

The Relationship of Scattered Subharmonic, 3.3-MHz Fundamental and Second Harmonic Signals to Damage of Monolayer Cells by Ultrasonically Activated Alburnex®

Douglas L. Miller and Shipping Bao+*

**MS# P7-53, Battelle Pacific Northwest National Laboratory, PO Box 999, Richland, Washington 99352; +U.S. Transuranium and Uranium Registries, Washington State University, Richland, Washington 99352*

Cultured Chinese hamster ovary cells attached to thin Mylar sheets were exposed to 3.3 MHz ultrasound in the presence of Alburnex® ultrasound contrast agent. The ultrasound beam was directed upward at the exposure chamber with the monolayer on the inside of the upper acoustic window. Cell membrane damage was detected by the firefly enzyme assay for released ATP and the subharmonic, fundamental and second harmonic scattered signals were recorded. ATP release increased monotonically with increasing pressure amplitude above apparent thresholds of 0.28 MPa for 1 s continuous and 0.56 Mp for 100 s pulsed (10 Us pulses, 1 ms PRP) exposures with 5 % Alburnex®. The subharmonic signal and, to a lesser extent, the second harmonic signal both increases with the cell membrane damage, which suggests that these signals have predictive value for bioeffects. If the monolayer was positioned on front window of the exposure chamber, cell membrane damage was greatly reduced, which confirms the protective influence of this configuration of monolayers reported in the literature. The effect decreased both a t high (50 %) or low (0.5 %) concentrations of Alburnex®. The strong nonlinear scattering of ultrasound by contrast agent gas bodies appears to provide useful indicators of gas body activity including cavitation bioeffects.

PACS numbers: 48.80Gx, 43.35Ei, 43.35Wa

USTUR-0080-97