



Lifetime considerations of geotextile UV exposure before installation

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Context

Materials for construction projects are subjected to several steps, into which they risk losing critical properties to their functions and usage



What is an acceptable temporary exposure?

Pierce Creek case study: Site description



Chesapeake & Delaware (C&D) Canal

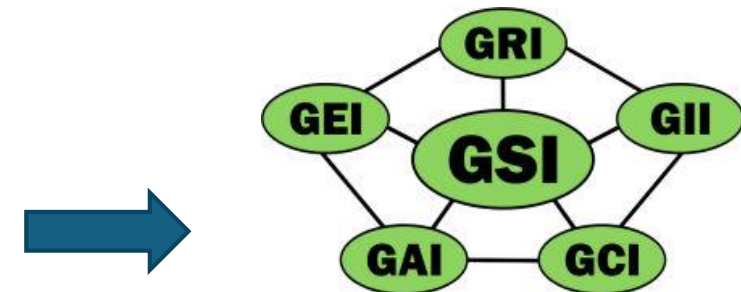


Pearce Creek Disposal

- 252 days of exposure
- In 2017, from January to August
- Seasonal variability
- Typical temperature from 26°F to 86°F
- 39.4848° N, 75.9848° W



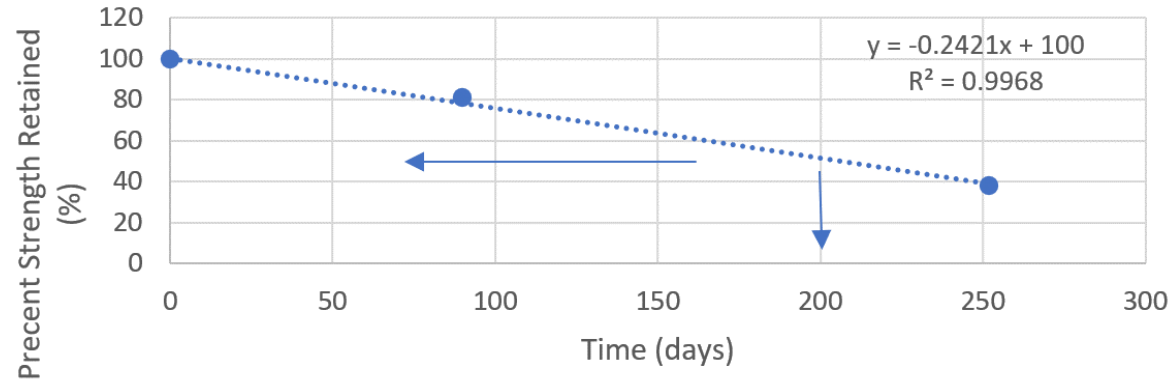
On-site sampling



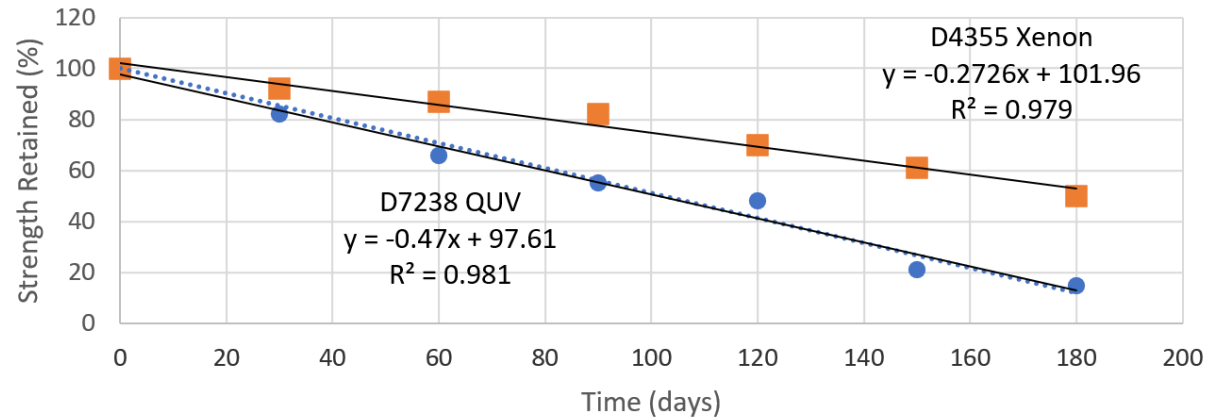
Testing, resistance & UV durability

Pierce Creek case study: Results and correlations

Field Results

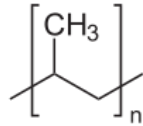


Laboratory Results

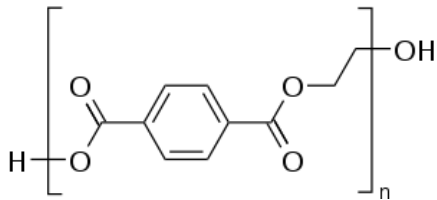


Deeper into considerations Materials

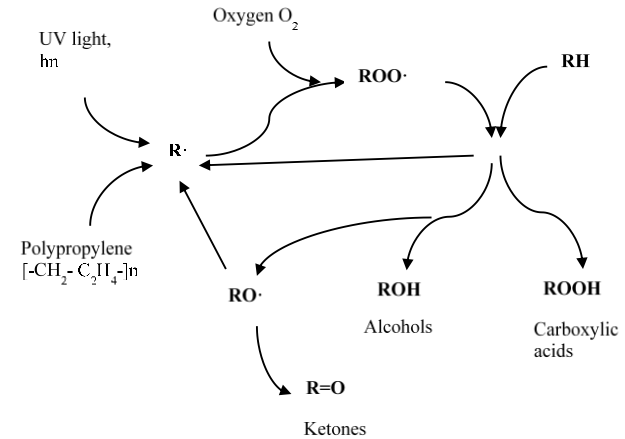
Polymer type
polypropylene (PP)



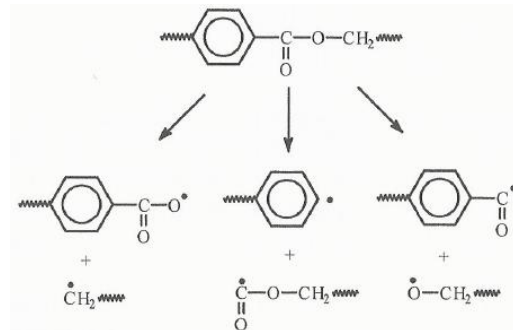
polyethylene terephthalate (PET)



