Rationale for Exclusion of Emission-Comparable Fuel

Peer Review Report of
Ronald Bastian, Donald Corwin, and David Wilson

Submitted by:

Environmental Science Center
Syracuse Research Corporation
7502 Round Pond Road
North Syracuse, New York 13212

Submitted to:

Stiven Foster
Office of Solid Waste and Emergency Response

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Table of Contents

I. Introduction

A panel of expert scientists was assembled to review Rationale for Exclusion of Emission-Comparable Fuel (April 2007). The peer review was charged with reviewing the technical bases for a proposal to expand the comparable fuel exclusion for fuels that are produced from hazardous waste.

The expert panel independently reviewed the report then participated in a teleconference on March 15 to review the charge and allow the panel to ask clarifying questions of U.S. EPA.

This report serves as formal documentation of the peer review process used. This report is organized in sections corresponding to the peer review process used, including the charge to reviewers, selection of review panel, and summary of comments. In addition, this report includes the following detailed attachments:

- Complete resumes for the peer review panel; and
- Written comments from each of the peer reviewers.

II. Objective and Charge for the Peer Review

The charge to the peer review panel was developed by SRC according to guidance from U.S. EPA[1] and OMB[2] on the conduct of peer review. The specific charge questions were based on a report for considering a proposal to expand the comparable fuel exclusion for fuels that are produced from hazardous waste but which EPA believes generate emissions that are comparable to emissions from burning fuel oil when such fuels are burned in an industrial boiler operating under good combustion conditions. Such excluded fuel would be called emission-comparable fuel (ECF). ECF would be subject to the same specifications that currently apply to comparable fuels[3], except that the specifications for certain hydrocarbons and oxygenates would not apply. The ECF exclusion would be conditioned on requirements including design and operating conditions for the ECF boiler to ensure that the ECF is burned under the good combustion conditions typical for oil-fired industrial boilers.

The following section presents the peer review charge and questions that were provided to the peer review panel.

Draft Charge Questions for Peer Review of
Rationale for Exclusion of Emission-Comparable Fuel (April 2007)

Comparable fuels are secondary materials (i.e., materials that otherwise would be hazardous wastes) which have fuel value and characteristics (i.e., physical properties related to burning, and levels of toxic constituent levels) comparable to those of fuel oil.

EPA has established specifications for comparable fuels in Table 1 to §261.38. Comparable fuels meeting the prescribed specifications are not solid wastes, and hence not hazardous wastes, provided they are burned in specified units.

EPA is considering a proposal to expand the comparable fuel exclusion for fuels that are produced from hazardous waste but which we believe generate emissions that are comparable to emissions from burning fuel oil when such fuels are burned in an industrial boiler operating under good combustion conditions. Such excluded fuel would be called emission-comparable fuel (ECF). ECF would be subject to the same specifications that currently apply to comparable fuels[4], except that the specifications for certain hydrocarbons and oxygenates would not apply. The ECF exclusion would be conditioned on requirements including design and operating conditions for the ECF boiler to ensure that the ECF is burned under the good combustion conditions typical for oil-fired industrial boilers.

EPA believes that available data and information indicate that emissions from burning ECF under the proposed, prescribed conditions would be comparable to emissions from an oil-fired industrial watertube steam boiler operating under good combustion conditions. In addition, EPA believe that the ECF boiler design and operating conditions would ensure that toxic organic

[1] U.S. EPA Science Policy Council Peer Review Handbook, 3rd edition. EPA 100-B-06-002. May 2006.
[2] OMB Policy Bulletin: "Final Information Quality Bulletin for Peer Review" 70 CFR 2664. January 14, 2005.
[3] See Table 1 to §261.38.
[4] See Table 1 to §261.38.

emissions would be comparable to emissions that would result if the waste fuel were burned in a "hazardous waste boiler"—a boiler subject to the RCRA requirements of Subpart H, Part 266, or the CAA requirements of Subpart EEE. Given that these analyses and information provide a principle component of the rationale for the proposed exclusion of ECF and, as such, are influential scientific information, a peer review of these findings is appropriate.

Charge:

- Question 1: Based on the supporting documents provided, is there reason to conclude that the types and concentrations of emissions of organic compounds from burning ECF in the specified industrial boilers under the specified operating conditions are likely to be significantly different from the types and concentrations of organic emissions from burning the same waste fuel in an industrial boiler under the RCRA requirements of Subpart H, Part 266, or the MACT/CAA requirements of Subpart EEE of Part 63.
- Question 2: Based on the supporting documents provided, is there reason to conclude that burning ECF in the specified industrial boilers under the specified operating conditions would result in either: (1) higher than trace levels (e.g., >10-50 µg/scm) of organic compounds other than those that may be emitted from burning either fuel oil or natural gas[5] in an industrial boiler operating under typical good combustion conditions; or (2) significantly higher concentrations of the types of organic compounds that may be emitted from burning either fuel oil or natural gas in an industrial boiler operating under typical good combustion conditions.

Background:

- Special conditions of the exclusion would include the following design and operating conditions for the ECF burner:
    1. The burner must be a watertube steam boiler other than a stoker-fired boiler;
    2. Carbon monoxide (CO) must be monitored continuously, must be linked to an automatic ECF feed cutoff system, and must not exceed 100 ppmv on an hourly rolling average (corrected to 7% oxygen);
    3. The boiler must fire at least 50% primary fuel on a heating value or volume basis, whichever results in a higher volume of primary fuel, and the primary fuel must be fossil fuel or tall oil with a heating value not less than 8,000 Btu/lb;
    4. The boiler load must be 40% or greater;
    5. The ECF must have an as-fired heating value of 8,000 Btu/lb or greater;
    6. ECF must be fired into the primary fuel flame zone;
    7. The ECF firing system must provide proper atomization;[6] and
    8. If the boiler is equipped with an electrostatic precipitator (ESP) or fabric filter (FF) and does not fire coal as the primary fuel, the combustion gas temperature at the inlet to the ESP or FF must be continuously monitored, must be linked to the

[5] Even if ECF emissions may be higher than fuel oil emissions for a particular compound (e.g., acetaldehyde), we would nonetheless conclude that ECF emissions would likely be comparable to industrial boilers burning clean (i.e., oil or gas) fossil fuels if the ECF emissions would not likely be higher than natural gas emissions.

[6] The acceptable atomization systems are air, steam, mechanical, or rotary cup atomization systems. The as-fired ECF must pass through a 200 mesh screen.

automatic ECF feed cutoff system, and must not exceed 400°F on an hourly rolling average.

- The specification levels in Table 1 to §261.38 would not apply to the following hydrocarbons and oxygenates:
  1. Benzene (CAS No. 71-43-2)
  2. Toluene (CAS No. 108-88-3)
  3. Acetophenone (CAS No. 98-86-2)
  4. Acrolein (CAS No. 107-02-8)
  5. Allyl alcohol (CAS No. 107-18-6)
  6. Bis(2-ethylhexyl)phthalate [Di-2-e thylhexyl phthalate] (CAS No.117-81-7)
  7. Butyl benzyl phthalate (CAS No. 85-68-7)
  8. o-Cresol [2-Methyl phenol] (CAS No. 95-48-7)
  9. m-Cresol [3-Methyl phenol] (CAS No. 108-39-4)
  10. p-Cresol [4-Methyl phenol] (CAS No.106-44-5)
  11. Di-n-butyl phthalate (CAS No. 84-74-2)
  12. Diethyl phthalate (CAS No. 84-66-2)
  13. 2,4-Dimethylphenol (CAS No. 105-67-9)
  14. Dimethyl phthalate (CAS No. 131-11-3)
  15. Di-n-octyl phthalate (CAS No. 117-84-0)
  16. Endothall (CAS No. 145-73-3)
  17. Ethyl methacrylate (CAS No. 97-63-2)
  18. 2-Ethoxyethanol [Ethylene glycol monoethyl ether] (CAS No. 110-80-5)
  19. Isobutyl alcohol (CAS No. 78-83-1)
  20. Isosafrole (CAS No. 120-58-1)
  21. Methyl ethyl ketone [2-Butanone] (CAS No. 78-93-3)
  22. Methyl methacrylate (CAS No. 80-62-6)
  23. 1,4-Naphthoquinone (CAS No. 130-15-4)
  24. Phenol (CAS No. 108-95-2)
  25. Propargyl alcohol [2-Propyn-1-ol] (CAS No. 107-19-7)
  26. Safrole (CAS No. 94-59-7)
- The ECF firing rate would be restricted for benzene and acrolein:
  - If the as-fired concentration of benzene or acrolein in the emission-comparable fuel exceeds 2% by mass, the firing rate of ECF could not exceed 25% of the total fuel input to the boiler on a heat or volume input basis, whichever results in a lower volume input of ECF.

