PCT
EBEAM AND INTEGRATION

Attainable Sustainable: Using Electron Beam Technology in Compostable Flexible Packaging

Karl Swanson and Sage Schissel

The packaging market is substantial and continues to grow.

- Global packaging market in 2018 is $975 B (Smithers Pira)
- Global flexible packaging market size of $221 B (Grand View Research)
- Flexible packaging in U.S. alone is **$31 B** (FPA)
- Growth rate for flexible packaging is **4.7%** (Grand View Research)
- **Sustainable packaging to grow 25%-30% / year** (DuPont)

Some of the current issues in packaging are consumer driven.

- Packaging is evil
  - Pollution
  - Sustainability
  - Recyclability
  - Compostability
- Product safety
- Short runs
  - More SKUs
- Fast delivery
  - The “Amazon effect”

Sustainability is a key trend for major CPGs, and ebeam can make it possible.

With ebeam, sustainability can be a fundamental aspect of flexible packaging.

REDUCE

- OPV vs. lamination
- Downgauging film
- No initiators or solvents
- Less energy consumption
- Less material waste
- Smaller footprint
- Working with digital

REUSE

- Stronger films
- More durable coatings
- Long machine lifetime

RECYCLE

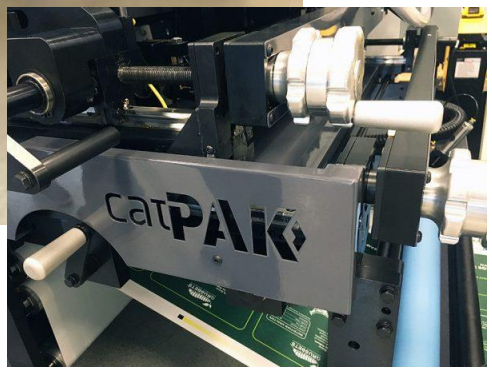
- One material packaging
- Compostable packaging
- Material degradation

EB-curable OPV
Print
4 mil Charter NEX GreenArrow™ GASF-295.31HBW

What does EB offer?
Package Protection Without Lamination

- Speed
  - Instant results – QC, slitting, pouching
  - Finished products in hours, not weeks
- Performance
  - Gloss, matte, soft touch, spot embellishment
  - Heat sealing, zippers, spouts
  - Pasteurization up to 90°C
- Safety
  - Indirect food contact compliance – FDA and EU
  - No odor

The CatPak, from S-One L&P, is an example of an ebeam finishing line.



Goal: To demonstrate that ebeam is a versatile tool for sustainability while furthering compostable food packaging technology.

Ebeam-cured Overprint Varnish (OPV)

Known: alternative to lamination

Benefits: less material than laminate, instant, *etc.*

Unproven: OPV does not inhibit or significantly impede composting

Ebeam Post-treatment

Known: ebeam degrades cellulose

Benefits: more volume with current infrastructure, more potential profit,

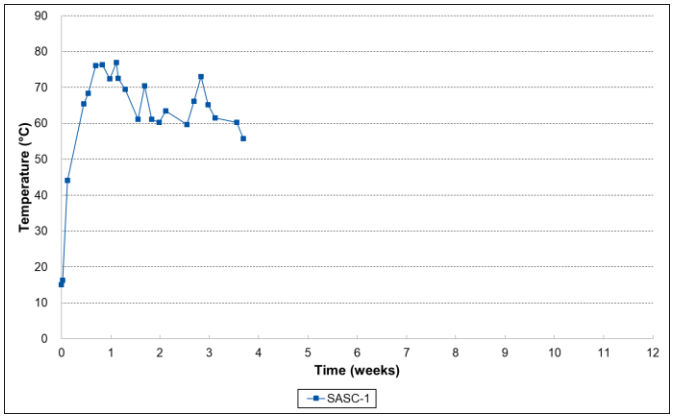
Unproven: high doses of ebeam accelerates the rate of composting

