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St Louis, MO

Biodegradable Flexible Packaging

What it is and how it can be used

Presented by:

Stewart Richards

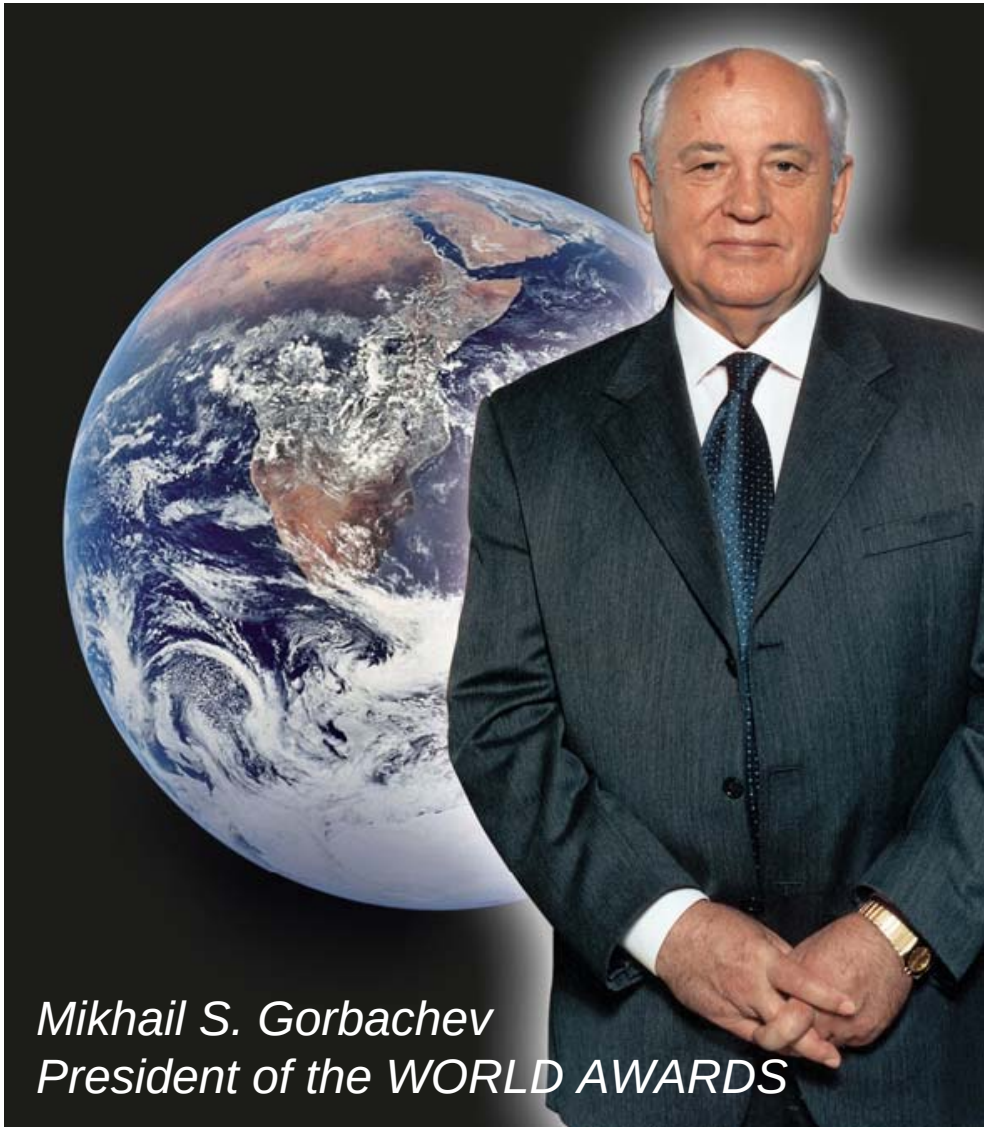
Technical Service & Development Manager Americas

Innovia Films Inc.

“It took almost 5 billion years to create the earth as we know it – with all its natural beauty.

But is has taken only 200 years to bring the earth to the brink of destruction.

It’s time to act now.”



Mikhail S. Gorbachev
President of the WORLD AWARDS

"The future depends on what we do in the present."