Supporting Documents

- Summary of Analysis of Emissions Data
- Technical Support Document for Comparable Emissions Peer Review

III. Selection of the Peer Experts (Expertise and Biography Sketch)

Peer Experts were selected for both independence and scientific/technical expertise. Each panel member was selected for his/her recognized technical expertise that bears on the subject matter under discussion. The evaluation of real or perceived bias or conflict of interest is an important consideration and every effort was made to avoid conflicts of interest and significant biases.

SRC was responsible for selection of the panel. SRC determined that, in order to provide a complete and thorough evaluation of the document, it was important to locate scientists with expertise in key subject areas.

SRC compiled a pool of 12 candidates with expertise in the key areas from our internal database of experts, Internet and literature searches, and professional contacts and referrals.

After carefully reviewing the candidates' credentials, interest, and availability, SRC selected the following three for the peer consultation (resumes for the experts are provided in Attachment A):

1. Ronald Bastian, Consultant, P.O. Box 688, Boothbay, ME 04537;
2. Donald Corwin, Therm-A-Cor Consulting, 418 Paulings Road, Phoenixville, PA 19460;
3. David Wilson, Consultant, Wilson Global Environmental Consultations, 709 Verdant Lane, Maryville, TN 37804.

IV. Conflict of Interest and Bias Issues

Each potential peer consultant was given a copy of SRC's COI policy statement and asked to complete a questionnaire to determine whether their involvement in certain activities could pose a conflict of interest or could create the appearance that the peer expert might lack impartiality. A copy of the questionnaire is found in Attachment B. Answering YES (or DON'T KNOW) to any question does not necessarily indicate there is a conflict of interest or problem, rather SRC contacts the individual for further detail and discussion.

V. Summary of Peer Review Comments

Complete written comments submitted by each member of the peer review panel are available in Attachments C–E.

Attachment A: Resumes of the Panel

RONALD E. BASTIAN, P.E.

Professional Qualifications

Nearly 40 years experience in engineering, consulting, and waste management operations. Work experience with the Eastman Kodak Company involved process design, startup, operation, testing, test reporting, and permitting of hazardous waste management operations. Provided leadership for the preparation and negotiation of permits for air, wastewater, solid and hazardous waste treatment in New York State and hazardous waste treatment in several other states. Held three management positions in Corporate Health Safety and Environment at Kodak. Work experience with Focus Environmental, Inc. enabled application of industrial experience to consulting and management of projects that provided regulatory services; concentrating in hazardous waste incineration permitting and compliance management systems, site remediation equipment performance evaluation, and process design, evaluation, and optimization for waste treatment processes. Very involved in incineration issues on a national level through his leadership in the American Society of Mechanical Engineers (ASME) and Coalition for Responsible Waste Incineration (CRWI). This involvement provides first-hand knowledge on the evolving Hazardous Waste Combustor MACT Rule affecting incinerators, boilers and cement kilns treating hazardous waste. Lifetime individual member and past Chairman of CRWI, past Chairman of the ASME Codes and Standards Committee for the development of Standards for Qualification and Certification of Hazardous Waste Incinerator Operators and Vice Chairman of the ASME Research Committee Industrial and Municipal Waste (ASME Research Committee on Energy, Environment and Waste).

Education

B.S., Chemical Engineering, University of Michigan, Ann Arbor, Michigan; 1966

Experience and Background

2004–Present Retired. Continued voluntary participation with ASME Research and QHO Committees and the Coalition for Responsible Waste Incineration

1992-2004 Senior Consultant, Focus Environmental, Inc., Knoxville, Tennessee. Responsible for consulting engineering and project management in hazardous waste thermal treatment process evaluation, operation, permitting, and regulatory compliance. A summary of specific experience follows:

- Hazardous Waste Combustor MACT Compliance
  - Project management and consulting assistance for preparation of HWC MACT Compliance Plans including Comprehensive Performance Test Plans; Startup, Shutdown and Malfunction Plans; Operation and Maintenance Plans; Feed Stream Analysis

Plans; CMS Performance Evaluation Plans; and Operator Training and Certification Programs.

  - Preparation of Alternative Monitoring Applications including alternative monitoring for use of voluntary continuous emission monitoring.
  - Preparation of operator training materials and classroom presentations for certification of hazardous waste incinerator operators.
  - Evaluations of Hazardous Waste Combustor MACT compliance for a rotary kiln process and several liquid injection incinerators.
  - Project management and preparation of reports for evaluation of Particulate Continuous Emission Monitoring Systems.

- Permit Application and Renewal
  - Project management and preparation for permit applications including comprehensive performance test planning for a MACT Upgrade of a rotary kiln incineration system.
  - Preparation and management of the Part B renewal applications for three major on-site hazardous waste management facilities.
  - Preparation and management of the Part B application for a new on-site BIF facility.
  - Project consulting and project management for preparation of air emission estimates such as a Title V Emission Inventory for an on-site hazardous waste incinerator, an air permit renewal for a fume incinerator, and a planned regenerative thermal oxidizer.

- Compliance Test Planning, Reporting, Permit Limit Development
  - Project management and preparation of HWC MACT CPT Plans for clients in New Jersey, Minnesota, Michigan, Louisiana, and Arkansas. Permit limit development for inclusion in Documentation of Compliance for each of these clients.
  - Project management and preparation of BIF Recertification of Compliance plans, associated test coordination and management, and assistance in preparing test reports for 4 BIF units in Louisiana.
  - Project management and preparation of RCRA trial burn plans with consideration of HWC MACT requirements for rotary kiln

incinerators for chemical manufacturers in Minnesota and Louisiana.

- Project management and preparation of a RCRA compliance and risk assessment trial burn for a liquid injection incinerator for a chemical manufacturer in Louisiana. Project management for associated air dispersion modeling and risk assessment. Project management and consulting for associated miniburn oversight and reporting with MACT compliance evaluation.
- Project management and preparation of a certification of compliance test plan, associated test management, and preparation of the Compliance Test Report for a sulfuric acid regeneration furnace in Texas.
- Project management, preparation of a trial burn plan, and associated test management and reporting for an aluminum potliner treatment process in Arkansas.
- Preparation of a combined RCRA/TSCA Trial Burn Plan and Quality Assurance Project Plan for a permitted mixed waste incinerator.
- Preparation of performance test and quality assurance plans; coordination of testing; and preparation of the performance test reports for several superfund sites utilizing low temperature thermal desorption for the treatment of excavated soil.

- Process Evaluation and Engineering
  - Project management and professional engineering oversight for a new fluid bed incineration process.
  - Project management for an Engineering Feasibility Study for a MACT compliance upgrade of air pollution control on a rotary kiln incinerator.
  - Project management and preparation of a process feasibility study for multiple metals emission monitoring.
  - Technical support for full-scale demonstration of multi-metal continuous emission monitors at a hazardous waste incinerator.
  - Preparation of a validation plan for a semi-continuous emission monitor being developed for compliance assurance for metals and particulate emissions.
  - Development and documentation of process performance evaluation criteria for thermal treatment of low level mixed waste.