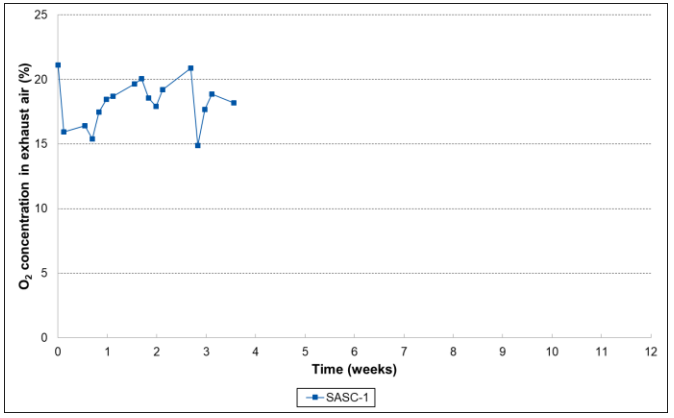
The materials chosen for this study represent a compostable food package.

- Futamura NatureFlex™ NK 120 gauge film
  - Cellulose film coated with PVdC
  - Suitable as laminate or mono-layer
  - Certified industrial and home compostable
- HP Indigo ElectroInk
  - Digital ink set
  - Indirect food contact safe
  - Certified industrial and home compostable
- DBT Coatings Gloss (EHG-2601) and matte (EMQ-3710) OPV
  - Protect and highlight digital ink
  - Indirect food contact safe
  - Solvent and PI free

Samples were composted by OWS following the test method ISO 16929:2013.

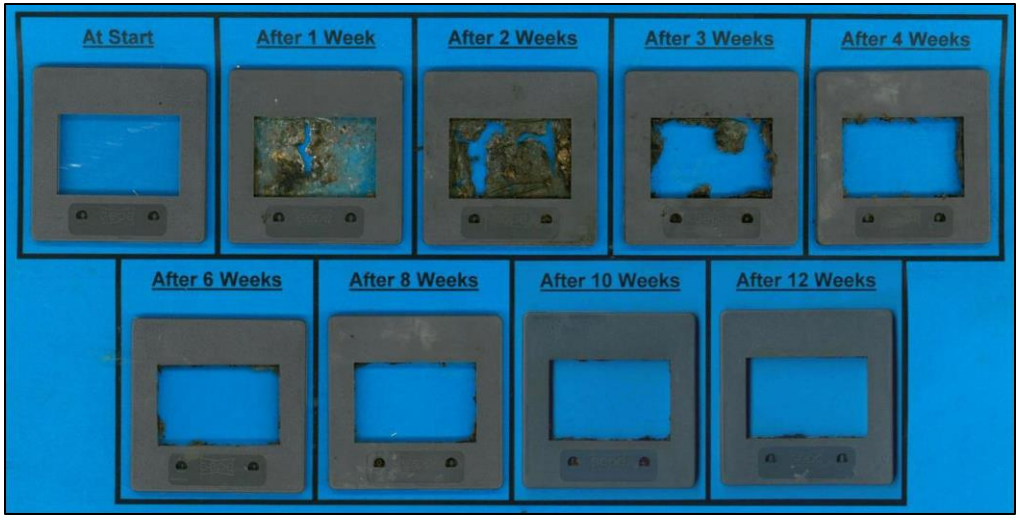
- Organic biowaste (vegetable, garden, and fruit waste)
- 200-L composting bin turned by hand every 1-2 weeks for 12 weeks
- Temperature 60-75°C for 1st week, and <65°C thereafter
- Aerobic test; O_2 in exhaust >10%
- Qualitative test / visual evaluation of disintegration



