**Specific Aims (Superfund – Overall)**

The rise in widespread human exposure to asbestos through anthropogenic disturbance of soils and rock [2] demands that focused efforts are applied to understanding and predicting the impact of this major Superfund health hazard in terms of both geology and public health. The problem is illustrated by a number of asbestos Superfund sites, sites with natural or secondary contamination by asbestos (Table 1), and newly discovered asbestos sites not previously predicted to contain asbestos [1, 3]. To address critical gaps in knowledge identified by communities near the latter, the proposed Center for Asbestos Research in the Environment (CARE) will put one of these sites, Boulder City/Henderson, Nevada, in context with known asbestos Superfund sites, especially the Libby Asbestos Superfund site in Montana.

The Environmental Protection Agency (EPA) conducted a risk assessment for Libby Amphibole Asbestos (LA) based on studies showing significant health effects at very low exposures [4] and developed a new toxicity value (Reference concentration, RfC) specifically for LA [5]. The dramatic outcome of this fiber-specific health assessment emphasizes the need to evaluate site-specific health impacts of mineral fibers. Very similar amphibole asbestos (AA) has recently been discovered in the arid lands of the Las Vegas, NV, metropolitan area, leading to potentially hazardous levels of human exposure from land development and its presence in residential areas, school grounds, roads, parking lots, and recreational areas [1, 3]. The Libby Epidemiology Research Program (LERP, ATSDR) has shown that 50% or more of people exposed to LA (even low levels) suffer from pleural scarring, and that this scarring can impact pulmonary function, leading to significant disability and death [6]. The concern for southern Nevada is that over 2.02 million people live within the area of potential exposure, and the extreme aridity of the region significantly increases the possibility for asbestos fibers to become airborne from anthropogenic and natural processes. If the outcomes of Nevada AA exposures approach the severity and frequency of those from LA exposure, the public health impacts will be tremendous. Our proposed Center draws strength from long-term collaborations among the investigators, especially through the LERP (Pfau, Noonan, Linker, Hernandez), the BLM-funded Human Health Risk Assessment of Nellis Dunes Recreational Area (Buck, Keil, Eggers, McLaurin), and with the Center for Asbestos Related Diseases (CARD) in Libby (Hernandez, Winters, Kuntz, Ward). This team comes together with a common goal, extensive experience and expertise, and a rich background of information regarding the health and community impacts of asbestos. We are only beginning to understand the extent of AA deposits, and rapidly growing communities in the Las Vegas metropolitan area are already struggling with uncertainties that are so reminiscent of the Libby experience. We could think of no better way to help these communities and local and federal agencies that face these difficult public health issues, than to create this Center and to use our combined experience as a template for a rapid and efficient response to AA exposures. Our overall hypothesis is that social, economic, recreational, and health impacts of the emerging public health quandary related to AA dust will be minimized through a community engaged with researchers to uncover scientifically-based solutions. **We identify four SRP Mandate-related (see bolded) problems that define our Aims:**

**Problem/Aim 1**: To address unknowns of the extent of AA: **Develop novel techniques for prediction** of AA in soils (P1) and bedrock (P3); **gather exposure data** from various activities (P2), and initiate creation of **new hazard maps** to assist with land management and individual informed decisions to limit exposure. Our expertise in geological/mineral analyses (P1, P3), environmental distribution of mineral dusts (P1, P5), Activity Based Sampling (P2), and geospatial technologies (P1, P3, P5) will be integrated toward this goal.

**Problem/Aim 2**: To address unknowns about the **human health impact** of Nevada AA: A) Compare effects of Nevada AA with LA in our mouse model [7, 8] (P4) at low doses, hypothesizing similar effects based on preliminary data; B) **Compare pulmonary and immune health** of a group with exposure to AA-containing dusts from off-road vehicle use to known health outcomes of LA (P2, P4). C) Address unknowns of how natural processes affect the **morphology of fibers (e.g. toxicity)** and occurrence across the landscape (P1).

**Problem/Aim 3**: To address the difficulty of **remediating or reducing toxicity** of these extremely biodurable materials spread over many square miles of land: A) Develop novel techniques to remediate disturbed biocrusts, and B) Develop knowledge/predictions of AA occurrence across the landcape to significantly reduce AA-containing dust and thereby control both dust exposure and its toxicity (P1, P3, P5). B) Engage community in the research in order to build understanding and community support for remediation and mitigation efforts.

**Problem/Aim 4:** To address the need to empower and engage stakeholders, and to sustain this work long into the future: A) Build research capacity and expertise via **inter-disciplinary training** of new researchers (TC), B) Develop **translational tools and technologies** that can be used in current and future AA sites (RTC); C) Build sustainable relationships with public officials, health providers, communities and policy makers, thus creating informed and integrated networks for information dissemination and sustained commitment toward a paradigm shift in awareness of, attitudes about, and approach to, AA (RTC, CEC, TC).