-- Mahatma Gandhi

Biodegradable &/or Sustainable Packaging

Key Drivers

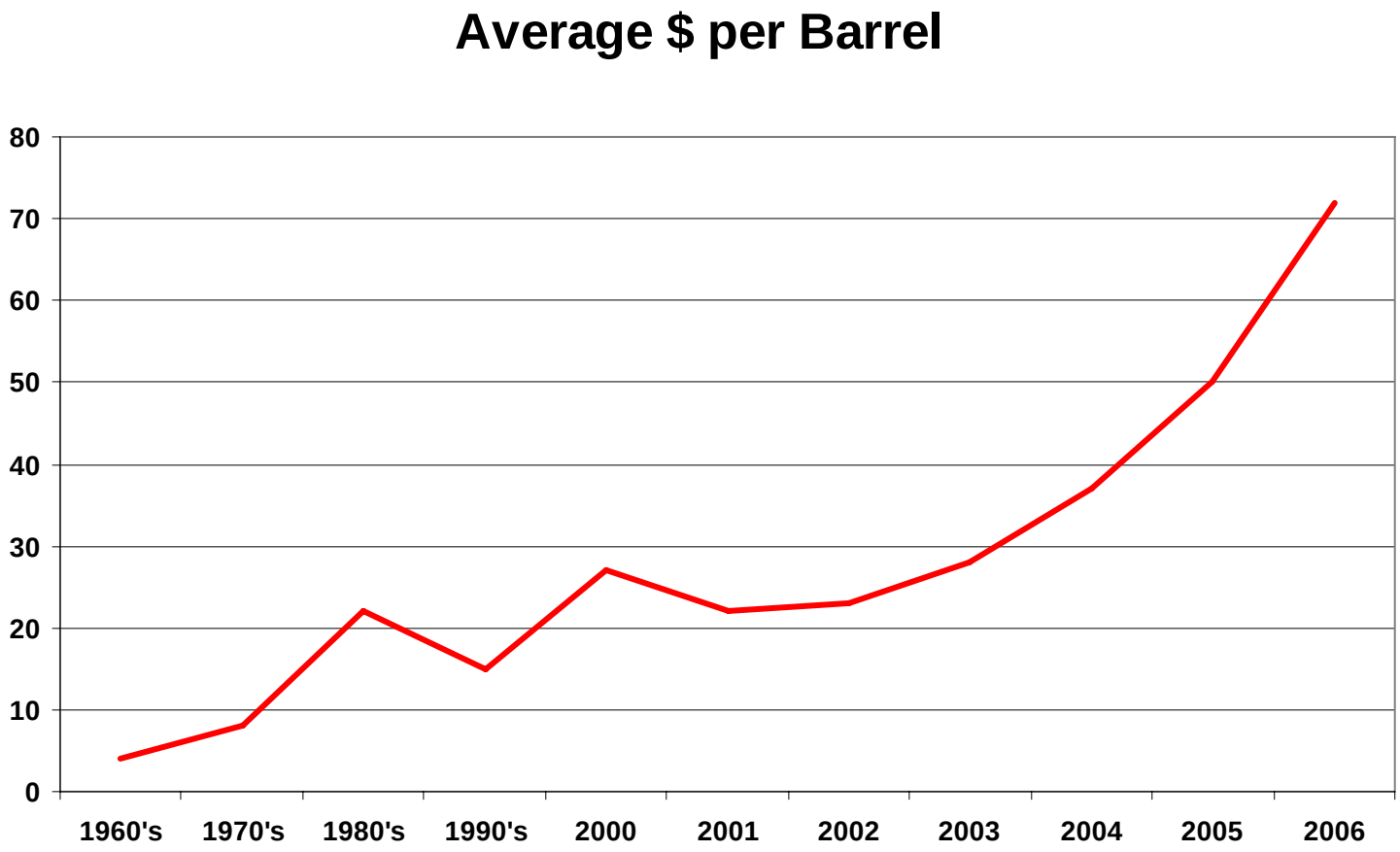
Drivers for Biodegradable & Sustainable Packaging

- Increasing governmental and industry awareness of the need to develop the use of sustainable resources. We need to preserve our resources & environment today, ... for future generations.
- One of the most pressing problems today is what to do with various waste products. Certain wastes can no longer be deposited in landfills, and landfill fees are on the rise.
- Very high proportion of flexible packaging is sourced from oil based derivatives.
- General public perception that ‘biodegradable is good’.
- **Retailers and marketers are aware of and want to take advantage of these issues thereby creating a significant market opportunity.**

