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**James A. Jacobs, P.G., C.H.G., C.P.G., QSP/QSD** has 34 years of experience as a geologist and environmental scientist focused on answering geologic, environmental impairment and forensic questions. Since 2002, he has also been an elected official of a publically owned treatment works (POTW), the Sewerage Agency of Southern Marin (SASM) and a sewer collection agency, Tamalpais Community Services District (TCSD). He has served as president for both agencies.

The proposed research is on evaluating the risks and measuring human exposures to volatile organic compounds in sewer air in buildings resulting from legacy sewer-plumbing systems intersecting shallow toxic groundwater plumes. The work involves a major update of an obsolete but widely accepted vapor intrusion model developed by US EPA in 2002. The accepted vapor intrusion model does not consider alternate exposure pathways which allow toxic gases or liquids in sewer infiltration as a source of VOCs for human exposure in plumbing-sewer systems. The project is to map out volatile organic compounds (VOCs) in sewer air in manholes, pipes and cleanouts at several EPA Superfund sites (or regulatory equivalent) in US urban-industrial settings and to quantify the exposure pathways in terms of VOC concentrations (and variability), and evaluate the number of buildings and fixtures with compromised vapor seals to understand the human exposure risk. Of the buildings with sewer air intrusion, the proposal is to collect samples for screening and laboratory analysis and to determine the concentrations of VOCs in indoor air and sewer air.

The importance of the project is that the US EPA vapor intrusion model is in need of updating and does not include alternate exposure pathways of VOC vapors from contaminated subsurface environments into indoor air. Unsuspecting occupants may be exposed to VOCs, including trichloroethylene (TCE) or other toxic chemicals through VOC-laden sewer air. TCE has only a 5  $\mu\text{g}/\text{m}^3$  level where fetal heart damage can occur. Compromised vapor seals on the sewer-plumbing system will impact the poor and minorities disproportionately as they tend to live in urban areas near current or former industrial settings where TCE, and other VOCs were commonly used.

Funding is requested for developing an alternate exposure pathway model based on field conditions by mapping out sewer content in leaky sewer lines near shallow toxic groundwater plumes in urban areas. The project will include obtaining sewer maps and groundwater elevation and contaminant concentrations, and preparing GIS maps with the data. Smoke testing and video camera inspections will be used to locate leaking sewer pipes in groundwater plume areas. Sewer air screening and wastewater sampling will be done with portable or fixed gas chromatography/mass spectrometry (GC-MS) equipment or passive sorber samplers. GIS maps will be made to show elevated concentrations of VOCs in sewer air, and buildings where vapor seals on plumbing fixtures (such as P-traps and toilet wax seals, etc.) are compromised. Indoor air and sewer air sampling will be performed to verify and measure air quality degradation by this alternate exposure pathway. Once the information is obtained, the vapor intrusion model can be updated and the information and recommended mitigation measures made available to environmental regulators, sewer agencies, responsible parties and the general public.