quantum Chemical(Global Plastics Recycling)
- Polymer Resource Group
- Catination
- Waste Alternatives
- Graham Recycling Corp.
- Clean Tech
- KW Plastics
- East Coast Recycling
- Talco Plastics
- Merlin Plastics
- Blueberry Recycling
- Resource Recycling
- Orion Pacific
- Resource Plastics
- Catenation
- P&E Plastics
- Quality Checked Plastics
- Tulip Corp.
- Polycycle
- Carlisle Plastics
- Midwest Plastics
- Polycycle SW
- American Recycling
- Southeast Recycling
- Desboro
- Environmental Plastics
- Wellstar Recycling

## Third Tear 1996-2000

- Fix Corp. **No longer became PET with ITW buying equip.**
- Ensley recycling Maryland (**formerly Polymer Resource Group**) Closed in 2001
- Ensley North **Carolina(Formerly Southeast Recycling)**Closed in May
- USPL/IL,USPL/CA,USPL/MA **Closed in 2001**
- Ecoplast Corp **sold to USPL** then to Envision
- FCR Plastics **sold to Envision**
- Plastic's Revolutions **Still around**
- Berou **Closed and reopened for toll business**
- RPM **switched to PP and back to HDPE**
- Polychem **Closed in 2009**
- American Recycling **Closed in 1999 became part of Blueridge then ITW**

## Latest Addition

- Tie Tech **Makes Rail Road Ties**
- Master Mark
- Envision Plastics North Carolina
- Envision Plastics California
- Sol Plastics Out as of 2009
- Poly Chem Out as of 2009
- Entropex
- Cycle Plastics Out as of 2009
- Hite Plastics
- BlueRidge Plastics Just recently became ITW
- Riggin's Mill Out as of 2009
- Epic
- Ensley North Carolina(Out as of 2009)



## Who is Left in HDPE Post Consumer Bottles?

- Clean Tech\*
- Entropex
- Envision Plastics
- Envision Plastics
- Epic\*
- Fresh Pak\*
- Graham Recycling Corp\*
- Haviland\*
- Hite Plastics
- ITW/Blue Ridge\*
- KW Plastics\*
- Master Mark\*
- Merlin
- Plastics Revolutions
- RPM
- Talco



## Today's Conditions

- Feedstock is changing(Barriers,PP,labels,fillers)
- Supply is shrinking in 2009, though single stream gave it a bump for the last 5 years
- Export is growing in demand
- Demand for Recycled is growing due to sustainability
- Quality of feedstock is diminishing partly due to bad single stream programs and export is not as concerned about quality as well as new materials coming into Mrf's
- New plastic materials are being collected
- Safety and Water requirements have gotten a lot tougher

# Issues affecting HDPE

- **Calcium Carbonate**
- **Colored PET**
- **Colored milk bottles**
- **Some new innovations such as barrier resins**
- **Film**
- **Growth of supply not keeping up with demand**
- **Export due to demand and lack of quality standards**

## HDPE Recycle Rates and Demand

- 1993            401    million pounds
- 2000            762    million pounds
- 2002            799    million pounds
- 2003            823    million pounds
- 2004            904.2 million pounds
- 2005            921.9 million pounds
- 2006            742    million pounds
- 2007            761    million pounds