  - Process evaluation for the application of a catalytic extraction process to the treatment of mixed waste.

- Risk Burns and Risk Assessment
  - Project management and consultant for preparation of CPT Plan addressing risk data collection of incineration units in Louisiana and Minnesota.
  - Project management for development of a Risk Assessment Work Plan for eight on-site BIF units and three incinerators.
  - Project management and preparation of compliance and risk assessment trial burn plans, associated test management, and preparation of Trial Burn Reports for four BIF Units.

1991-1992 Unit Director, Environmental Technology, Eastman Kodak Company, Rochester, New York. Responsible for line management of 20-person environmental engineering section. Section responsibilities included air, waste, and wastewater technology development with monitoring and sampling support. Also responsible for project management for Kodak Park Site New York State Part 373 Hazardous Waste Permit Trial Burn Plan/Testing/Report and the Site SPDES Permit Application for the wastewater treatment plant.

1990-1991 Unit Director, Water & Solid Waste Technology, Eastman Kodak Company, Rochester, New York. Responsible for line management of 20-person environmental engineering section. Section responsibilities included process engineering, permitting and remedial investigation for waste treatment processes, groundwater assessment and contaminated soil management at Kodak Park.

1988-1990 Program Manager, Soil Management, Eastman Kodak Company, Rochester, New York. Responsible for directing contractors in the development of a soil management protocol, agency negotiation and directing day-to-day waste management decisions relative to soil management for the Kodak Park Site.

1987-1988 Unit Director, Environmental Services, Eastman Kodak Company, Rochester, New York. Responsible for line management of 20-person environmental section. Section responsibilities were environmental compliance advice, air emission source permitting, operations support to waste treatment operations and environmental reporting for all divisions at the Kodak Park Site.

1984-1987 Group Leader/Project Manager, Environmental Services, Eastman Kodak Company, Rochester, New York. Responsible for group and project direction for environmental services to waste treatment operations at Kodak Park including RCRA Trial Burn execution and permit negotiation for the 120MM Btu/hr rotary kiln hazardous waste incinerator.

1982-1984 Process Engineer, Engineering Process Systems Evaluations, Eastman Kodak Company, Rochester, New York. Responsible for process improvement investigations on several coating and drying operations at Kodak Park in Rochester and Kodak Colorado.

1977-1982 Engineering Coordinator, Waste Disposal Operations, Eastman Kodak Company, Rochester, New York. Responsible for leading the efforts of 6 process design and operations engineers on all work performed for Waste Disposal Operations (Wastewater Treatment, Solid and Hazardous Waste Incineration). Coordinated efforts resulted in decisions to increase waste solvent recovery capacity thus reducing waste incineration, alternative management of paper and gelatin discharges to reduce waste treated by central wastewater treatment, and the addition of sludge thickening and odor control processes to allow full capacity utilization of the wastewater treatment plant.

1977-1980 Department Manager/ Technical Assistant to the Department Manager, Waste Disposal Operations, Eastman Kodak Company, Rochester, New York. Responsible for line management of 60 operation personnel and 2 operations engineers for incineration and wastewater treatment operations. These operations included a 120 Ton/day solid waste incinerator/boiler, a 120MM btu/hr rotary kiln hazardous waste incinerator and a 36 MGD activated sludge secondary wastewater treatment plant.

1971-1977 Process Engineer, Utilities Division, Eastman Kodak Company, Rochester, New York. Responsible for process design, operator training, start-up, debugging and operation for a rotary kiln hazardous waste incinerator and a multiple hearth sludge incinerator in addition to several projects related to waste disposal operations at Kodak Park.

1967-1971 Industrial Engineer, Photoprocessing Operations, Eastman Kodak Company, Rochester, New York. Responsible for industrial engineering support and evaluation including workstation redesign, workflow improvement, and auditing of process and operations standards at Kodak's US photoprocessing operations.

Registration/Certification

- Registered Professional Engineer: New York, Pennsylvania

Professional Affiliations

- Coalition for Responsible Waste Incineration
  - Lifetime member (1996 to date)
  - Invited member (1994-1995)

  - Invited member and Technical Director (1993)
  - Chairman Board of Directors (1991-1992, 1988-1989)
  - CEMS Issue Leader for Hazardous Waste Combustor MACT Rule
  - Chairman 1989 Hazardous Waste Incineration Seminar
  - Advisory Committee for Third International Congress on Toxic Combustion By-Products
  - Chairman Colloquium on Applied Combustion Third International Congress on Toxic Combustion By-Products
- American Society of Mechanical Engineers
  - Vice Chairman ASME Research Committee Industrial and Municipal waste (Now ASME Research Committee on Energy, Environment, and Waste) (2003-2005)
  - Chairman ASME Codes and Standards Committee on the Qualification and Certification of Hazardous Waste Incinerator Operators (1991-2004)
  - Co-Chairman Continuous Emission Monitors Subcommittee on the ASME Research Committee on Industrial and Municipal Waste (1994 – 2003)
  - ASME Research Committee on Industrial and Municipal Waste (RCIMW) (Now ASME Research Committee on Energy, Environment, and Waste)(1971-date)
  - Steering Committee Chair for ASME/EPA/DOE/A&WMA Jointly Sponsored Emissions and Process Monitoring Workshop (1996)
  - ASME Representative on USEPA National Roundtable on Combustion Strategy
  - Co-Chair 1993 ASME/EPA Metals Workshop
  - Past Co-chairman of RCIMW Metals Emissions Subcommittee (1989-1991)

Selected Publications and Presentations

Bastian, R.E., Panel Member for Experience with Energy Release Characteristics and Controls in Boiler Furnaces -- ASME Present Status and Research Needs in Energy Recovery from Waste Conference, Hueston Woods State Park, Oxford, Ohio, September 1976.

Bastian, R.E., Seeman, W.R., "The Design and Operation of a Chemical Waste Incinerator for the Eastman Kodak Company", 1978 ASME National Waste Processing Conference, Chicago, Illinois, May 1978.

Austin, D.A., Bastian, R.E., Wood, R.W., "Factors Affecting Performance in a 90 Million BTU/Hr Chemical Waste Incinerator: Preliminary Findings", Air Pollution Control Association, City, State, May 1982.

Bastian, R.E., Wood, R.W., "Eastman Kodak Company Chemical Waste Incinerator Process Performance Testing", American Institute of Chemical Engineers, City, State, August 1987.

Bastian, R.E., "Eastman Kodak Company Waste Incineration Organic Compound Destruction", Louisiana State University Conference on Rotary Kiln Incineration, City, Louisiana, October, 1987.

Bastian, R.E., "Solid Waste Management -- An Industrial Perspective", presentation at League of Women Voters, Rochester, New York, April 1988.

Bastian, R.E., "Incineration -- Where Does it Fit?", Press release for Coalition for Responsible Waste Incineration, December 1988.

Bastian, R.E., Osborne, J.M., Wilson, J.D., Wood, R.W., "Management and Control of Combustion Excursions from Rotary Kiln Incinerators", ASME Research Committee on Industrial and Municipal Waste, June 1989.

Bastian, R.E., Session Chairman "Report from the Coalition for Responsible Waste Incineration on Research Needs", First International Congress on Toxic Combustion By-Products, UCLA, August 1989.

Bastian, R.E., Panel Discussion: "Public Policy and Incineration: Issues and Concerns", First Hazardous Waste Treatment and Prevention Technologies Conference, City, State, October 1990.

Bastian R.E., Presenter ASME/EPA Brainstorming Workshop on the Control of Metal Emissions from Waste Combustion Devices, "Experience in Metal Emissions Testing from an Industrial Operation Perspective", Cincinnati, Ohio, November, 1991.

