

# The Continued Evolution and Application of Stable Isotopes to Environmental Issues R.

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## Introduction and Aim.

Over the past ten years I have presented several papers discussing the application of stable isotopes to a wide variety of environmental issues. The developments and new applications continue to expand into new areas and utilizing additional isotopes. The purpose of this paper will be to provide an updated review of these novel approaches and applications using examples from our laboratory. There are two significant areas of interest that will be discussed in detail. As previously discussed the major reason that isotopes have become so widely used in environmental problems is due to the ability to measure isotopic compositions of individual compounds in complex mixtures using gas chromatography-isotope ratio mass spectrometry (GCIRMS). Many of these applications have utilized carbon and/or hydrogen isotopes. However the past two or three years have seen the development of methods to determine the chlorine isotopes of organic compounds in addition to carbon and hydrogen. The most versatile method for the determination of chlorine isotopes actually involves gas chromatography-mass spectrometry (GCMS) and not GCIRMS. As with carbon and hydrogen isotopes, the role of the chlorine isotopes in environmental applications is again to differentiate release points of contaminants along evaluating the extent of natural attenuation of specific organic compounds in the environment. However it means at this time for the chlorinated hydrocarbons such as TCE, DCE and vinyl chloride a 3D approach can be used to study the origin and fate of these compounds. The second topic to be discussed in detail will be the use of stable isotopes in

vapor intrusion studies. This is a very important issue in the US at the present time and there is a great deal of interest in determining whether VOCs in indoor are coming from household consumer products or from subsurface groundwater plumes leaking into the houses. Examples will be given to illustrate the role of stable isotopes in this application and how in many cases the use of multiple isotopes can be used to differentiate the sources of these indoor air VOCs.