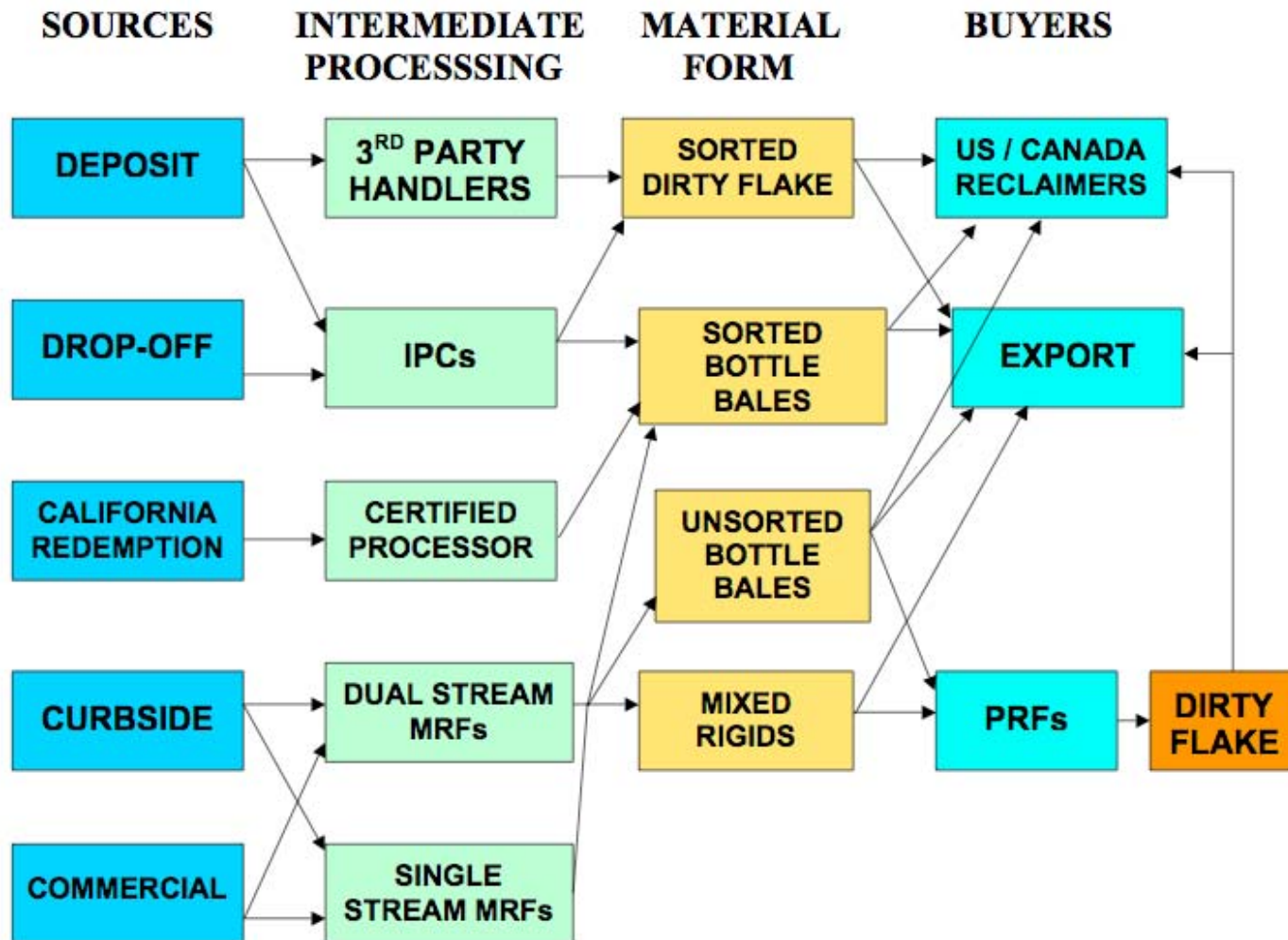
# Exports for PET

- 1995, 22% of collected bottles exported
- 2005, 42% of collected bottles exported
- 2006, 51% of collected bottles exported

## Result?

US reclaimers see stifled growth in supply of bottles even as gross amount collected grows. HDPE is following this pattern

