C14 Falsifying a Hypothesis: Real Science in the Dirt

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After attending this presentation, attendees will have been given a specific example in of the use of applying convergent data to answering complex environmental and litigation questions.

This presentation will impact the forensic community and/or humanity by driving home with a concrete example the all too often overlooked fact that the actual job of science is the falsification of hypotheses.

In the summer of 2005 the authors were confronted with a most interesting problem, the proving of a negative. This is an unusual problem, since if the thing to be examined simply isn't there, how do you examine it for its properties?

Our client, a remediation company, had contracted to remediate a piece of land prior to transfer of title, that was believed to have been mildly contaminated with diesel-range petroleum hydrocarbons during previous usage as well as with carcinogenic polynuclear aromatic hydrocarbons (cPAH) originating from old railroad activities adjacent to the property. With this in mind, the remediation contractor had stripped away the surface soils and begun a bio-remediation plan for the sub lying soils where the lighter hydrocarbons had entered by gravity. All proceeded fairly smoothly until higher levels of hydrocarbons were discovered at greater depth, culminating in the discovery of an abandoned fuel tank and significant levels of leaked fuel. The remediation team proceeded with the bioremediation plan, expanding the scope, until what had been estimated to be a 4,000 cubic yard remediation had expanded in scope to encompass closer to 15,000 cubic yards of material. The local representatives of the State regulatory authority stepped in at this time, expressing their opinion that the entire bioremediation activity had been a fraud, that the remediator had merely tilled the soils, mixing clean soils with contaminated soil until levels below the threshold for action were attained. Under this scenario, the entire mass of disturbed soil, having been subject to dilution had to be considered as contaminated as the original problem soils and disposed of as hazardous material (Dilution is no Answer to Pollution!). A new contractor was brought in and a plan to remediate the soils based on the presence of the remaining cPAH developed. The original contractor, complaining that he had been improperly removed, developed an alternative plan and requested that his plan be considered. The State regulators, still insisting on their original scenario, required that he prove that his entire project was not a dilution, but had, in fact, resulted in bio-remediation before they would even discuss the remaining issues with him.

We were hired to examine samples from the site and all existing data from the course of the remediation to determine whether the losses of hydrocarbons observed were more likely to have been from dilution of the soil or biodegradation of the hydrocarbons present. The authors were unable to compare the hydrocarbons present in the fuels before and after remediation because the original analyses of the fuels were of a type that gives very little composition data (total diesel-range petroleum hydrocarbons, TPHd) and the final post-treatment concentrations being below the detection limits used by the laboratory precluded even examination of the distillation pattern of the material present for the grossest characterization.

Physical and chemical (PAH distribution) examinations of the contaminated soils indicated that the cPAH remaining in the soils were primarily due to the presence of particles of asphalt, with smaller amounts of coal and ash rather than from residual fuels. With this in mind, it was felt there was finally had something to examine. CPAH associated with these activities had been found in the preliminary investigations, and the materials involved are not expected to be significantly affected by bio-remediation techniques without extraordinary measures. Comparisons of the levels of cPAH in the more contaminated soils before and after remediation were made. These indicated that even if the highest levels of these compounds had remained in the soil after the surface stripping, then dilutions of the order of 2-10 times might be expected (not unusual in land farming operations), while the loss of fuel hydrocarbons seen would require dilutions more on the order of 50 to 100 times. Since the soils had been treated without bias of what was present, it was unlikely that the soils containing the asphaltic particles were any less diluted than those containing only fuel hydrocarbons. Armed with these analyses the original remediator was able to prove to the regulators that significant dilution had not occurred, and that bio-remediation did account for the bulk of the diminution of the contaminating hydrocarbons and get them to examine his further proposals.

Soil Contamination, Convergence of Data, Dilution Issues

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