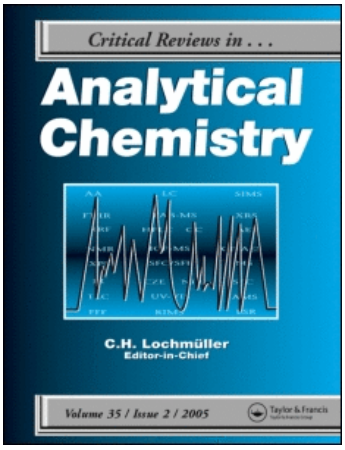

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The Environment and a Public policy for control and Sustainability: Command and Control *vs.* Process Alteration and Design

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The Environment and a Public Policy for Control and Sustainability:

Command and Control *vs.* Process Alteration and Design

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The historical model for environmental protection was one of first neglect and then one of discovery, command and control. The Command and Control model is one in which a hazard is identified and an ordinance created which requires "end-of-pipe" trapping of the harmful effluent or emission. The fatal problem is the control technology invariably converts a hazardous material's form from air-borne to liquid or from liquid to solid. There are exceptions, of course, but electrostatic precipitators, limestone wet scrubbers, settling ponds, waste storage sites, incineration, etc. all create a different problem.

In the 1970's period in the United States of America, there was a sudden call to protect the environment and the creation of a central government agency with the power to create law in the form of regulation was created. The number of problem areas and sources were vast in number. The only limitation on control technology was the size of the gross national product of the USA? Clearly a country with a growing social concerns budget { Medicare, Social Security, AFDP, } and a global defense responsibility could not simply put a fitting on the end of every pipe and ducted vent in America. A priority list of most to least hazardous threat was needed. Our first achievement was the creation of a new verb " *to prioritize* " but ultimately the control systems division of the US-EPA undertook the development of an "Environmental Assessment Strategy" to create the list. The strategy was to:

• Screen for Hazardous Sources

• Chemically and Physically Characterize the Most Hazardous

**• Use the Results to Adapt Existing Control Technology –or-
Create new Control Technology.**

The approach was quite innovative for the times but a quarter century has passed and effort can now be devoted to designing less harmful processes, to modifying the way chemistry is done and the way by-products are utilized { e.g. - fly-ash is converted to road materials }. What follows is a series of slides used at the Workshop in St. Petersburg. The flow of 1975 ideas vs. 1998 ideas is the important part. Some additional biographical information is included so that the audience may place the author's contributions in perspective. Clearly the RCIS is in the position the US was in 1975 in many areas of remediation need. And so the cost-effective "Phased Approach" is worthy of revisiting in that case. The work in the US can be found in the

following references and work cited therein. {ref. 6 and 7 are examples of modern research into process modification – the Green approach}:

1. C. H. Lochmüller, J. Galbraith, R. Walter and J. Joyce, "Integrating Sampling Methods for Trace Metal Analysis of Natural Water Systems: Ion Exchange Membrane Targets for Proton-Excited X-ray Fluorescence Analysis", Analytical Letters, 5(12), 943 (1972)..

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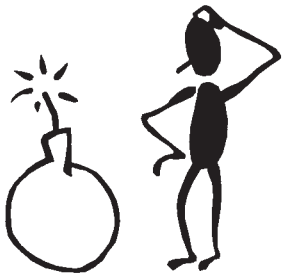
5. C. H. Lochmüller, S. S. Saavedra, "Sample and Sorbent Integrity During Combustion Source Sampling", Anal. Let., 19(1&2), 47-64 (1986).

6. M. Koel, M. Kaljurand, C. H. Lochmüller and Martin Moebus, Factor Analytical Resolution of Simultaneous, Dynamic Thermal Processes in Thermochromatography of Oil Shale, J. Chemometrics and Intell. Lab. Systems, 30, 173-78 (1996)

7. M. Koel, Q.Liu and C. H. Lochmüller, Analytical sub- and supercritical extraction of oil shale using CO2 and water, Proc. of the 5th Meeting on Supercritical Fluids: Materials and Natural Products Processing (Nice, France,23-25.March 1998), page 827-831 (1998

Improving the Environment for Health and Profit



The Process of Environmental Assessment, Control and Manufacturing Cost Reduction

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Elected Member, Committee of Revision - United States Pharmacopeial Convention (1985-90; 1990-95; 1995-2000); Chairman, Division of Analytical Chemistry, American Chemical Society (1983-84); Member, Committee to Review NBS/NIST Programs : *Center for Analytical Chemistry*- National Research Council (1987-90.)

