Research by both chemical suppliers and vinyl manufacturers have confirmed that wrinkles in swimming pool liners develop because of the growth of the liner’s dimensions due to an excess of absorbed water. Technical articles published in the past have stressed the adverse affect of low pH as the main cause of liner growth. However, recent experiments have shown that high levels of sanitizers, whether bromine or chlorine, are the primary cause behind excessive water absorption. If the sanitizer level is allowed to remain high, double, triple, or even four/five times the normal amount of water can be absorbed. Therefore, controlling sanitizer levels is the number one priority when maintaining proper water chemistry, which is essential, if wrinkling problems are to be avoided.

pH and cyanuric acid stabilizer levels are important secondary factors because they control the activity of the sanitizer. However, once wrinkles have developed, correction of pH or stabilizer content will not reverse the amount of water absorbed into the liner. In some cases, draining the pool and allowing the water to slowly desorb and evaporate has reduced or eliminated wrinkles. This procedure is not without risk because some liners, depending on age, may over shrink and not stretch back into place without failing. It has also been shown that once the surface of the liner has been affected by the sanitizer, water can rapidly reabsorb and the wrinkles may quickly reappear.

Pool water clarity is often reduced by undisolved particulate matter introduced by bather load. Often these particles can be flocculated by the use of a clarifier and removed by filtration. The filtration system must be operated at it’s optimum level, since sanitizer alone cannot eliminate excessive particulate matter present in the pool, and the overuse of chlorine or bromine to improve clarity will increase the probability of wrinkle development.

**EXPERIMENT RESULTS**

1. Samples taken from heavily wrinkled liners, preserved in pool water, surface dried, weighed, then desiccated to constant weight, indicate that absorbed water can reach as high as 10% of liner weight.

2. Immersion testing of precisely weighed liner samples in pure distilled water and sanitizer free tap water showed that weight gain due to absorbed water levelled off at 0.6%. No dimensional changes occurred.

3. Immersion testing of precisely weighed liner samples in chlorinated and brominated water in the 20 to 50 ppm range showed weight gains that continued to climb indefinitely and did not level off. Dimensional increases of 1.0 - 3.0% were also measured on these samples.

4. Immersion testing in water containing mono potassium persulphate type non-chlorine shock showed weight gains levelling off at about 0.6%, essentially identical to unsanitized tap water.

5. Samples from heavily bleached, used pool liners showed high weight gains in immersion tests in comparison to unbleached samples, taken from the same liner from above the waterline. Bleached test samples curled into tight coils with the bleached surface facing to the outside, as a result of greater water absorption occurring on the faded side than on the unfaded side.
1. Do not allow free chlorine levels to exceed a maximum of 3 ppm, bromine levels a maximum of 4 ppm for long periods. Peak chlorine levels of 5 -10 ppm are required for superchlorination, but should be allowed return to the 2 -3 ppm range by natural dissipation. If bleaching of the blue liner colour is occurring, it is a direct indication that the chlorine levels have been too high.

2. Routinely stabilize outdoor and indoor chlorinated swimming pools with cyanuric acid stabilizer and maintain a minimum level of 50 ppm. It is recommended that levels be checked every 3 or 4 weeks.

3. Maintain pH levels in the 7.2 - 7.8 range.

4. Test result accuracy can be adversely affected by poor quality test kits and reagents. Keep reagents current by replacing them every 6 months and use a professional quality test kit recommended by your pool dealer.

5. Use non-chlorine shock to reduce organic contaminants, rather than high levels of chlorine or bromine during the pool season, as well as preparing the pool for winter.

6. Use flocculants and a filtration system in proper operational condition to remove undissolved particulate matter instead of high levels of chlorine/bromine oxidizer, to attain sparkling clear pool water.

7. It is important to maintain thorough circulation of the pool water in order to prevent settling and concentration build-up of chemicals on the pool bottom. Even liquid chlorine can settle to the bottom if sufficient inter-mixing is not achieved.

8. Frequent reports have been received concerning wrinkle development on walls of pools employing automatic pool covers. The phenomenon is most likely a result of chlorine concentration build up due to the air tight nature of the cover design and/or temperature differentials between water side and ground side of liner causing accumulation of moisture from condensation that forms ripples.

Note: Vinyl Spa Liners
The material formulations for vinyl spa and pool liners are very similar; therefore, the above information relating to the sanitizer induced water absorption that results in wrinkling is also valid and applicable to spa liners, keeping in mind some differences in chemical treatment practices.