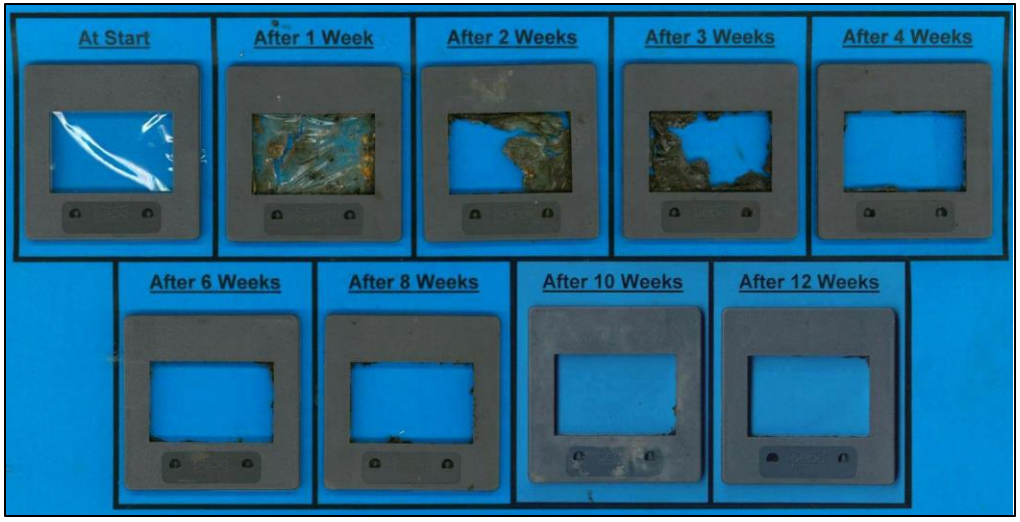


A curing dose (30 kGy) of ebeam doesn't impact the compost rate compared to the plain film.

Control (Plain Film)

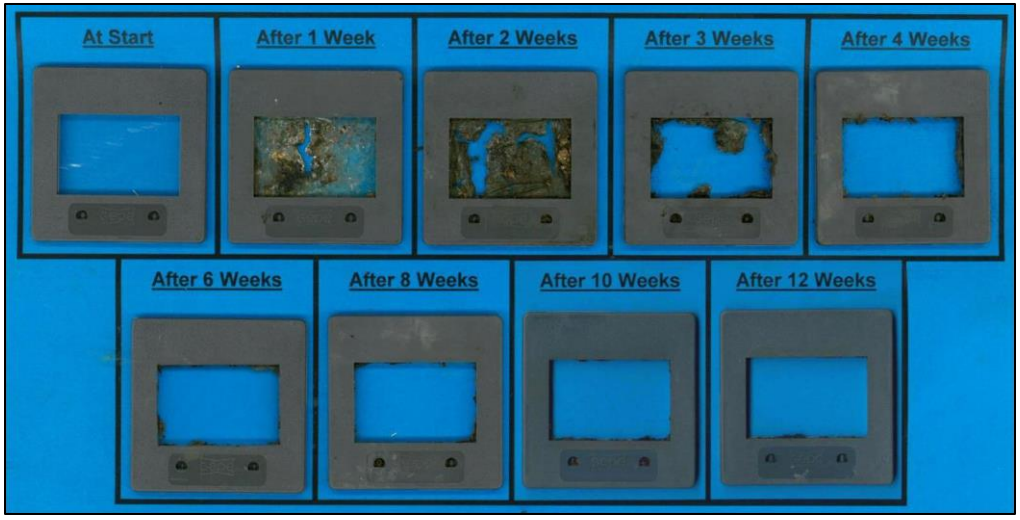


EB Control (Plain Film, 30 kGy)