# Materials Flow Chart



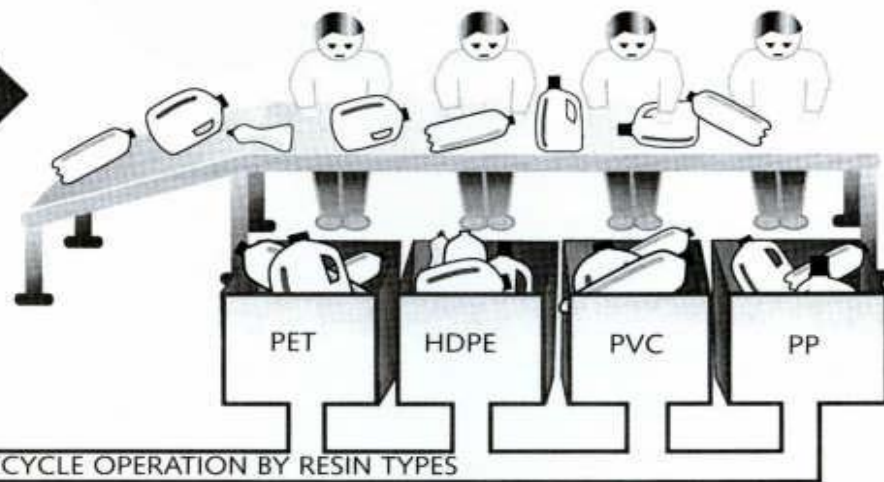
CURBSIDE COLLECTION



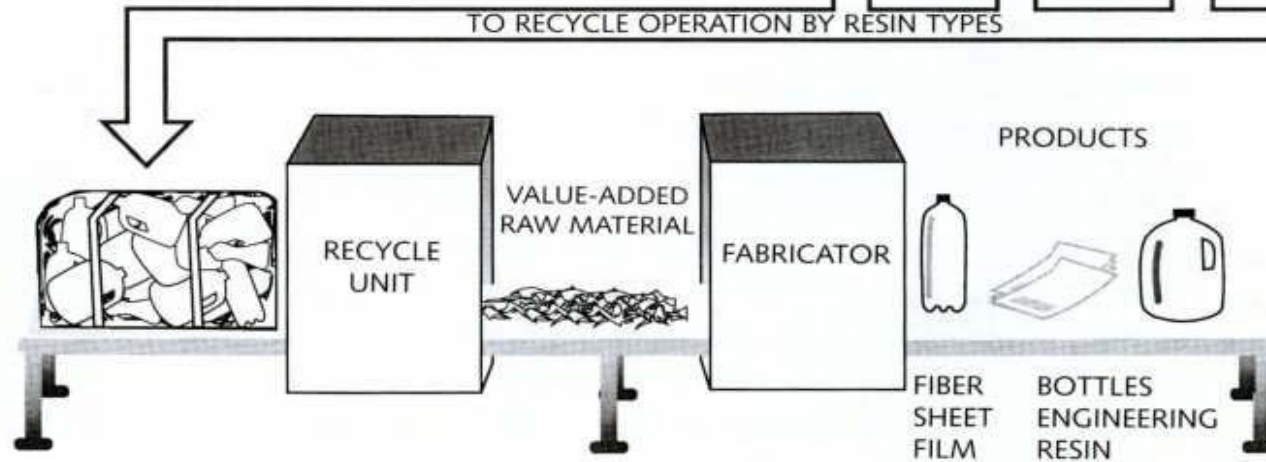
TRANSPORT  
TO MRF



SORTING (MANUAL OR AUTOMATIC)  
SEPARATE RESIN TYPES



TO RECYCLE OPERATION BY RESIN TYPES



# Issues that affect Ag Plastics and Pesticide Containers

- Sun degradation
- Dirt and silica (hard to remove and not embed in the process and can cause wear and tear on equipment)
- Fillers and Additives
- Chemicals and dealing with water discharge
- Variation in polymers
- Surface area to bulk density of film to clean is expensive
- Not many sustainable markets



## OBJECTIVES

- **To explore adding other consumer plastics such as Nursery Containers & or Pesticide Containers**
- **Look at potential Cost for a processor**
- **Look at potential end markets**
- **Look at what issues there could be**
- **Look at next steps**

## Reclaimer Business Model - Sales

- No clear public policy on PCR use.
- Most orders month to month, no long term contracts.
- Higher costs for those users augmenting with PCR, i.e., not using as primary feedstock.
- Inconsistent quality expectations.

# SMART

All objectives will be “SMART”: Specific, Measurable, Achievable, Realistic, and Time-based.

- **S** - All plans will be based on being cost effective and scalable
- **M**- Success will be measured based on pounds collected, customer and associate satisfaction surveys and any cost savings realized
- **A** - All goals will be achievable based on pilot testing
- **R** - Objectives will be developed by a team approach
- **T** - Scope and Approach is to be defined by 4<sup>th</sup> qrt 2009 with a tentative pilot beginning in Fiscal calendar 2010

## Costs To Start a Plastics Recycling Plant

- Estimated Cost per pound for a plant located in the most efficient site

	1 Ton/HR	2 Ton/HR	3 Ton/HR
<b>Reprocessing System</b>			
Labor	0.039	0.024	0.020
Electricity	0.007	0.007	0.007
Water	0.003	0.003	0.003
Chemicals	0.010	0.010	0.010
Gas	0.006	0.006	0.006
Landfill	0.008	0.008	0.008
Maintenance	0.015	0.015	0.015
Lease	0.011	0.011	0.011
Extrusion	0.060	0.060	0.060
Depreciation	0.041	0.032	0.027
Overhead			
<b>Totals</b>	<b>0.198</b>	<b>0.170</b>	<b>0.156</b>