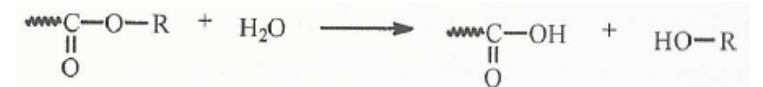
Degradation
... by photooxidation



... by hydrolysis

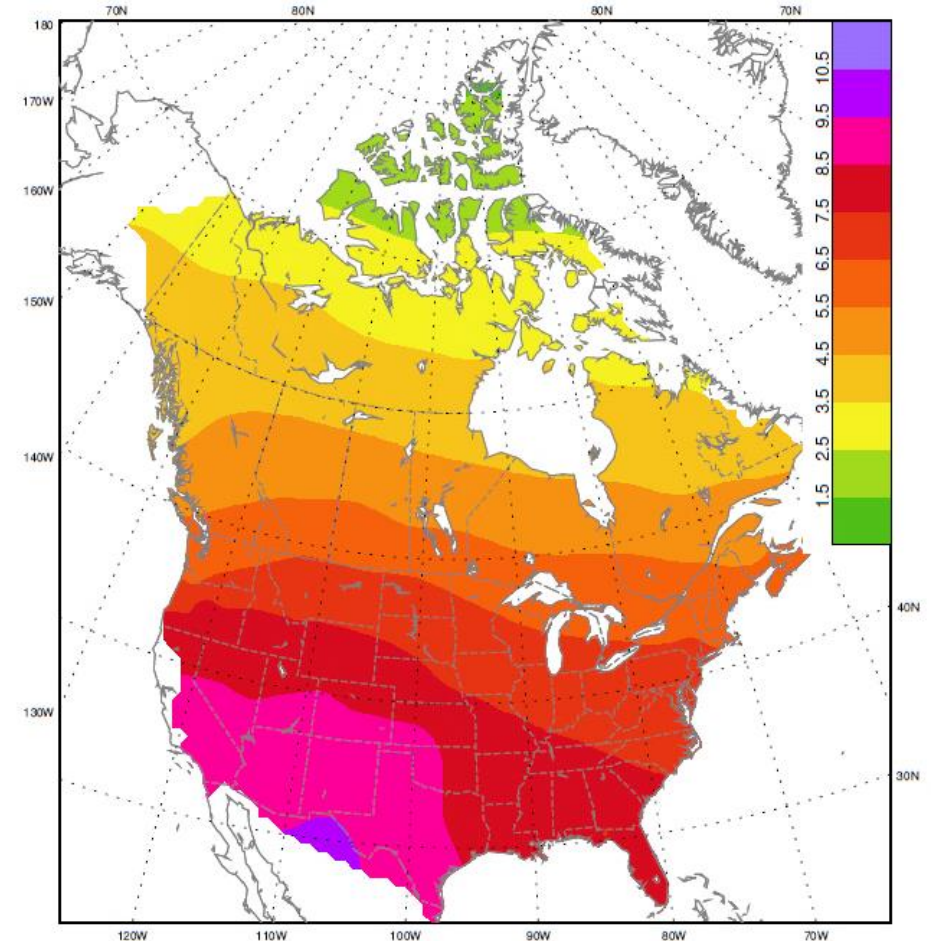