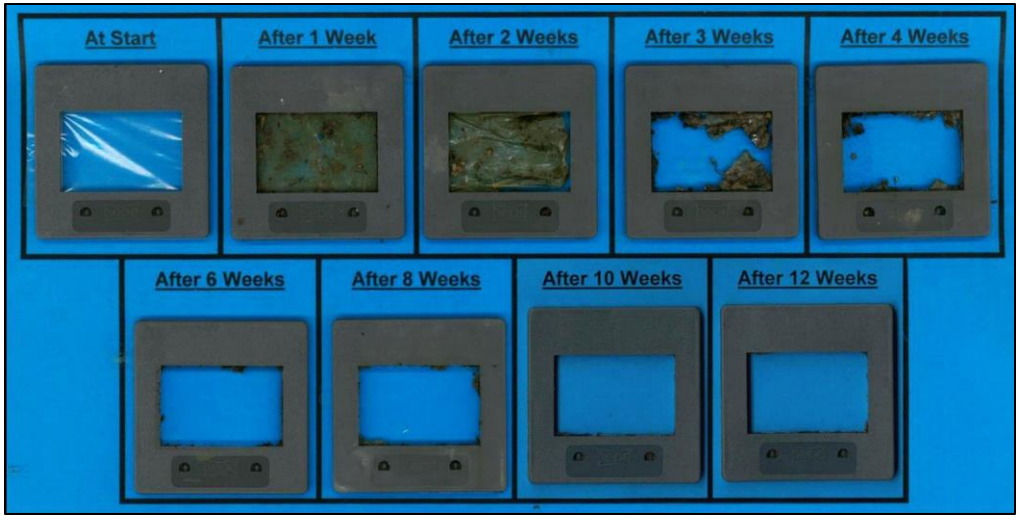


A matte, eb-cured OPV doesn't significantly impact the compost rate compared to the plain film.

Control (Plain Film)

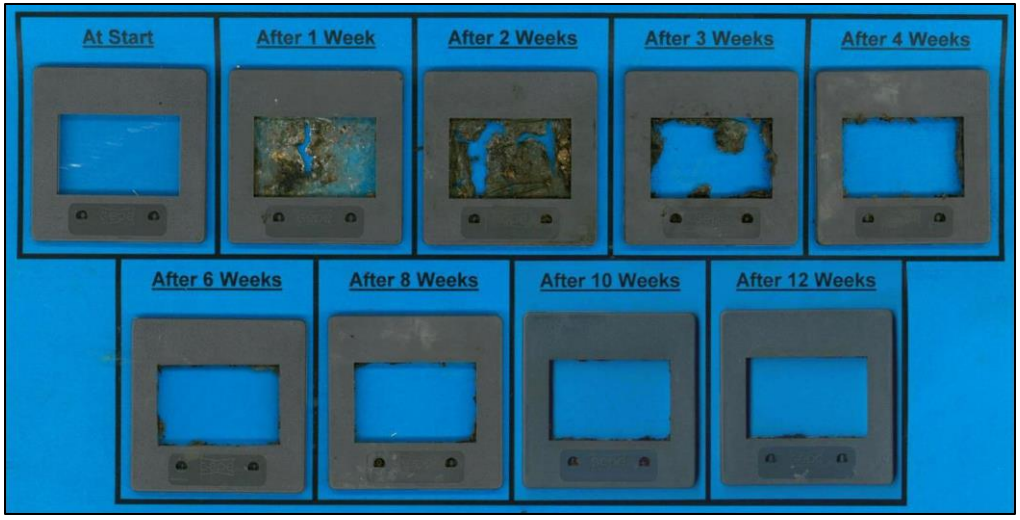


EB-cured Matte OPV at 2.2 g/m^2

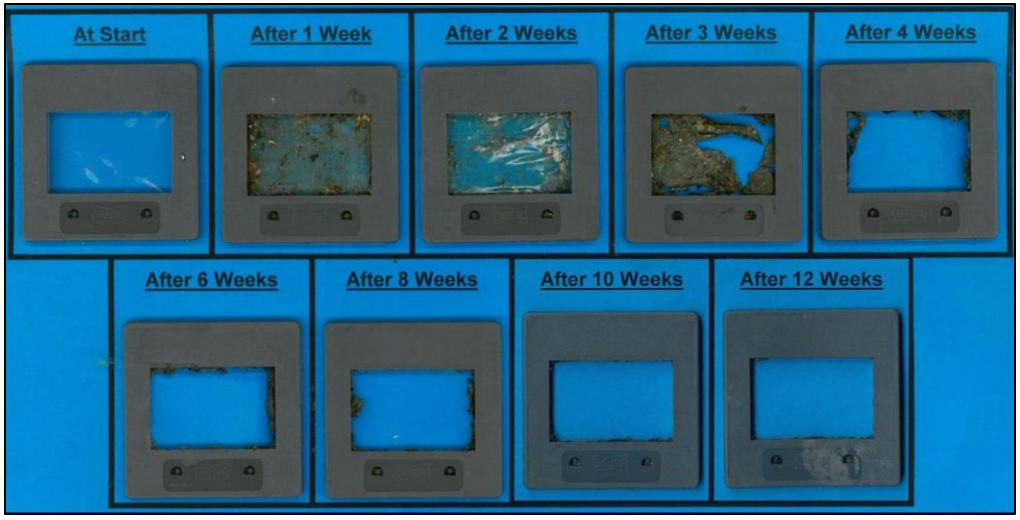


A gloss, eb-cured OPV doesn't significantly impact the compost rate compared to the plain film.

