Clayton Environmental Consultants

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DIOXINS/FURANS DETERMINATIONS AFTER PCB FIRES

by Jaswant Singh, Ph D.
Vice President/Technical Director
and
Paul Epstein, Ph D.
Mass Spectroscopist

When overheated or involved in a fire, PCBs can produce a complex mixture of organic compounds, many of which are known to be far more toxic than PCBs themselves Although dioxins and furans are the most widely recognized PCB oxidation products, many other chlorinated materials may be produced, such as

- PCDDs (polychlorodibenzodioxins)
- PCDFs (polychlorodibenzofurans)
- PCBPs (polychlorobiphenylenes)
- PCPYs (polychlorinated pyrenes)
- PCDPEs (polychlorinated diphenyl ethers)

Many of these compounds are known to

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Uhler Named President

Mr. Robert G Uhler has been named President of Clayton Environmental Consultants, effective May 25, 1985 Bob joined Clayton in 1983, coming from National Economic Research Associates (NERA), a sister company to Clayton under Marsh & McLennan Companies, Inc He has an M.A in economics, and has specialized in risk/benefit analysis for the utility industry and, more recently, environmental economics Bob will direct Clayton operations in the U S , Clayton Environmental Consultants, Ltd in Canada, and Bowring Clayton Environmental Services in the U.K , from Clayton headquarters in Southfield, Michigan

Andrew Hicks of Bowring Clayton Environmental Services was one of the speakers at a breakfast seminar on asbestos in London, U K., in May For information on upcoming seminars, see Page 3.

Contaminated Properties: Buyer Beware

by Douglas Bach
Environmental Engineer

Cavaet emptor—let the buyer beware—has long been sound advice when purchasing property. But in recent years, the old adage has taken on added significance. With the threat of toxic contamination, real estate purchases present far more than the usual investment risks, owning some properties can cost millions of dollars in cleanup and legal fees As more and more cases of contaminated real estate deals surface, property acquisitions are being approached much more cautiously than in the past

Consider just a few of the cases we have encountered at Clayton where a party has unwittingly acquired a contaminated white elephant.

■ A large municipality purchased an abandoned factory from a struggling manufacturer for ten dollars The factory contained hundreds of pieces of PCB-filled electrical equipment which was quickly vandalized by thieves seeking copper Numerous spills of this highly persistent and toxic chemical within the building have rendered the plant unusable and could cost millions of dollars to clean up

■ A bank purchased a corner lot, formerly occupied by a gas station, as a site for a branch operation Shortly after the branch opened, employees began complaining of gasoline fumes within the building The old underground fuel storage tanks are suspected as the source of the odors Investigating the site will cost tens of thousands of dollars, remediation is likely to cost much more

■ A bank foreclosed on a long-time paint formulating operation, only to find itself the owner of some badly contaminated property occupied by hundreds of drums of hazardous wastes After considerable legal squabbling, the site eventually became eligible for federal cleanup under Superfund.

■ A municipality acquired an abandoned gas station through non-payment of taxes Several dilapidated hazardous waste hauling vehicles were found on the property and the underground tanks—over 30 years old—were still in place The

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oxins/Furans Determinations (Continued from Page 1)

be highly toxic To account for such components in addition to the dioxin (2, 3 7, 8-TCDD) in determining a safe level subsequent to a PCB fire in 1981 in the Binghamton (New York) State Office Building a composite index called the TCDD equivalent was developed by a panel of experts The TCDD equivalent takes into account the concentrations of chlorinated dioxins, furans and biphenylenes in the sample and makes certain assumptions about their toxicities as compared to the toxicity of 2, 3, 7 8-TCDD

The basic assumption in developing the TCDD equivalents for reentry criterion was that a no-observed effect level of 1 nanogram/kg/day in rats has been reported for 2 3 7, 8-TCDD To determine TCDD equivalent, analysis of soot, air, and wipe samples are analyzed using complex GC/MS analyses Sampling for airborne chlorinated dioxins, furans and other aromatic compounds is performed through a combination of filter and sorbent media using relatively large sample volumes

Air samples for PCDFs, PCDDs, and PCBPs are collected using a high-volume sampling device based on one designed by the New York State Department of Health and used at the Binghamton State Office Building site The sampler is a two-stage unit consisting of a 47-mm glass microfiber filter followed by a glass absorption tube containing activated silica gel The samples are connected to a 1 5 cfm Gast vacuum pump Large (approximately 100 cubic meter) air samples led to measurements in the range of 5 to 100 picograms per cubic meter of air (pg/m³)

After extensive cleanup, the samples are analyzed by gas chromatography/mass spectrometry (GC/MS) A typical mass chromatogram for a mixture of PCDFs is shown in Figure 1 The analytical protocol used is a modification of the methods developed by the U S EPA Region VII laboratory

The samples are fortified with an internal standard mixture containing several ^{13}C labeled PCDDs and PCDFs and a ^{37}CL labeled 2, 3, 7, 8-TCDD as a surrogate and then extracted in a Soxhlet for 20 to 24 hours with toluene as the solvent The extract is passed through chromatography columns, consisting of silica gel treated with sodium hydroxide silica gel treated with sulfuric acid, and a basic alumina column.