Bastian, R.E., Smith, G.D., "Hazardous Waste Incineration -- Managed By and For People", 1992 Incineration Conference, Albuquerque, New Mexico, May 1992.

Bastian, R.E., Panel Member "Public Acceptance: What Factors Influence Public Opinion?", 1993 Incineration Conference, Knoxville, TN, May, 1993.

Bastian, R.E., Lee, C. C., Seeker, W.R., "Continuous Performance Assurance of Metals Management", 1994 Incineration Conference, Houston, TX, May, 1994.

Hoffman, D.P., Gibson, L.V., Hermes, W.H., Bastian, R.E., "Guideline for Benchmarking Thermal Treatment Systems for Low-Level Mixed Waste", 1994 Incineration Conference, Houston, TX, May, 1994.

Session Vice Chair and Panel Leader for "Integration of Emerging CEM Technologies and Stack Sampling Methods into Regulatory Approaches for Waste Combustors" , 89th Annual A&WMA Meeting, Nashville, TN, June, 1996.

Workshop Organizer for ASME/EPA/DOE/A&WMA "Emissions and Process Monitoring Workshop", Research Triangle Park, December, 1996.

Speaker for Local Chapter of A&WMA, "Continuous Emissions Monitors Development Update" Research Triangle Park, NC., December, 1996

Session Chair for "Suitability for Use of CEMs for Regulatory Compliance for Hazardous Waste Combustors", 90th Annual A&WMA Meeting, Toronto, Ontario, Canada, June, 1997.

Bastian, R.E., Lambert, R.H., "Particulate Matter Continuous Emission Monitor Test Performance in a Moisture-Saturated Flue Gas", 1999 International Conference on Incineration, Orlando, FL, May, 1999.

Bastian, R.E, Schomer, T.L., "Implementation Planning to Effectively Address the HWC MACT Provisions", 2001 International Conference on Thermal Treatment Technology, Philadelphia, PA, May, 2001.

CURRICULUM VITAE

DONALD L. CORWIN P.E., Principal
Therm-A-COR Consulting, Inc.
418 Pawlings Road
Phoenixville, PA 19460

June 2006
610-935-8493 (v)
610-935-5467 (f)
DCorwin@Therm-A-Cor.com

AREAS OF EXPERTISE

Air pollution control, Combustion, Heat transfer, Energy recovery, Incineration, Oxidizer Systems, Incineration control, Combustion safeguards, Process design, Equipment design, Project management.

EDUCATION

BS - Aerospace Engineering 1970, Penn State University; Fluids, Electrical
MS - Aerospace Engineering 1972, Penn State University; Fluids

CONTINUING EDUCATION

General Electric "A" Course	1974
Industrial Combustion Technology	1978
ASME Pressure Vessel Section VIII	1979
Penn State Univ. Mechanical Engineering Review	1980
Industrial Waste Incineration Technology	1981
Fired Process Heaters Design	1983

PROFESSIONAL EXPERIENCE

1998-	Present Principal Therm-A-COR Consulting Inc. Phoenixville PA
1987 – 1998	RMT/Four Nines. Plymouth Meeting, PA 93-98 Senior Consultant (RMT) 91-93 Principal (Four Nines) 89-93 Engineering Manager (Four Nines) 87-98 Project Manager (Four Nines)
1978 - 1987	T-Thermal Co. Conshohocken, PA 86-87 Major Projects Manager 84-86 Laboratory Manager 78-84 Project Manager

1972 - 1978	General Electric Co. Philadelphia, PA 75-78 Solar System Engineer 73-75 Thermodynamic Engineer 72-73 Aerodynamic Engineer

REGISTRATIONS

Registered Professional Engineer	PA, NY, NJ, DE, TX, LA, VA, WI, WV, MN, UT, MD (First PA – 029512 E)
Board Certified Forensic Engineer	

PROFESSIONAL AFFILIATIONS

- American Society of Mechanical Engineers
  - ASME Research Committee on Municipal and Industrial Waste (Secretary)
  - ASME Hazardous Waste Operators Exam Committee
- Air and Waste Management Association
- National Society of Professional Engineers
- National Academy of Forensic Engineers
- National Fire Protection Association
- Rutgers University – Lecturer - EPA Regulators Review Course

PAPERS AND PRESENTATIONS

Short Course - 1996 to 1999 “Safety Audit of Oxidizer and Vent Collection System”
Client Chemical Plants (11) USA and Canada.

1995 to 1996 “Operation and Management of BIF unit”, Client Plant, Short courses on the operational and engineering principles of BIF combustion units. (combustion, refractory, heat transfer, air pollution control, emissions)

Operation and Maintenance Requirements of a Hazardous Waste Incinerator, USPCI Clive Incineration Facility, UT - 1993.

"High Performance Test Cell Heater Operations and Control Requirements", AEDC Tullahoma, TN - 1985

Book – Section 8.2, “Rotary Kilns,” *Standard Handbook of Hazardous Waste Treatment and Disposal*. Freeman, H. M. Editor, McGraw-Hill. 1997.

Papers -

“Process Control with a Radiation Thermocouple”, American Flame Research Council, Dynamics and Control of Industrial Combustion Processes, Atlanta, GA, Nov 2005

“Rapid Process Control with Radiation Thermocouple”, Incineration and Thermal Treatment Conference, Phoenix, AZ, May 2004

“Burner Design: Fuel NOx and Staged Air Experience”, Incineration and Thermal Treatment Conference, Orlando, FL, May 2003

“Process Monitoring with a BIF Unit”, Incineration and Thermal Treatment Conference, New Orleans, LA, May 2002.

“Operational Considerations with a Liquid Waste Burner”, Incineration and Thermal Treatment Conference, Portland OR, May 2000.

“Process Production Increases through Oxidizer Control Modification”, Incineration and Thermal Treatment Conference, Orlando FL, May 1999

“Thermal VOC Oxidizer Modifications for Improved Efficiency” 1997 AICHE Annual meeting, Los Angeles, CA - 1997

"A Detailed Review of Metal Partitioning in a Kiln", 13th Incineration and Thermal Treatment Conference, Houston, TX - 1994

"Operational Problems with Mobile Combustion Systems", 13th Incineration and Thermal Treatment Conference, Houston, TX - 1994

"Air Toxics Emissions Control: Application and Design", 87th Annual AWMA Conference, Cincinnati, OH – 1994

"Radiation Cooling In Hazardous Waste Incinerators "11th Incineration Conference Albuquerque, NM - 1992

"VOC Control Techniques", Third International Congress on Toxic Combustion By-Products - 1992

"Industrial Waste Incineration System Material Selection and Application Problems", International Conference on Fireside Corrosion – Palm Coast, FL 1989

SUMMARY EXPERIENCE

Mr. Corwin has over 25 years of experience in designing, installing and troubleshooting problems with air pollution control, combustion, incineration and heat transfer equipment. He generated and supervised the development of the detailed engineering for the mechanical, electrical, and process designs of combustion and air pollution equipment. He provided detailed technical oversight for the manufacture of heat transfer, incineration and combustion equipment systems. These systems included solar energy collectors, ASME Code high temperature heat exchangers, liquid and solid incinerators, low NOx burners, air pollution control equipment and LNG vaporizers. Mr. Corwin directed the field start up of these units.

Mr. Corwin designed and supervised the design of heat exchanger applications, LNG vaporizer and incinerator systems to meet the EPA, NFPA, IRI, Hartford, and NEC code requirements. Mr. Corwin provides detailed engineering review of operational systems that were not meeting client operational expectations. He analyzes actual operational conditions and generated corrective action plans. He has reviewed the catastrophic failure of refractory and heat transfer systems to identify the cause of the failure. He generated opinion reports on the catastrophic failure of mechanical equipment. He reviewed historical data for the operation of a kiln to determine if the system was in compliance with NY DEQ requirements.