Some Interesting Facts About Oil and Packaging

- 8% of Oil is Converted into Plastics
- Over 50% of Packaging is Plastic
- Oil has increased in price 500% since 1990's
- Only Discovering 1 Barrel of Oil for every 4 used
- 2005…
  Middle East uncertainty, Oil supply, Gas prices, Katrina, Rita

Some Interesting Facts About Oil and Packaging



Biodegradability & Compostability

What is the difference?

- BIODEGRADABILITY - Capacity of a substance to be broken down by micro-organisms. [No set time scale]
- COMPOSTABILITY - A managed biodegradation process, through production of a useful compost in a maximum period of 180 days. This requires conformity to an agreed norm.
- COMPOSTABILITY NORMS – EN, ASTM, DIN, GreenPla
  Europe has adopted EN 13432 & U.S. has adopted ASTM D 6400.

Composting Norm for 'BIODEGRADABLE PLASTICS'

A BRIEF GUIDE TO ASTM 6400

- In simple terms, the biodegradability of the material is compared to a control (pure cellulose) and must biodegrade to a minimum of 90% of the control level.
- Constituents of the packaging material >1% by weight must be measured individually, and also biodegrade to a minimum of 90% of the control level.
- Constituents <1% by weight are exempted, but the sum of such constituents must not compromise biodegradation.
- Pilot composting & plant-growing tests are also carried out on the material.
- Heavy metal content tests are also required.

Methods of Composting

Industrial composting:
Suitable for all certified compostable materials

Windrow Composting
(not suitable for Oxo-degradables)

In-vessel Composting

Home composting:
Only suitable for unmodified plant-based materials & materials tested specifically

Not suitable for materials that require higher temps to achieve biodegradation

Product Certification

Packaging films having been fully tested & certified to the European composting norm EN13432 as well as the American standard ASTM 6400. They can therefore carry the following logos:

Compostable
Kompostierbar
7P0085

Dincertco, Germany
Also UK, Netherlands & Poland

COMPOSTABLE
Biodegradable Products Institute | US COMPOSTING COUNCIL

BPI logo, USA

They are also certified as fully ‘home’ compostable…

HOME
OK compost
AIB VINÇOTTE

OK Compost, Belgium

Sustainable Films

What does the Term Sustainable Mean ?

- A sustainable film is one that is sourced with high levels of renewable raw materials.
- All sustainable films currently available are sourced from Bio-Based materials.
- This results in renewable cycles of less than 10 years
- The degree of sustainability is determined by the Carbon^{14} ratio

Main Biopolymers

- Most biopolymers exhibit either ‘Cling Film’ or ‘LDPE type’ properties. (Tear resistant, stretchy, weld seals, low melting points). They also tend to lack transparency and gloss.
- Only Cellulose or PLA based films exhibit ‘orientated’ type properties (stiffness, dimensional stability, transparency and gloss)
- Most biopolymers (with the exception of Cellulose and PLA films) are based on synthetic rather than renewable resources, but all are truly biodegradable these days...

Current Issues with Biodegradable Films

- Achievement of Moisture Barrier
- Cost
- Infra-structure to cope with composting of biodegradable used or waste films

