Assessing Source Contributions to Air Quality and Noise in Unconventional Oil Shale Plays

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Background. Unconventional oil and gas development (UOGD) extraction techniques have enabled the exploration of previously inaccessible or uneconomic shale plays, resulting in thousands of extraction sites across relatively small geographic areas. Air emissions, radioactivity, and noise related to this shale exploration boom represent significant new sources of pollutants to the atmosphere. As these emissions increasingly also occur more commonly near where people live and work, there is a potential for human exposure.

Methods. Our study is designed to better describe both emissions and exposure to UOGD related air pollutants and noise. It will focus on oil and gas shale plays in the US, specifically the Permian Basin (PB) and the central part of Western Gulf Basin (Eagle Ford, EF). We are characterizing the impact and sources of UOGD activities on ambient air pollution, radioactivity, and noise by 1) time-resolved stationary monitoring in the Permian Basin, 2) measuring the spatial distributions of targeted UOGD pollutants with time-integrated passive sampling in both basins; and 3) better understanding location and magnitude of UOGD-related flaring by linking our monitoring data with satellite observations.

Results. We have established a location for a mobile monitoring laboratory (trailer) that houses instruments that continuously measure gaseous, specifically methane (CH_4), speciated non-methane hydrocarbons (NMHCs), ozone (O_3), nitrogen oxides (NOx) and carbon monoxide (CO) and dioxide (CO_2), together with black carbon, noise, airborne gas-phase and particle-associated radioactivity, and meteorology in Loving, New Mexico. This location, which sits in the northwest part of the Permian Basin, is surrounded by active wells (as determined by permit and production data pulled from the Enverus database), many that flare (as determined by analysis of Visible Infrared Imaging Spectroradiometer (VIIRS) nightfire satellite observations). It is also in a relatively populated area of southeast New Mexico, around in which we are also establishing a passive monitoring network for collecting time-integrated samples of NMHCs. The passive sampler network will involve community science to host the samplers, and will better our understanding of regional variability of population exposures to UOGD activities.

Conclusions. In this study, we will collect unique and abundant air quality measurements in communities near oil and gas production activities, including gas flaring, in a real-world context. Our combination of instruments builds on monitoring techniques that will deliver observational data at high time resolution, coupled with spatial data sources, in order to characterize processes that impact air quality across both space and time.