Mr. Corwin has extensive practical experience in the preparation of specifications, the procurement of the most cost effective equipment and start-up of combustion, incineration and the associated air pollution control equipment. He has preformed troubleshooting on numerous combustion and air pollution control systems. He developed recommendations that successfully eliminated the emissions problems experienced by the combustion equipment.

Mr. Corwin provides accident reconstruction analysis of combustion system failures to the insurance industry. He has evaluated duct fires, natural gas system explosions and operational failures that result in property damage.

LEGAL EXPERIENCE

DEPOSITIONS

1. E. Thomas Payne v. Simonds Manufacturing Corporation, United States District Court, 92-119-P-C, Maine 1992.

Expert testimony for Simonds Manufacturing Corp

Mr. Frederick J Badger Esq.
Richardson et al.
82 Columbia Street
PO Box 2429
Bangor, ME 04401-2429

2. United States of America v. Marine Shale Processors, Inc, United States District Court, CV 90 1240, March 1994. (2 depositions)

Expert testimony for the United States of America

Mr. Bruce C Buckheit Esq.
United States Department of Justice
P.O. Box 7611
Ben Franklin Station
Washington DC 20044

3. MMT Envrionmental Services v Webcraft Technologies Inc, United States District Court, CV-3-93-546, 19 July 1995.

Expert for Webcraft Technologies

Mr. Cory Ayling Esq
McGrann, Shea, Franzen, Carnival, Straughn & Lamb ESQS
2200 LaSalle Plaza
800 LaSalle Avenue
Minneapolis, MN 55402

4. Cindy Kay Wilson et al vs Interplastic Manufacturing Company et al, Kent Count Circuit Court, Case 97-CI-851 20 Jan 2004

Fact Witness for Interplastic Manufacturing Company

Mr. Thomas S. Calder Esq.
Dinsmore & Shohl
1600 Chemed Center
255 East Fifth Street
Cincinnati, OH 45202-3172

5. Cindy Kay Wilson et al vs Interplastic Manufacturing Company et al, Kent Count Circuit Court, Case 97-CI-851 20 Jan 2004

Expert Witness for Interplastic Manufacturing Company

Mr. Thomas S. Calder Esq.
Dinsmore & Shohl
1600 Chemed Center
255 East Fifth Street
Cincinnati, OH 45202-3172

6. United States of America v Westvaco Corporation, United Stated District Court
Civil Action MJG 00 CV 2602, April 2004

Expert testimony for the United States of America

Ms. Deborah Behles Esq.
United States Department of Justice
P.O. Box 7611
Ben Franklin Station
Washington DC 20044

COURT TESTIMONY

1. United States of America v. Marine Shale Processors, Inc, United States District Court,
CV 90 1240, March 1994. (Incinerator Characteristics)

Expert testimony for the United States of America

Mr. Bruce C Buckheit ESQ
United States Department of Justice
P.O. Box 7611
Ben Franklin Station
Washington DC 20044

2. United States of America v. Marine Shale Processors, Inc, United States District Court,
CV 90 1240, July 1994. (PSD Evaluation)

Expert testimony for the United States of America

Mr. Bruce C Buckheit ESQ
United States Department of Justice
P.O. Box 7611
Ben Franklin Station
Washington DC 20044

JESSE DAVID WILSON
Wilson Global Environmental Consultations
709 Verdant Lane
Phone: 865-983-9852 Maryville, TN 38704 Fax: 865-981-7482

Self Employed: Wilson Global Environmental Consultations, 1998-Present

EMPLOYMENT: Retired 12-31-97; 33.7 years with The Dow Chemical Company, Midland, Michigan

EXPERIENCE: Combustion Technology Applications and Environmental Management

QUALIFICATIONS:

- Thirty-one years industrial management experience in disposal techniques for domestic waste and hazardous materials (i.e., PCBs, halogenated dioxins and furans, pesticides, brominated and fluorinated materials), waste recycle and reuse, incineration, waste water treatment, landfill, air pollution equipment applications, emission sampling, ambient air studies, complaint answering, permit application and reviews, and response to regulations and litigation.
- Thirteen years Corporate Technology Center technical contact for trace organics, combustion and air pollution control system troubleshooting; incineration system design, specifications for waste treatment, P&ID design reviews, combustion technology improvement assessments, pre-startup reviews, modifications globally; and communications to management on environmental issues, regulations, goals and capital plans.

PROFESSIONAL EXPERIENCE::
Wilson Global Environmental Consultations, Maryville, Tennessee- 1998-Present
The Dow Chemical Company, Midland, Michigan- 1964-1997
Corporate Environmental Technology Center- 1984-1997

Senior Environmental Associate-1988
Senior Environmental Specialist, higher level-1984

- Corporate Technology Center representative for engineering, equipment selections, and P&ID review for fourteen rotary kilns, eight small solid waste units, six waste boilers, and three thermal oxidizers; and global review of twenty-nine commercial incineration units and five cement kilns for approval to accept waste from Dow.
- Performed global, site environmental waste management reviews; developed and taught classes for Combustion and Incineration, Air Pollution Control, Test Burn Plans, Test Burn Sampling, Environmental Management Basics, Reactive Chemicals for Rotary Kilns; and performed combustion reviews for operational performance assessment, loss prevention, reactive chemicals, and regulatory improvement for five rotary kilns, twenty-two boilers, ten heaters, twelve thermal oxidizers and seven small solids incinerators.
- Technical contact for trace organics (i.e., dioxins and furans, PCBs) and conventional pollutants, engineering, operational changes, stack gas sampling, air permit reviews, test burn

plans, legislation, regulations; and consultant to Dow Texas for 2.5 years addressing trace organics from combustion units and technology for reductions,

- Reviewed and prepared technical comments on federal promulgated rules for burning of hazardous waste in boilers and furnaces; acted as co-chair for ASME sub-committee peer reviewing federal incineration guidance document; represented Dow on CMA work groups, federal research peer reviews, Vinyl Institute Incineration Task Force and at hazardous waste workshops; prepared and presented data on "Relationship Between Dioxin and Furan Stack Gas Emissions and Chlorine in Waste Feeds" in response to proposed waste management regulations.

Michigan Division Environmental Services-1976-1983

Senior Environmental Specialist-1979-1983

- Coordinated or reviewed all detail process design packages ensuring that waste reactive chemicals, waste reduction or water control parameters and state and federal requirements were an integral part of design; developed and prepared technical solutions for dioxins, PCBs, landfill remediation, incineration improvements in response to state and federal regulations; prepared technical comments in response to hazardous waste rules; prepared extensive documentation for answers to questions raised by the state on incineration operations for the Midland facilities; reviewed PCB surrogate test burn plans and incinerator operational design plans to determine feasibility for obtaining PCB permit; developed, reviewed and participated in trace organic test burns for the Midland incinerators to assure compliance with state law; reviewed and assembled technical responses to litigation activities concerning dioxins and waste water permits.
- Developed and prepared response positions and long range alternative strategies to deal with Water Pollution Control, Air Pollution Control, and Underground Injection Control Regulations; and Toxic Substance Control, Safe Drinking Water, and Solid Waste and Resource Recovery Control Acts.

Environmental Engineering Supervisor-1978-1979

- Managed four environmental engineers in day-to-day, plant wide assignments, participated in or led environmental audits at other Dow sites for compliance with Clean Air Act, Toxic Substance Control Act, and Clean Water Act.
- Incineration representative on the Michigan Division Dioxins Task Force resulting in the "Trace Chemistry of Fire" report; designed test burn for trace organics sampling and burner modifications for site rotary kiln.