**Capital Investment \$6,736,989    \$10,737,826    \$13,300,646**

Note: does not include overhead, freight, packaging or material cost

# Potential End Markets

- New Flower Pots and Flats(this can be sustainable in the long run)
- Plastic pallets
- Erosion protection
- Trash carts
- Back into packaging containers(this is the most sustainable of history has a say)
- Corrugated pipe industry(will need new supply as bottles are getting too expensive)



# Issues running Flower Pots

- Not all the same polymer
- Not all the Same Melt Flow
- Mostly Dark colors, no natural or clear
- Additives such as Calcium Carbonate which will contaminate the Bottle recycling stream or cause yield loss
- Contamination creates water reclamation challenges along with high yield loss
- **Good News is they are already use to consuming recycled resins and most of their resins can marry with ag pipe.**

## Not the Same Polymer or Melt Flow

- Flower pots (They are PP, HDPE, PS and some composite blend pot and flats with melt flow being dependent on size and how it was molded.)
- Pesticide Containers( Mostly HDPE and HMW. Some are flourinated and some have barriers such as EVOH or Nylon.
- AG Film Mostly Polyolefin based but can be clear, black, LDPE, LLDPE and HDPE with additives.

Picture of Pesticide containers collected under California guidelines for our Chino, CA plant





# Issues Running Pesticide Containers

- **Waste Water**
- **Exposure to workers**
- **Varing melt flows and colors**
- **Discharge issues**
- **Migration of Chemicals into Polymer**
- **Concerns from end markets on polymer safety**

Therefore I Suggest creating a task force and establish a time line and goals and identifying Associations who could be involved.

- Can we accomplish this in a year?
- Can we include technical and financial experts to help the task force establish the feasibility of both?
- What Associations could contribute?(PSI,ACRC,APR,ACC, PPI,ISRI,WRAP,EPRA,SWA and NRC)



## FINANCIAL FEESABILITY

1. Can the collectors get enough to cover collecting the additional pounds?
2. Can the MRF(multi material recovery facility) cover the sortation, baling, storing costs?
3. Can the Processor economically make a PCR for an end market in comparison to prime resin? If, not at what critical mass can the processor do so.

## TEST TECHNICAL APPROACH

- Obtain, test, and compare recycled resins.
- Determine effects of contamination.
- Prepare blends of recycled and virgin.
- Evaluate short and long-term properties.
- Prepare specification for resin and/or blends.
- Make an end product out of recycled resin or blend.
- Evaluate short and long-term properties.



## RESIN SPECIFICATION

- Define the quality of recycled resins for blending.
- Establish contamination limits and stress crack performance requirements.

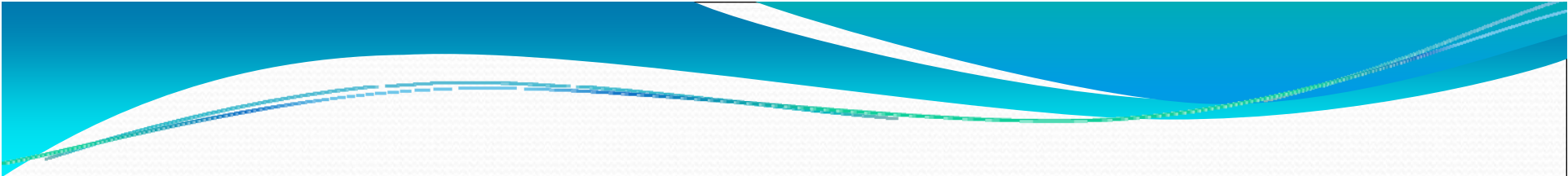
## SPECIFIED PROPERTIES

- Melt Flow Rate (2 loads)
- % Volatiles
- % Ash
- % Polypropylene
- Tensile Stress
- Elongation-at-Break
- 15% NCTL (NCLS)
- BAM Stress Crack Test in Water
- OIT or OITemp



## Task Force makes a FINAL REPORT

- Sources of quality recycled resins.
- Specification for recycled resins.
- Relationships between key material properties and recycled resin content.
- Recommended stabilizer package.
- Short-term tests to predict long-term performance.
- Economics behind the production of the new PCR
- Identify end markets and look for solutions to issues as opposed to it can't be done.



Parting words of wisdom;  
We do not inherit the earth from our  
ancestors but rather borrow it from  
our children      *unknown Native American*

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