

UV EXPOSURE HAS NO PRACTICAL EFFECTS ON PVC PIPE PERFORMANCE

Ultraviolet (UV) radiation from sunlight can affect the outermost surface of PVC pipe. However, even after prolonged exposure, there is no practical effect on PVC pipe's performance characteristics. UV exposure affects PVC pipe material in two ways:

- *Fading of pigment*, which is characterized by whitening of the pipe's color. Since the pipe is intended to be buried, pigments are not colorfast and will fade when exposed to sunlight.
- *Conversion of PVC molecules to polyene*, which is a yellowish discoloration limited to the first .001" to .002" of exposed surface. Often called "UV degradation" or "sunburn," this process takes much longer than the color-fading phase.

UV inhibitors like titanium dioxide are added to the pipe material to counter sunlight effects. When sunlight exposure ceases, UV radiation has no further effect on the pipe.



Figure 1: Surface discoloration of PVC pressure pipe stored outdoors, unprotected for 15 years. The discolored pipe passed all test requirements for new pipe.

RESULTS FOR PVC PIPE PROPERTIES

A two-year study on the effects of long-term sunlight exposure on PVC sewer pipe (See Uni-Bell UNI-TR-5: "The Effects of Ultraviolet Aging on PVC Pipe" at www.uni-bell.org.) has shown that there are no practical effects on PVC pipe's physical properties:

| Physical Property | Performance Characteristics | Effects of Sunlight Exposure | ASTM Test Method |
|-----------------------|-----------------------------|------------------------------|------------------|
| Tensile Strength | Pressure Capacity | No Effect | ASTM D638 |
| Modulus of Elasticity | Pipe Stiffness | No Effect | ASTM D790 |
| Impact Strength | Impact Resistance | Decrease | ASTM D2444 |

UV-EXPOSED PVC PIPE RETAINS ITS FLEXIBILITY

The sole performance characteristic adversely affected by sunlight exposure is impact strength, which decreased from its original levels. However, after two years of exposure, average impact strength still exceeded the value required for new pipe. A pipe flattening test (per ASTM D2412) was also performed on UV-exposed PVC pipe. Samples flattened to 40% of original inside diameter showed no signs of cracking, indicating that the pipe had retained its flexibility.

NO TAPPING RESTRICTIONS, INSTALLATION UNAFFECTED

There are no restrictions on cutting or tapping of UV-discolored PVC pipe. As well, UV-exposed PVC pipe can still be installed with less care than is necessary for more vulnerable clay, concrete, or mortar-lined/epoxy-coated ductile iron alternatives. In general, the effect on the impact strength of thick-walled pressure pipes such as those made to AWWA C900 and C905 is unnoticeable.

PREVENTING UV EXPOSURE

UV exposure can be avoided by shading the pipe from the direct rays of the sun by covering it with an opaque, light-covered material. The covering should be positioned to allow adequate ventilation to prevent heat build-up.