Environmental Lab Supervisor-1977-1978

- Supervised day-to-day lab analysis for two chemists and two technicians in supporting Waste Water Treatment Plant, discharge permit requirements, incinerators, and landfill operations.
- Solved technical problems related to discharge permit by implementing laboratory procedure changes and quality checks for routine samples, resulting in manufacturing rates being maintained without reductions in production.

Environmental Specialist-1975-1976

- Managed Midland document collection for Agent Orange lawsuit and Federal Clean Water Act request for process waste water data from manufacturing plants.

Michigan Division Waste Control Department-1966-1972

Senior Waste Control Engineer-1972-1975

- Coordinated evaluation and solution of air, liquid and solid waste problems for Midland, other global locations, and customer plants; performed stack gas sampling to establish air pollution design needs for Eastman Kodak kiln.
- Supervised the activities and training of thirteen waste control trainees over a period of two years; used developed programs for Environmental Basics and Stack Gas Sampling in training of trainees.

Shift Leader-1974

- Responsible for rotary kiln and two thermal oxidizers for six months.

Assistant Coordinator Air Pollution Control-1969-1972

- Reviewed air pollution permit applications before submission to the state; evaluated and recommended industrial air pollution control equipment to meet present and future requirements.
- Supervised sampling team that established air pollution control equipment requirements for new 3M rotary kiln incinerator; carried out stack gas sampling at Dayton County Municipal Waste facility, Rollins-Purple incinerator, boiler in Canada, and aluminum extrusion factory; provided training and environmental reviews at three other Dow locations to address specific emission issues.

Waste Control Engineer-1968-1969

- Reviewed and approved water and air pollution projects prior to submission to the state for operating permits; evaluated the use of incinerator quench waste heat for use as a brine concentration technology.

Air Pollution Control Chemist-1966-1968

- Reviewed P&IDs for plant process authorizations to meet new Michigan Air Regulations; implemented emission reduction for bromine, chlorine and brominated, chlorinated compounds at manufacturing plants by identifying sources, and at herbicide manufacturing plants by using vegetation studies, and at waste incineration facilities by identifying operational issues; developed ambient air quality monitoring, and vent gas sampling program.
- Sampled stack gas at waste incinerator to establish air pollution control design parameters for $1.5 million liquid residue thermal oxidizer, and at new herbicidal fume scrubber.

Michigan Division Analytical Laboratory-1964-1966

Chemist-1964-1966

- Performed analysis in thirty-three areas of analytical chemistry for product quality control, supported research in the development of new products, and solutions to production problems; coordinated quality control lab at chloroacetic acid plant; developed procedure and sampled hydrogen gas for trace organics at ammonia plant; and performed studies for biodegradability of surfactants at waste water treatment pilot plant.
- Developed and implemented preventative maintenance program at Midland ammonia plant.

EDUCATION: B. S., Education with chemistry and biology majors, Cumberland College, Williamsburg, Kentucky, 1964

ADDITIONAL COURSE WORK:

1964 - 1973	Delta College, University Center, Michigan Courses: Accounting, Mathematics, Physics, Computer Science; Hours: 22
1965 - 1971	Central Michigan University, Mt. Pleasant, Michigan Courses: Biology, Education, Economics, Mathematics, Chemistry, Statistics, Thermodynamics; Hours: 28
1968 - 1972	Saginaw Valley State University, Saginaw, Michigan Courses: Engineering, Statistics; Hours: 5
1971	University of Michigan, Ann Arbor, Michigan Course: Environment and Health; Hours: 2

AWARDS

1994	Featured as environmental spokesperson in Dow Brinewell publication article, Winter, 1994-1995, "Trends and Realities in the Workplace".
1994	Special Recognition Award for combustion technology reviews
1993	Personal service recognition award for accomplishments in Texas trace organics reductions.
1991	Recognition award from Corporate Business Research and Technology Committee for combustion and trace organics presentations, cement kiln technology, and research guidance.
1978	Recognition award for service on 'Trace Chemistry of Fire" technical team
1984	Nominated for Dow Team of Champions for leadership in the area of environmental protection
1968	Recognition award for performing work in a superior manner
1964	Voted Mr. Most Likely to Succeed, Cumberland College, Williamsburg, Kentucky

SPECIALIZED TRAINING:

1996	Opportunities for the Chemical Industry in China, Chemical Week Seminar, Beijing, China
1972	Chemical Engineering for Chemist, Dow Class

1972	Strategy of Process Design. A.I.Ch.E Class
1968	Particulates and High Performance Collection, Industrial Ventilation and Air Pollution Control, Michigan State University, Lansing, Michigan
1968	Combustion Evaluation, National Center for Air Pollution Control Training Programs, Research Triangle Park, North Carolina
1967	Air Pollution and Its Control, Oakland University, Rochester, Michigan
1967	Control of Gaseous Emissions, Health Education and Welfare, Cincinnati, Ohio
1966	Source Sampling for Atmospheric Pollutants, Health Education and Welfare, Cincinnati, Ohio
1966	Design of Air Pollution Sampling Trains, Health Education and Welfare, Cincinnati, Ohio

PUBLISHED PAPERS:

2005	Wilson, Jesse David, "Halogen Chemistry Review And Impact on Operations Of Waste Facilities", IT3'05 Conference, May 2005, Texas, USA.
2004	Wilson, Jesse David, "Knowledge Of Reactive Chemicals Impacts The Safe Operations Of Hazardous Waste Incineration Facilities", The 3rd International Conference on Combustion, Incineration/Pyrolysis and Emission Control (3rd i-CIPEC), October 21-23, 2004, Zhejian University, Hangzhou, China.
2004	Wilson, Jesse David, "pH Control Understanding For Improved Acid Gas And Halogen Scrubbing", IT3'04 Conference, May 10-14, 2004, Phoenix, Arizona.
2004	Wilson, Jesse David, "Incineration Design Limitations", IT3'04 Conference, May 10-14, 2004, Phoenix, Arizona.
1995	Townsend, D.I., Wilson, J.D., Park, C.N., "Mechanisms for Formation and Options for Control of Emissions of PCDDs and PCDFs from Incinerators", 14th International Incineration Conference, Bellevue, Washington.
1995	Wilson, J.D., Park, C.N., Townsend, D.I., "Dioxin Emissions from Full Scale Hazardous Waste Combustion Units Handling Variable Chlorine Feed Compositions", 14th International Incineration Conference, Bellevue, Washington.
1989	Wood, R.W., Bastian, R.E., Osborne, J.M., Sigg, A., Wilson, J.D., "Rotary Kiln Incinerators-The Right Regime", Mechanical Engineering, September, Vol. 111 No. 9
1989	Wood, R.W., Bastian, R.E., Osborne, J.M., Sigg, A., Wilson, J.D., "Management and Control of Combustion Excursions from Rotary Kiln Incinerators", Proceedings-82nd A&WMA Annual Meeting, Anaheim, CA, June 25-30
1971	Sawinski, Richard J., Wilson, J. David, "Evaluation of Combustion Gases From Industrial Incineration", American Institute of Chemical Engineers, Cincinnati, Ohio, May 16-19, 1971
1964-1997	Thirty-five Dow internal reports

PRESENTATIONS:

2005	Wilson, Jesse David, "Halogen Chemistry Review And Impact on Operations Of Waste Facilities", IT3'05 Conference, May 2005, Texas, USA.
2004	Wilson, Jesse David, "Knowledge Of Reactive Chemicals Impacts The Safe Operations Of Hazardous Waste Incineration Facilities", The 3rd International

Conference on Combustion, Incineration/Pyrolysis and Emission Control (3rd i-CIPEC), October 21-23, 2004, Zhejian University, Hangzhou, China.

2004 Wilson, Jesse David, "pH Control Understanding For Improved Acid Gas And Halogen Scrubbing", IT3'04 Conference, May 10-14, 2004, Phoenix, Arizona.

