The primary aging mechanism of nitrate ester propellants includes several steps that begin with the thermal decomposition of the nitrate ester and lead to, if unmitigated, the evolution of several gas species to include CO2 and NO2. These gases may lead to internal fissuring of the propellant or autocatalytic decomposition and combustion. Stabilizers are added to the propellants to neutralize the decomposition products and minimize the gas production. These stabilizers are consumed with aging with the service life of a particular propellant system determined as the time that the stabilizer mass fraction is consumed below a minimum acceptable level. The U.S. Army WDI directorate has an on-going technology program for the development of a service life monitoring system that incorporates non-destructive sensors for the monitoring of nitrate ester aging. This presentation presents an update of sensor/propellant aging test results, and the results of a series of nitrate ester humidity aging results that have been completed to date. The effects of aging under controlled humidity on the thermal decomposition of two nitrate ester/RDX propellants are examined. Propellant samples are accelerated aged at 60 °C and 70 °C at various levels of relative humidity. Differential Scanning Calorimetry is used to study the post aged samples to determine the activation energy of the peak exotherm and peak temperature of these events. Nitrate ester stabilizer depletion rates are presented as a function of aging and humidity. The results of the study show that the moisture level during aging irreversibly alters the activation energy of the primary heat release events and significantly influences the stabilizer depletion rates. In addition, humidity effects on the deterioration of the mechanical properties of the nitrate ester are investigated. The acidic by-products of the thermal decomposition of the nitrate ester plasticizers and hydrolyzed binder combine with the available excess moisture leading to the acidic catalyzed hydrolytic decomposition of the binder polymer reducing the cross-link density, elastic modulus and the strain endurance of the composite material. Dynamic Mechanical Analysis and polymer solvent swell testing are used to investigate the effect that the temperature and humidity induce aging has on the rheology of the polymer composite to include changes in cross link density, loss and storage modulus, and the glass transition temperature. A correlation of the change in these properties with the magnitude of the relative humidity of the aging environment is demonstrated. On-going propellant aging test results using carbon nano-tube gas sensors as a health monitoring device are presented.