Editorships and Editorial Boards
Critical Reviews in Analytical Chemistry- Editor-in-Chief (1994-pres..); Isolation and Purification -Editor ('91-94), Associate Editor ('94 to pres.) ; J. Chem. Inform. and Comp. Sci.; J. Chromatog. Sci.; J. Chemometrics; Chemically Modified Surfaces

Honors
American Microchemical Society Student Award -1964
Pioneer in Laboratory Robotics Award - 1985
American Chemical Society Award in Chromatography - 1987
North Carolina Distinguished Chemist, Amer. Institute of Chemists-1988
Life Member with Honor, Estonian Chemical Society -1996
EKS Societal Medal *No.*12 - Estonian Chemical Society 1997
Phi Lambda Upsilon

The Stages of Assessment

- Major "Fires" are obvious and easily identified.
- Ranking sources by industrial/municipal type using adequate methods to control expense
- Macro *vs.* Micro Control and Compliance.

1975-76 Advisory leave - U.S.E.P.A. - IERL/RTP \- Development of Environmental Assessment Strategies.

1976-84 Organic Analysis Advisory Panel U.S.E.P.A. -

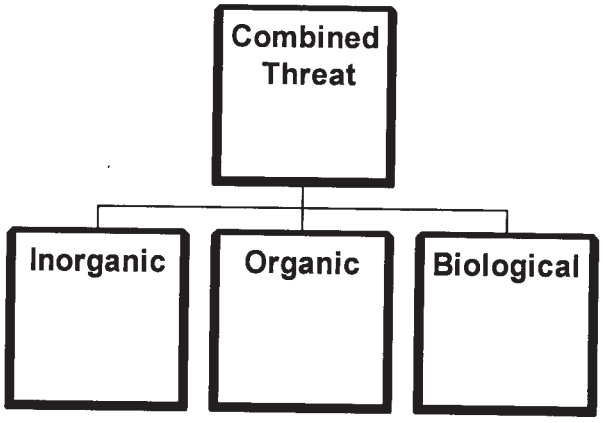
1984 Peer Review Committee, USEPA Integrated Air Cancer Project USEPA

1986 Peer Review Committee, Integrated Air Cancer Project, USEPA

1988 Peer Review Committee, USEPA Integrated Air Cancer Project HERL/IERL/EMSL -RTP USEPA

Assessment & Prioritization

Pollutant Classes



Screen THEN Study

- There are many sources and limited funds=>cost effective methods are needed
- Mass emission data; elements;compound classes; biological response.
- Avoid ' lists ' of compounds

Phase 1: 1975 version

- Elements by SSMS
- Organics by LC fractionation, IR, PDMS
- Biological: Alveolar Macrophage [death];Ames Assay *s.typhomerium [survive]*

Phase II: 1975 version

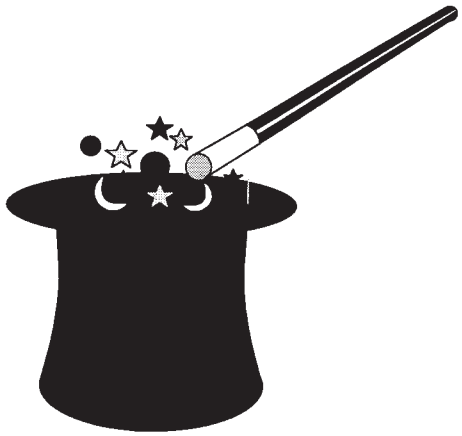
- Rank sources and samples based on Phase I
- Identify chemical threat by compound type or types
- Beware of synergistic effects when seeking compound information

Phase III: 1975 version

- Existing control technology usable?
- Convert waste form or truly remediate?
- Cost - Risk - Benefit

Phase III: 1998 version

- Is best fix: Head of pipe, middle of pipe, end of pipe?
- Is better best fix a complete process change? {GREEN CHEMISTRY}
- Can we change the process enough to save what we are wasting? {GREEN MONEY}



Wise Use of 'Compliance Data'

- Government sets standards for emission.
- Measurements must be made.
- Archive the results or use them for profit?
- A published example or two of profit.