2004 Wilson, Jesse David, "Incineration Design Limitations", IT3'04 Conference, May 10-14, 2004, Phoenix, Arizona.

1995 "Update of Dioxin and Chlorine Feeds Study", presented to EPA Staff for ASME, Washington, DC

1995 "Dioxin and Chlorine Feed Relationships for Incinerators", presented to EPA Staff for The Dow Chemical, Washington, DC

1994 "Relevance of Chlorine in Dioxin Formation for Kinetically Controlled Combustion Devices", Poster Session, 14th International Symposium on Chlorinated Dioxins, PCB and Related Compounds, Kyoto, Japan, Townsend, D., Park, C., Wilson, J. D.

1994 "Future Hazardous Waste Incinerator Emissions Standards-What is Expected and What Timetable?" Ford, Bacon & Davis Technical Session, Salt Lake City, Utah, Wilson, J. D., Barber, S.

1994 "Mechanisms of Formation of PCDD/PCDF from Hazardous Waste Incinerators", presented to EPA Dioxin Reassessment Team for The Dow Chemical, Washington, DC, Wilson, J.D., Townsend, D., Park, C.

1993 "Waste Water Treatment and Purification Steps", Sciences for Native Americans, South Dakota School of Mines and Technology, Rapid City, South Dakota, Wilson, J. D.

1992 "Incineration of Industrial Waste", Sciences for Native Americans, South Dakota School of Mines and Technology, Rapid City, South Dakota, Wilson, J. D.

1980 "Incineration and Incinerators", given at the seminar on Biological and Chemical Safety in the Research Laboratory, for the American Association of Laboratory Animal Science, Kalamazoo, Michigan, Wilson, J. D.

1968 "Vent Gas Sampling and Analysis at the Midland Division, The Dow Chemical Company", 55th General Motors Spectrographic Conference, General Motors Research Laboratories, Warren, Michigan, Ilgenfritz,E.M., Shively.J.F., Wilson, J. D.

PROFESSIONAL SOCIETIES:

American Chemical Society
Air and Waste Management Association
Subcommittee member for ASME Research Committee on Industrial and Municipal Wastes

DOW MANAGEMENT TRAINING COURSES:

1969	Labor Relations
1968	Modern Supervisors Techniques
	Creative Problem Solving
	Management by Objectives
	Job Performance Review
	Developing Communication Skills
1967	Operations Improvement Management Course
	Safety for the Supervisor
	Effective Listening
	Front Line Supervisors Course
	Economic Evaluation Familiarization

Attachment B: Questionnaire

Conflict of Interest and Bias Questionnaire for Comparable Emissions Peer Review

Instructions to Candidate Reviewers

1. Please check one YES/ NO/ DON'T KNOW response for each question.
2. If your answer is YES or DON'T KNOW please provide a brief explanation of the circumstances. We do not desire a lengthy response on this form at this time. We will contact you for additional information as needed.
3. Please make a reasonable effort to accurately answer each question. For example, to the extent a question applies to individuals (or entities) other than you (e.g., spouse, dependents, or their employers), we expect you to make a reasonable inquiry, such as e-mailing the questions to such individuals (or entities) in an effort to obtain the information needed to accurately answer the questions.

Questions

1. Are you (or your spouse or dependents) or your current employer, an author, contributor, or an earlier reviewer of the document(s) being reviewed by this panel?

   YES__ NO__ DON'T KNOW__

2. Do you (or you spouse or dependents) or your current employer have current plans to conduct or seek work related to the subject of this peer review following the completion of this peer review panel?

   YES__ NO__ DON'T KNOW__

3. Do you (or your spouse or dependents) or your current employer have any known financial stake in the outcome of the review (*e.g.*, investment interest in a business related to the subject of peer review)?

   YES__ NO__ DON'T KNOW__

4. Have you (or your spouse or dependents) or your current employer commented, reviewed, testified, published, made public statements, or taken positions regarding the subject of this peer review?

   YES__ NO__ DON'T KNOW__

5. Do you hold personal values or beliefs that would preclude you from conducting an objective, scientific evaluation of the subject of the review?

   YES__ NO__ DON'T KNOW__

6. Do you know of any reason that you might be unable to provide impartial advice or comments on the subject review of the panel?

   YES__ NO__ DON'T KNOW__

7. Are you aware of any other factors that may create potential conflict of interest or bias issues for you as a member of the panel?

   YES__ NO__ DON'T KNOW__

Acknowledgement

I declare that the disclosed information is true and accurate to the best of my knowledge, and that no real, potential, or apparent conflict of interest or bias is known to me except as disclosed. I further declare that I have made reasonable effort and inquiry to obtain the information needed to answer the questions truthfully, and accurately. I agree to inform SRC promptly of any change in circumstances that would require me to revise the answers I have provided.

____________________ ____________

Candidate Signature Date

Attachment C: Panel Member 1, Ronald Bastian, comments

Draft Charge Questions for Peer Review

PEER REVIEW by Ronald Bastian: RATIONALE FOR EXCLUSION OF EMISSION-COMPARABLE FUEL

Overview:

EPA has established specifications for comparable fuels in Table 1 to §261.38. Comparable fuels meeting the prescribed specifications are not solid wastes, and hence not hazardous wastes, provided they are burned in specified units.

This peer review was conducted because the EPA is considering an expansion of the comparable fuel exclusion for fuels that are produced from hazardous waste but which are believed to generate emissions that are comparable to emissions from burning fuel oil when such fuels are burned in an industrial boiler operating under good combustion conditions. Such excluded fuel would be called emission-comparable fuel (ECF). ECF would be subject to the same specifications that currently apply to comparable fuels, except that the specifications for certain hydrocarbons and oxygenates would not apply. The ECF exclusion would be conditioned on requirements including design and operating conditions for the ECF boiler to ensure that the ECF is burned under the good combustion conditions the EPA believes to be typical for oil-fired industrial boilers.

EPA provided available data and information they believe indicate that emissions from burning ECF under the proposed, prescribed conditions would be comparable to emissions from an oil-fired industrial watertube steam boiler operating under good combustion conditions. In addition, the EPA believes that the ECF boiler design and operating conditions would ensure that toxic organic emissions would be comparable to emissions that would result if the waste fuel were burned in a “hazardous waste boiler”—a boiler subject to the RCRA requirements of Subpart H, Part 266, or the CAA requirements of Subpart EEE.

Given that the analyses and information evaluated by EPA provide a principle component of the rationale for the proposed exclusion of ECF and, as such, are influential scientific information, a peer review of these findings was requested by EPA and is provided in this review.

Charge:

- **<u>Question 1</u>: Based on the supporting documents provided, is there reason to conclude that the types and concentrations of emissions of organic compounds from burning ECF in the specified industrial boilers under the specified operating conditions are likely to be significantly different from the types and concentrations of organic emissions from burning the same waste fuel in an industrial boiler under the RCRA requirements of Subpart H, Part 266, or the MACT/CAA requirements of Subpart EEE of Part 63.**

This review will provide reasoning to expect the types and concentrations of emissions from the specified industrial boilers from burning ECF ***could*** *be different from the types and concentrations of organic emission from burning the same waste fuel in an industrial boiler under the RCRA retirements of Subpart H, Part 266, or the MACT/CAA requirements of Subpart EEE of Part 63. The primary reason for this is that the proposed regulatory operating requirements although comparable could be less stringent for the specified industrial boilers than for most of the RCRA or MACT/CAA regulated hazardous waste units. In addition, the comparable compliance demonstration requirements for the specified industrial boilers are only comparable to RCRA or MACT/CAA regulated boilers that qualify for destruction and removal efficiency (DRE) demonstration waiver under (§ 266.110). The emission data comparison was not restricted to industrial boilers burning hazardous waste that would have qualified for this waiver. It included industrial boilers that would have demonstrated compliance with other RCRA, MACT/CAA requirements, including risk assessment trial burns that likely resulted in additional regulatory oversight.*