... by photooxidation



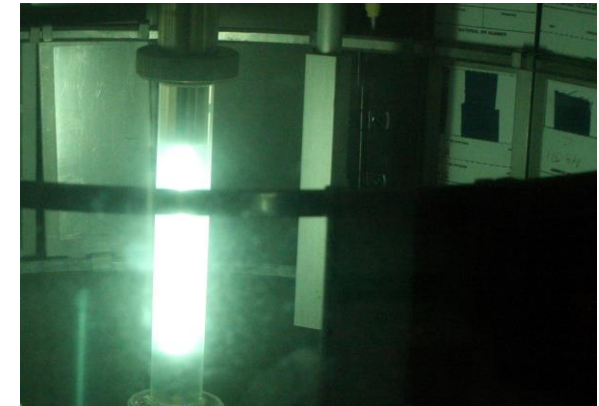
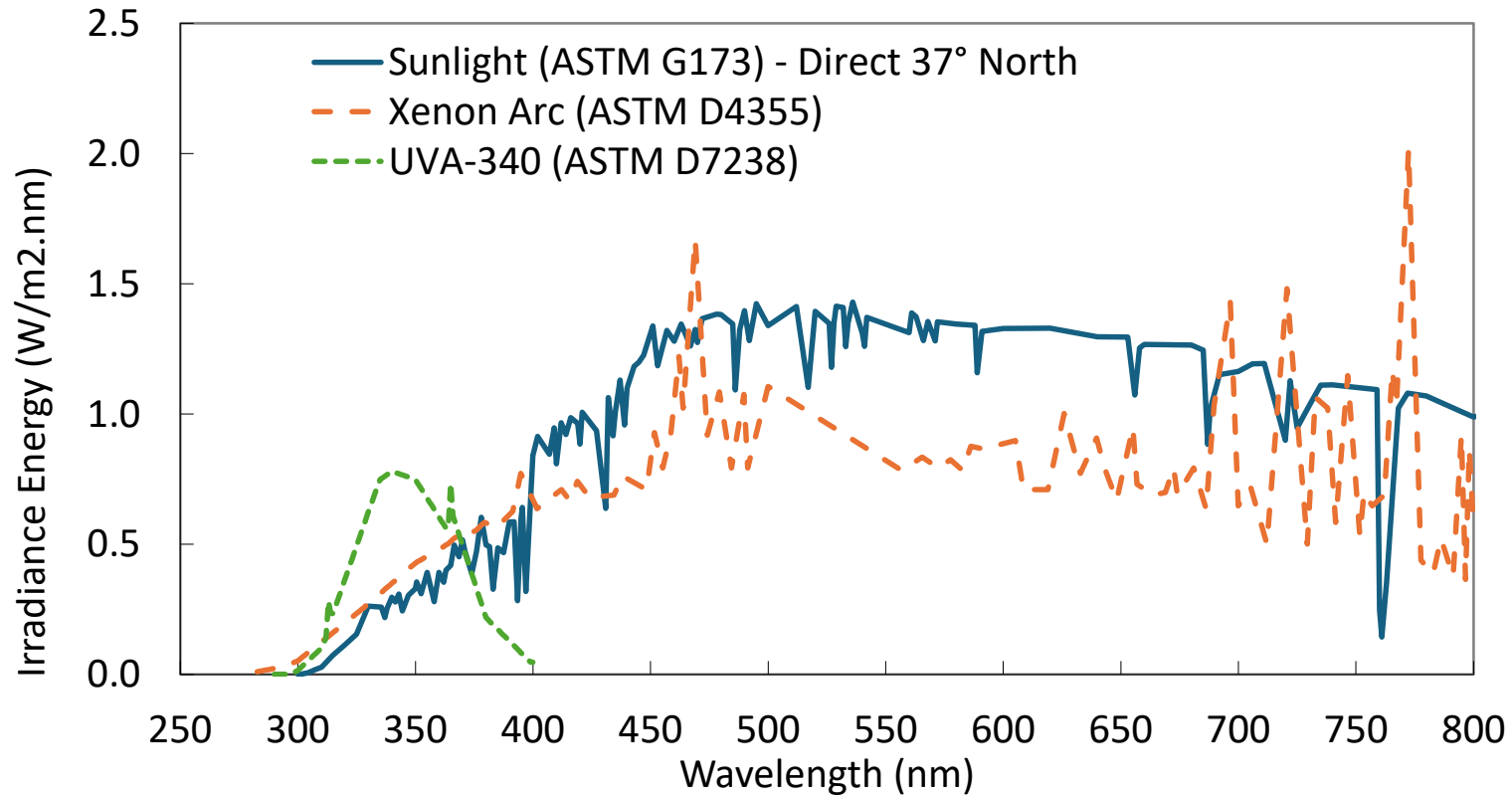
Deeper into considerations Outdoors