The cleaned-up extracts are then analyzed by selected ion monitoring (SIM) capillary column GC/MS Ions for all of the PCDDs and PCDFs containing four or more chlorines are monitored within the correct GC retention time windows Quantitation is based on the labeled internal standards that were added to the sample before extraction Choice of capillary columns depends on whether the analysis is for isomer specific TCDD (CP-SIL 88) or total PCDDs and PCDFs (DB-5)

The TCDD equivalents are then analyzed using the New York State Department of Health algorithm to calculate "2, 3, 7, 8 TCDD equivalents" in terms of all the PCDDs, PCDFs, and PCBPs in the sample

It should be emphasized that quantitative standards for many of the chlorinated aromatics are not available to analytical chemists making quantitative analyses of these compounds difficult However, this criterion based on select organic compounds still presents a useful way of approximating the acceptable contaminant levels It is evident that if oxidation products of PCBs are suspected the main concern should be evaluation of TCDD equivalent PCB measurement although important may in fact be secondary

Dr Paul Epstein is head of the organic analytical group at Clayton His expertise includes GC/MS analyses of dioxins/furans and other toxic organic compounds Questions on this should be directed to him at (313) 424-8860 — Editor

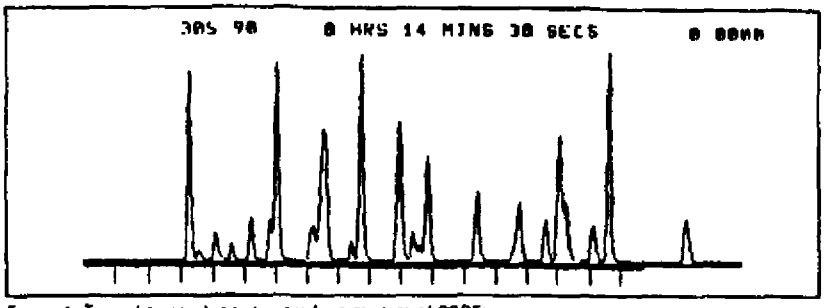

Figure 1 Typical mass chromatogram for a mixture of PCDFs

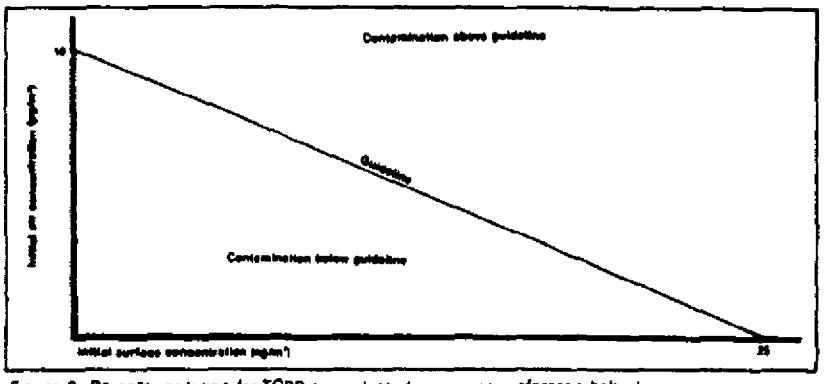

Figure 2 Re-entry criterion for TCDD equivalents (source see reference below)

Based on the calculations of the TCDD equivalent, a reentry criterion was developed by the Binghamton advisory panel. This criterion is represented in Figure 2 and takes into account combined exposure through air and surface contamination This guideline is based upon limiting the workday contaminant intake to 2 pg/kg per day of 2 3, 7 8-TCDD equivalent As Figure 2 shows, if surface contamination is zero or below the detection limit, then the air limit of 10 pg/m³ of 2, 3, 7, 8-TCDD equivalent becomes the reentry guideline If, on the other hand, the airborne value for the TCDD equivalent is nondetectable, then the reentry value will be based entirely on the surface contamination

References

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