Current Issues with Biodegradable Films

Currently best moisture barrier achieved with Cellulose based films

Transparent Films 2g/100in^2/day

Metallised Films 0.32g/100in^2/day

Transparent BOPP < 0.4g/100in^2/day

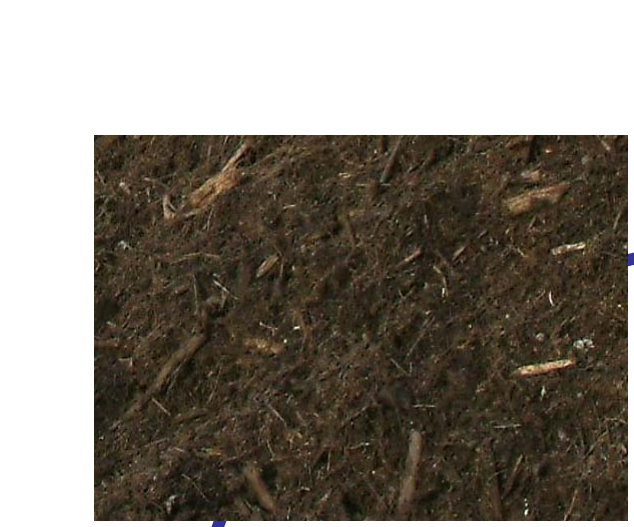
Metallised BOPP < 0.04g/100in^2/day

Ceramis coated PLA which is transparent is achieving < 0.70g/100in^2/day

Cellulose Films and Making them truly Biodegradable

- Heat-sealable Cellophane Films have always been in excess of 90% biodegradable
- Coatings to make them heat-sealable such as PVdC did not allow them meet the composting norms
- Biodegradable heat-sealable coatings now being used that allow the films to meet the norms.
- The “Holy Grails” of moisture and oxygen barrier are still being pursued

