C33 Using Environmental Forensics to Explain the Unexplainable

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The goal of this presentation is to help environmental forensic scientists to think "outside the box," while using scientifically sound data to explain seeming incongruous or "impossible" data.

As knowledge about the behavior of environmentally sensitive chemicals increases, data that "could not possibly be correct" can often be explained, provided, of course, that the data are, in fact, correct. The behavior of dense non-aqueous phase liquids, DNAPLs, in subsurface soils provides a classic example. Data that reported the increasing concentrations of DNAPLs with depth were initially greeted with suspicion, since they were in conflict with the anticipated concentrations that would result if the contaminants were moving through the subsurface in a dissolved state. Today, this once incongruous behavior has been explained using sound scientific reasoning and accepted as correct.

The authors of this paper will present three examples of case studies where the initial data review and evaluation might have resulted in the incorrect conclusion that something was wrong with the data. The ***first case study*** involves the release of a specific PCB-containing (formerly) commercially available Aroclor mixture at a manufacturing facility, where it was used as a heat transfer fluid. The identity of the particular Aroclor that was used was well known to the operators of the facility. However, Aroclor-specific analyses of groundwater at the site revealed the "presence" of another Aroclor, in addition to the one that was used, depending on the locations where the samples were collected. This second Aroclor had been identified in samples collected during several different sampling events.

The company had no record, nor recollection, of usage of this other Aroclor that was identified in some of the groundwater samples. What happened? Could the data be wrong? The next step was a re-analysis of additional samples collected from the same locations where the second Aroclor had been identified. These samples were analyzed by multiple laboratories and the chromatograms were also reviewed independently for confirmation of the Aroclor identity. The results were the consistent in all instances, identifying the presence of the second Aroclor.

The answer to this "mystery" involved an analysis of the complex behavior of a mixture of chemicals (the Aroclor) in the environment. Additional forensic work confirmed that the data were, in fact, not only correct but also were supportive of the facts, as they were understood.

The ***second case study*** features an evaluation of measured pesticide concentrations in soil and groundwater that violated all understanding of how chemicals move through the environment. No natural transport processes could be used to explain the relative concentrations in soil, when the locations of the most likely sources were factored into the analysis. Again, what could possibly account for these data? They must be wrong.

The ***third case study*** also involves PCBs. Extensive sampling and analysis of the soil at an old industrial site indicted that PCBs (on an Aroclor-specific basis) were weathered in the soil to a depth of approximately ten (10) feet. However, there were a few soil samples collected at approximately five (5) feet that were not weathered. Why?

This seeming inconsistency was rather simple to explain, once the locations of buildings, now demolished, were identified. The samples collected in these areas had been under buildings and/or paved areas. As such, they were not subject to weathering. Easy!

However, why were there two soil samples collected at one location from depths of 15-16 feet and 24-26 feet that showed weathering? Moreover, the sample collected at the same location from a depth 18.5 –20 feet was, as expected, not weathered! Not so easy! A very detailed review of the data (which in all three instances were correct) provided an answer, consistent with sound, defensible science.

The above examples will be presented in a way that will, hopefully, challenge the audience and involve them in the environmental forensic process of identifying and determining the possible explanations for the seemingly anomalous data.

Anomalous Data, Environmental Transport, PCBs

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