- **Climate:** solar light intensity, with latitude, altitude, rainfall, often specific to location
- **Rain and humidity:** humid climates favor polymer degradation from leaching or hydrolysis
- **Slope and orientation** to sunlight intensifies the radiant energy from field conditions.

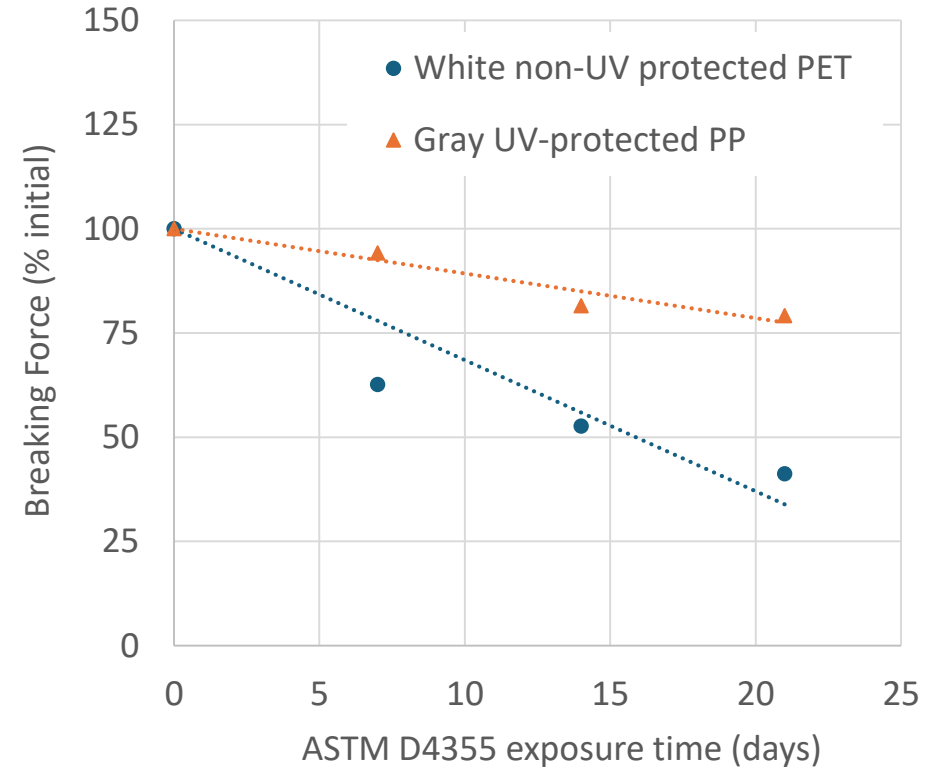
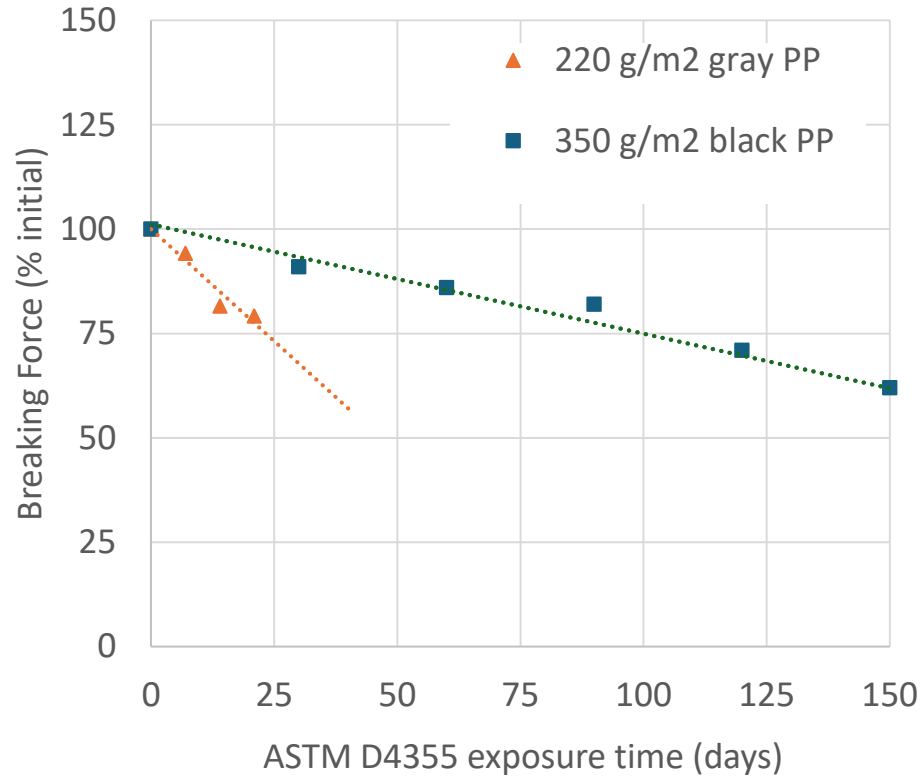