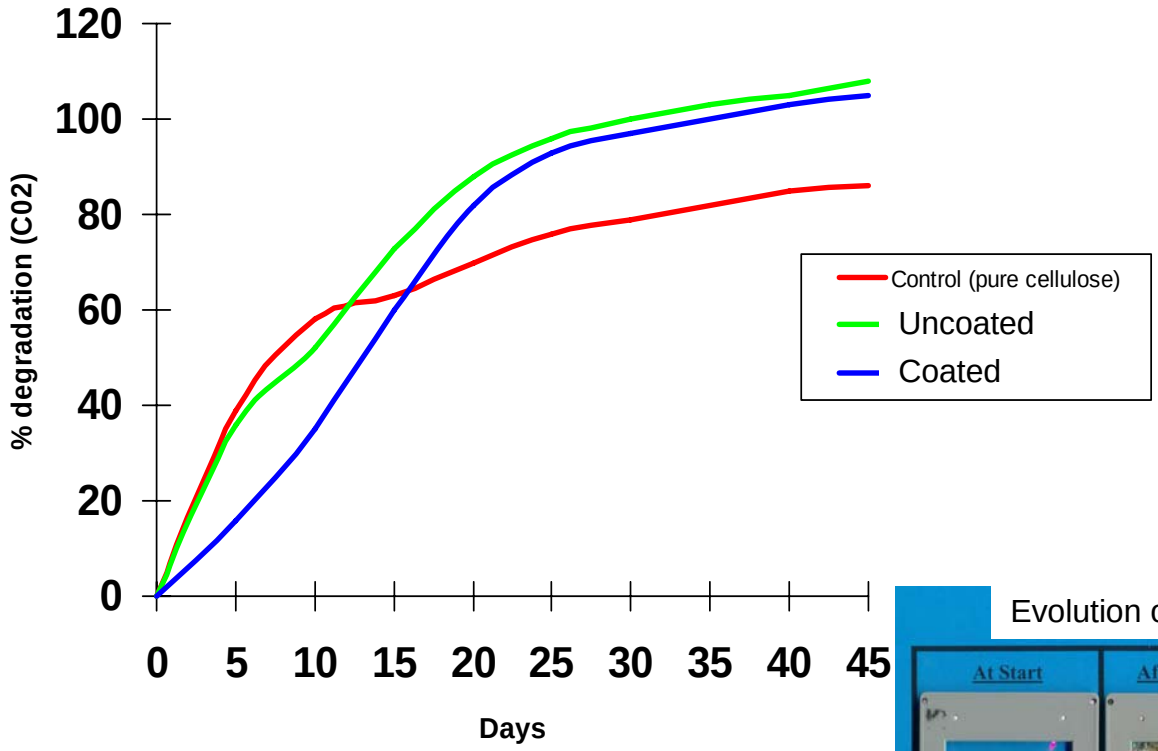
The Cellulose Film Cycle



Elements Required for Biodegradation of Cellulose Films

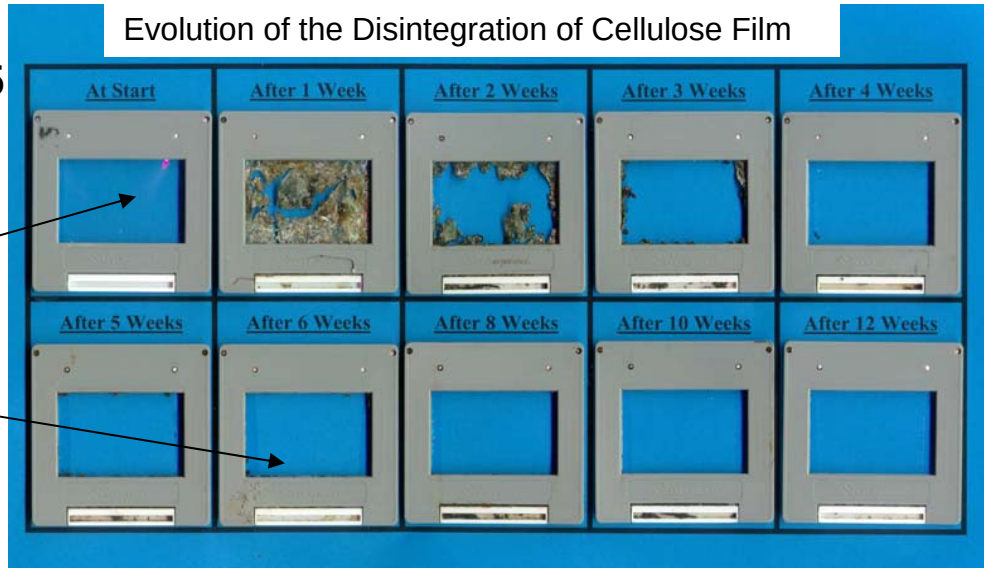
- High Enough Water Activity
- Aerobic Environment
- Nutrient
- Elevated Temperature will increase rate of degradation but not essential

Biodegradation of Cellulose Films



Full film sheet present

Total visible disintegration confirmed



Cellulose Films Used Extensively for Fresh Produce

- **Extends shelf life by controlling moisture environment (prevents mold growth)**
- **Perforation controls gas environment (controls ripening)**
- **Maintains produce aroma**
- **Reduces Waste Produce and all packaging is compostable**

Pristine Tomatoes

- Preserving the quality of the fruit from vine to consumer is essential to successful marketing.
- Consumers buy tomatoes based on:
  - Color
  - Appearance
  - Flavor
  - Aroma

The Results-Extension of Produce Shelf Life

Vine Tomatoes

Film	Weight loss	Mold	Ripening / Softening	Aroma	Skin Appearance	Color
Cellulose mid barrier	Low	OK @ 36 days	Moderate	Good	No Change	No Change
Cellulose low barrier	High	OK @ 36 days	Moderate	Good	No Change	No change
BOPP Perforated	Medium	25 days	Moderate	Lost tomato aroma	Mold	No change
BOPP Breathable	Lowest	25 days	Moderate	Lost tomato aroma	Mold	No change
PLA	Highest	OK @ 36 days	Moderate	Lost tomato aroma	Wrinkled @ 26 days	No change
Control unwrapped	Medium	OK @ 36 days	Overripe and soft @ 26 days	Lost tomato aroma	Wrinkled @ 26 days	No change

