PET Plastic Durability in Long-Term Sun Exposure

1. Effect of temperature on the release of intentionally and non-intentionally added substances from polyethylene terephthalate (PET) bottles into water: Chemical analysis and potential toxicity
   a. Bach, Dauchy, Severin, Munoz, Etienne, & Chagnon Study
   - Temperature & pressure of CO2 increased release of formaldehyde and acetaldehyde
     - Detected in all PET-bottled water
     - Note: Storage temp of water bottles was near PET glass transition temp
   - Pressure exerted on the bottle wall by carbon dioxide could activate aldehyde migration
   - Neither UV stabilizers nor phthalates were detected in bottled water before or after experiments
   - PET-bottled water after 10 days at 60[°C] did not induce any toxic activity

2. Does sunlight change the material and content of polyethylene terephthalate (PET) bottles?
   a. Wegelin, Canonica, Alder, Marazuela, Suter, Bucheli, Haefliger, Zenobi, McGuigan, Kelly, Ibrahim, & Larroque Study
   - Photoproducts are generated at outer surface of bottle
   - No UV-absorbing compounds that might possibly be released in concentration lower than the detection limit into the water could be detected
   - Did not reveal any organic substances leaching from PET material
   - Photoproducts increase with progressing sunlight exposure time the absorbance of the solar UV-spectrum
   - Photochemical ageing of the bottle does not change the quality of the water stored in the bottle with regard to aldehyde, organic photoproduct, additive, or phthalate concentrations
   - Sunlight irradiation might accelerate the migration of PET-components or the generation of products through thermos-activated chemical reactions

3. Comparative assessment of genotoxicity of mineral water packed in polyethylene terephthalate (PET) and glass bottles
   a. Ceretti, Zani, Zerbini, Guzzella, Scaglia, Berna, Donato, Monarca, & Feretti Study
   - Plastic bottles may contaminate water with material’s components by migration
   - PET degradation & water contamination is highly dependent on storage condition
   - Material of bottle does not appear to affect genotoxic properties of water contained in it, even after bottled water exposure to 40[°C] for 10 days
Conclusions:

- All studies based on PET plastic bottles that contain water
- Water quality barely changes during short exposure times
- High temp & CO2 presence increased release of formaldehyde & acetaldehyde
- UV stabilizers & phthalates found not to be an issue
- Need study of water quality change for water briefly in contact with PET that has been exposed to sun for long time
- Recommend not to consume stored water from gutter until more information/data is collected