Accelerated UV Laboratory Testing

- Accelerated UV tests are quick, used as index
- What does it mimic? Florida, Arizona, others?
- For geotextiles UV Xenon was first used under ASTM D4355, 2nd oldest standard developed under ASTM D35



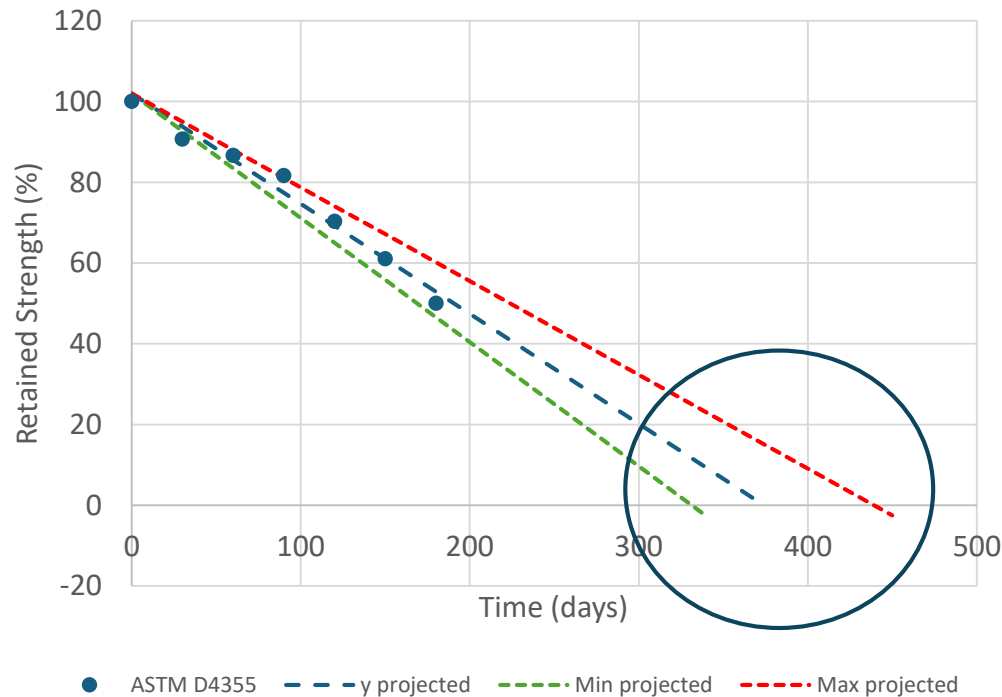
Material Comparison



Despite its polymer sensitivity to UV light, a well UV-protected PP will better resist than non UV-stabilized PET

Sustainability: The role of material durability

- The engineering project uses durability as the amortization of the GHG contribution at the construction stage, basically divided into « cradle to gate », « gate to construction » and « construction to end of life ».
- Durability is acting on the « construction to end of life » considerations. Models are often based on few properties measured, and it includes statistical uncertainty and project risks.



- Uncertainty from data analysis
- Uncertainty from correlation with site conditions
- Risk on project timeline

Conclusion

- Accelerated UV remains an efficient fast answer to the evaluation of exposed materials, herein geotextiles
- No easy prediction should be considered. Knowing your material is complex, predicting their behaviour with site-specific conditions is more complex.
- Risk of accidental change to the initial project plan should be considered for sustainability, with « possible futures and alternatives » scenarios thinking.

Thank you

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