Future structures from Bio-based Films

Typical structure using Oil-based Films

Reverse Printed Polypropylene

Polyethylene

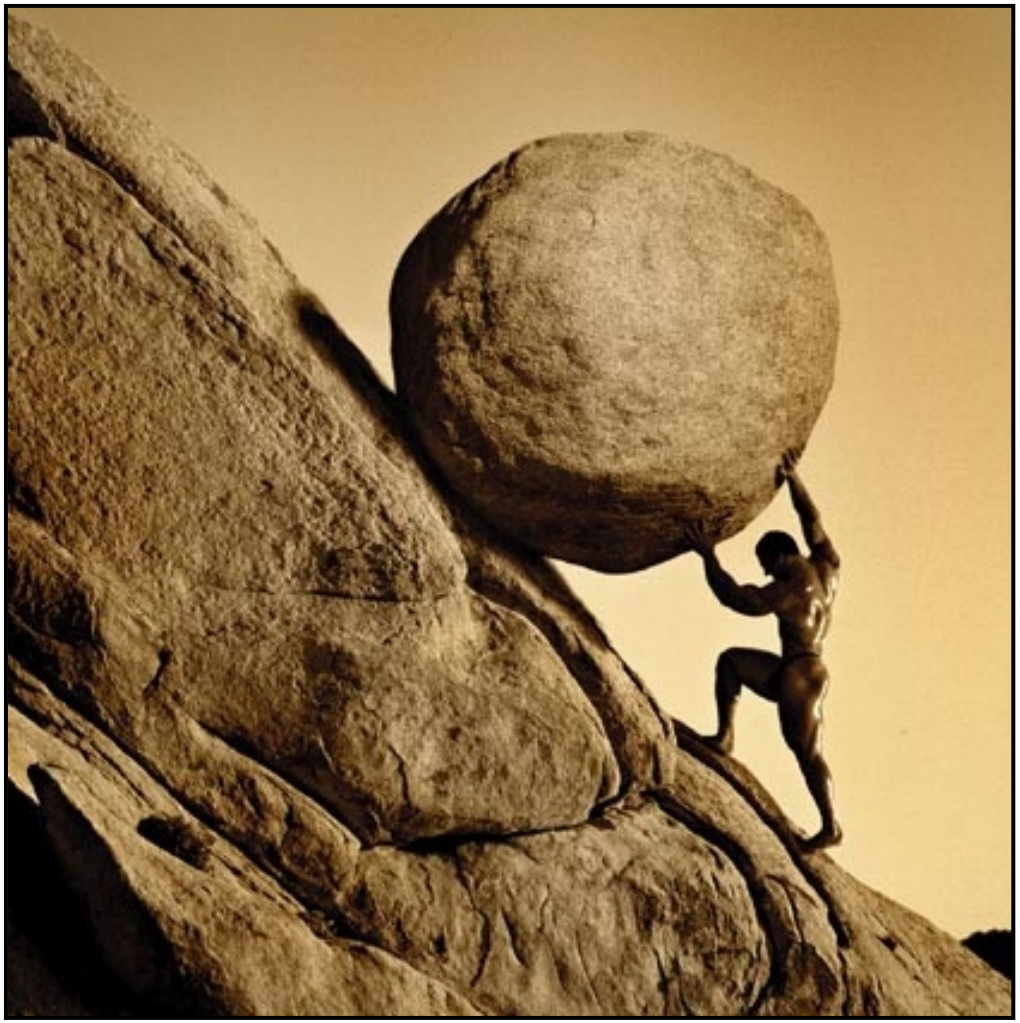
- Polypropylene Film provides durability and good surface for print graphics
- Polyethylene Film provides enhanced sealability

Future structures from Bio-based Films

Proposed structure using Bio-based Films

- Cellulose film provides durability and good surface for print graphics
- Bio-based Sealant Film provides enhanced sealability

Persistence Pays



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Thank You

PRESENTED BY

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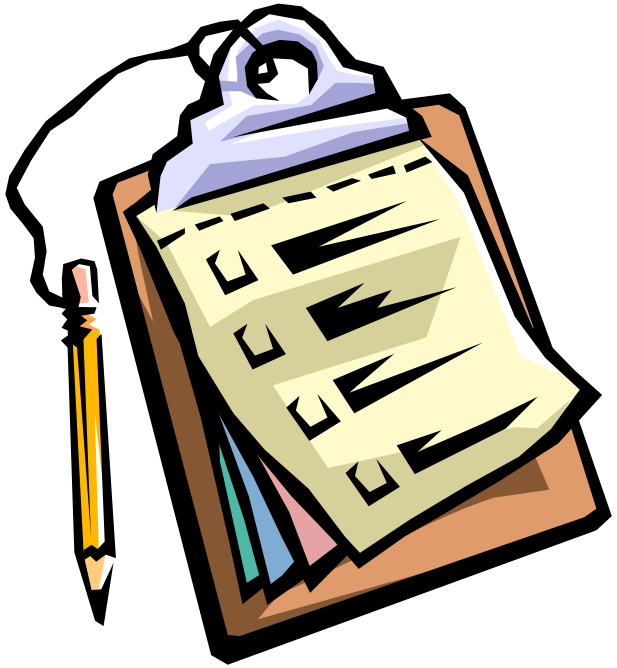

Please remember to turn in your evaluation sheet...