Control (Plain Film)



EB-cured Gloss OPV at 3.7 g/m^2



High doses of ebeam visually changes the NK120 compostable material.

0 kGy

50 kGy

100 kGy

150 kGy

200 kGy

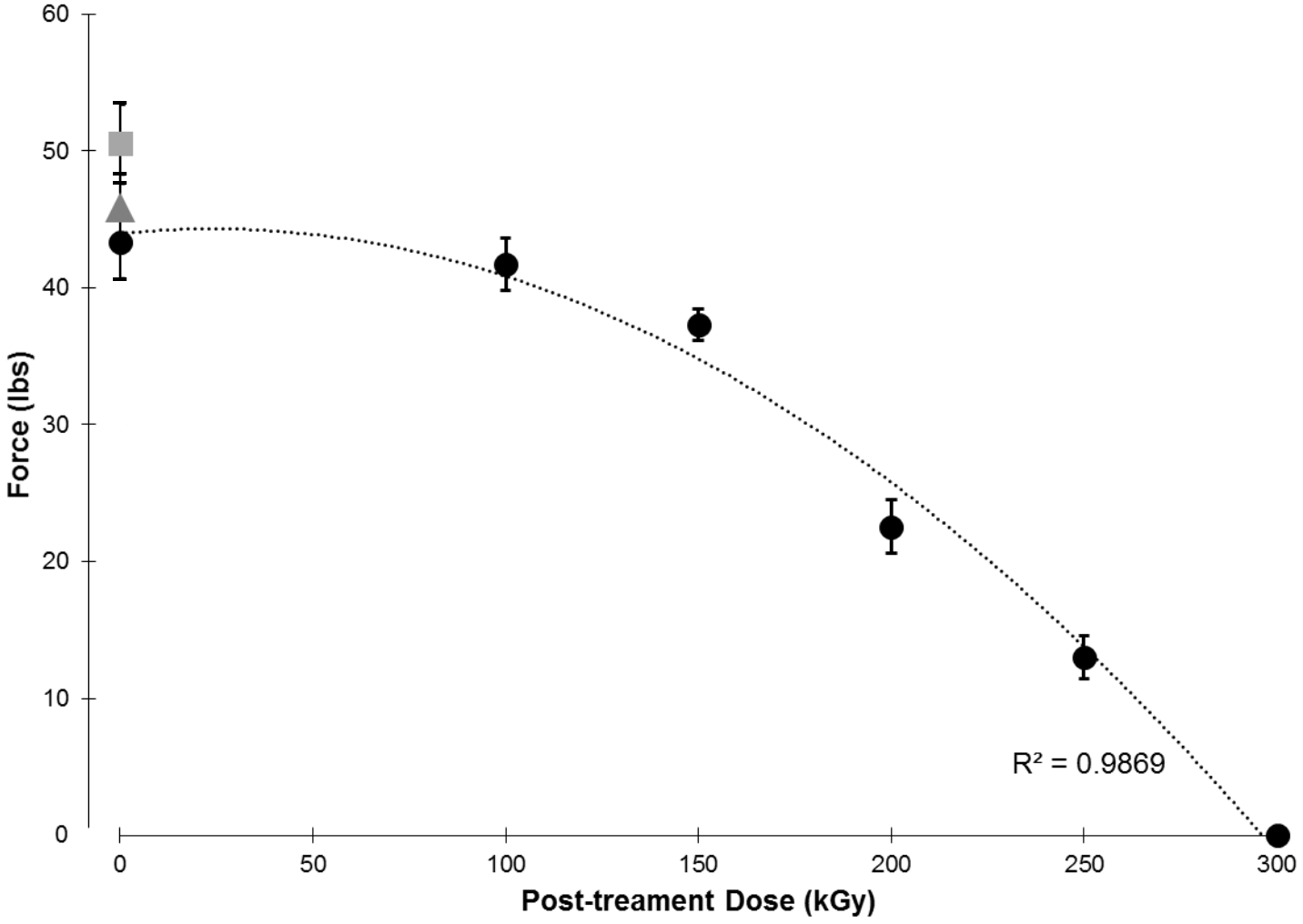
250 kGy

300 kGy

350 kGy

400 kGy

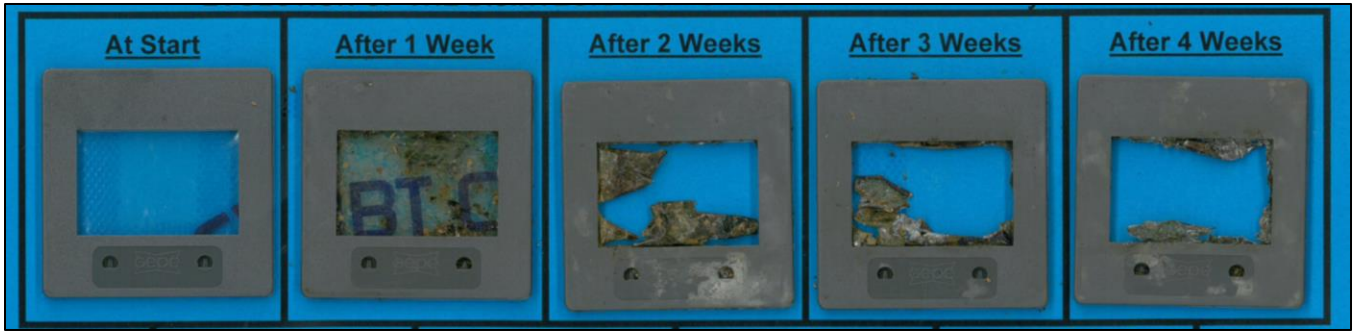
As the ebeam post-treatment dose increases, puncture resistance decreases.



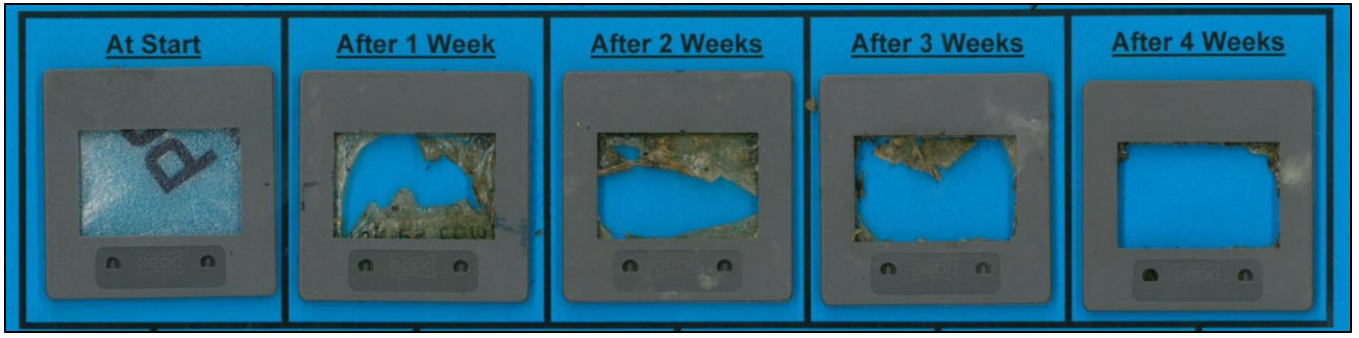
Post-treating the packaging material with high doses of ebeam accelerates disintegration.

Control

Post-treatment: 150 kGy



Post-treatment: 300 kGy



Conclusions and Future Work

- Proved using a qualitative compost testing method
  - EB-cured OPV's do not inhibit or significantly impede compostability
  - Post-treating compostable packaging after use with high doses of ebeam can be used to accelerate disintegration
- Next steps include
  - Quantitative testing with a wider variety of materials
  - Engaging with the compostable industry to implement the technology

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Questions?

Karl Swanson
President

karl.swanson@pctebi.com
M: 563-343-9056

Sage Schissel
Applications Specialist

sage.schissel@pctebi.com
M: 563-549-3442

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