- **Question 2: Based on the supporting documents provided, is there reason to conclude that burning ECF in the specified industrial boilers under the specified operating conditions would result in either: (1) higher than trace levels (e.g., >10-50 ug/dscm) of organic compounds other than those that may be emitted from burning either fuel oil or natural gas in an industrial boiler operating under typical good combustion conditions; or (2) significantly higher concentrations of the types of organic compounds that may be emitted from burning either fuel oil or natural gas in an industrial boiler operating under typical good combustion conditions.**

  This review will provide reasoning to conclude that it would be expected that organic compounds other than those that may be emitted from burning either fuel oil or natural gas in an industrial boiler operating under typical good combustion conditions would be present. The concentrations of some of the compounds would likely exceed trace quantities. However, concentrations would depend on the specific compounds present in the feed, the concentration and mass feed rate of these compounds, and the size and resulting stack gas flow rate of the specific boiler unit. It would also be possible that higher concentrations of the types of organic compound normally emitted from burning either fuel oil or natural gas in an industrial boiler could occur. Whether the increase in concentration of the emission is significant would depend on the same three items that qualify the previous statement (specific compounds present in the feed, concentration of these compounds in the ECF feed, and the size of the specific unit).

Background:

EPA provided the following background information:

- Special conditions of the exclusion would include the following design and operating conditions for the ECF burner:
  1. The burner must be a watertube steam boiler other than a stoker-fired boiler;

2. Carbon monoxide (CO) must be monitored continuously, must be linked to an automatic ECF feed cutoff system, and must not exceed 100 ppmv on an hourly rolling average (corrected to 7% oxygen);
3. The boiler must fire at least 50% primary fuel on a heating value or volume basis, whichever results in a higher volume of primary fuel, and the primary fuel must be fossil fuel or tall oil with a heating value not less than 8,000 Btu/lb;
4. The boiler load must be 40% or greater;
5. The ECF must have an as-fired heating value of 8,000 Btu/lb or greater;
6. ECF must be fired into the primary fuel flame zone;
7. The ECF firing system must provide proper atomization;[7] and
8. If the boiler is equipped with an electrostatic precipitator (ESP) or fabric filter (FF) and does not fire coal as the primary fuel, the combustion gas temperature at the inlet to the ESP or FF must be continuously monitored, must be linked to the automatic ECF feed cutoff system, and must not exceed 400°F on an hourly rolling average.

It is noted that the above operating conditions are similar but slightly more restrictive than RCRA, MACT/CAA industrial boilers that qualify for Waiver of DRE trial burn for boilers (§ 266.110). However, these conditions are not necessarily more restrictive than most RCRA units that would likely have been included in the "Risk Burn" emissions data evaluated by EPA and provided for this review.

- The specification levels in Table 1 to §261.38 would not apply to the following hydrocarbons and oxygenates:
  1. Benzene (CAS No. 71-43-2)
  2. Toluene (CAS No. 108-88-3)
  3. Acetophenone (CAS No. 98-86-2)
  4. Acrolein (CAS No. 107-02-8)
  5. Allyl alcohol (CAS No. 107-18-6)
  6. Bis(2-ethylhexyl)phthalate [Di-2-e thylhexyl phthalate] (CAS No.117-81-7)
  7. Butyl benzyl phthalate (CAS No. 85-68-7)
  8. o-Cresol [2-Methyl phenol] (CAS No. 95-48-7)
  9. m-Cresol [3-Methyl phenol] (CAS No. 108-39-4)
  10. p-Cresol [4-Methyl phenol] (CAS No.106-44-5)
  11. Di-n-butyl phthalate (CAS No. 84-74-2)
  12. Diethyl phthalate (CAS No. 84-66-2)
  13. 2,4-Dimethylphenol (CAS No. 105-67-9)
  14. Dimethyl phthalate (CAS No. 131-11-3)
  15. Di-n-octyl phthalate (CAS No. 117-84-0)
  16. Endothall (CAS No. 145-73-3)
  17. Ethyl methacrylate (CAS No. 97-63-2)
  18. 2-Ethoxyethanol [Ethylene glycol monoethyl ether] (CAS No. 110-80-5)
  19. Isobutyl alcohol (CAS No. 78-83-1)
  20. Isosafrole (CAS No. 120-58-1)

[7] The acceptable atomization systems are air, steam, mechanical, or rotary cup atomization systems. The as-fired ECF must pass through a 200 mesh screen.

21. Methyl ethyl ketone [2-Butanone] (CAS No. 78-93-3)
22. Methyl methacrylate (CAS No. 80-62-6)
23. 1,4-Naphthoquinone (CAS No. 130-15-4)
24. Phenol (CAS No. 108-95-2)
25. Propargyl alcohol [2-Propyn-1-ol] (CAS No. 107-19-7)
26. Safrole (CAS No. 94-59-7)

- The ECF firing rate would be restricted for benzene and acrolein:
  - If the as-fired concentration of benzene or acrolein in the emission-comparable fuel exceeds 2% by mass, the firing rate of ECF could not exceed 25% of the total fuel input to the boiler on a heat or volume input basis, whichever results in a lower volume input of ECF.

Supporting Documents Discussion:

- **Discussion of the Summary of Analysis of Emissions Data**

In the absence of emissions data from boilers burning ECF, EPA evaluated organic emissions data from watertube steam boilers burning hazardous waste and compared those emissions with emissions from oil-fired industrial boilers. EPA proposed that using hazardous waste boiler emissions as a surrogate for ECF boiler emissions is a reasonable worst-case because the exclusion would be conditioned on the ECF boiler operating under conditions relating to assuring good combustion conditions that are at least as stringent as those required of boilers burning hazardous waste. The EPA states that "The CO controls for ECF boilers plus the requirement to fire ECF into the primary fuel flame zone **are equivalent** to the controls on organic emissions for hazardous waste boilers--CO controls and compliance with the 99.99% destruction and removal efficiency (DRE) standard. *(Note: this would only be true for boilers that qualify for the waiver under § 266.110. Otherwise, most of the boilers would also have operating limits on combustion chamber temperature and maximum production rate or flue gas flow rate which relate to good combustion conditions and organic constituent emission control. In addition, these boilers that do not qualify for the DRE waiver would likely have been required to conduct emission testing for risk assessment evaluation ("Risk Burns"). The testing could have resulted in additional operating conditions for the control of organic emissions.)* The EPA feels that the other ECF boiler controls are more restrictive than controls that apply to hazardous waste boilers, but are appropriate to help assure that an ECF boiler operates under good combustion conditions given that ECF would be burned under a conditional exclusion absent a RCRA permit and the regulatory oversight typical for a RCRA hazardous waste combustor, and absent the extensive operating limits (e.g., combustion chamber temperature, maximum load) that are established subsequent to emissions testing to demonstrate compliance with a destruction and removal efficiency (DRE) standard. *(Note: the proposed operating conditions are identical to those required of hazardous waste boilers operating under § 266.110, with the exception of a slightly more restrictive viscosity specification and as the EPA states the proposed limits are less restrictive than those imposed on hazardous waste boilers not qualifying for operation under § 266.110. Therefore one cannot conclude that "other ECF boiler controls are more restrictive than controls that apply to hazardous waste boilers.")*

The EPA obtained organic emissions data for 26 hazardous waste watertube steam boilers which **data were generated during risk-burn testing** required under RCRA omnibus authority codified at §270.32(b)(2). **EPA requires this testing as necessary on a site-specific basis to ensure that emissions are protective of human health and the environment.** These data included 28 test conditions for the 26 boilers that provide 175 detected measurements of organic compounds, where a measurement is a three-run set. (*Note this is an average of three test runs*.) EPA also had data for hazardous organic compounds emitted from oil-fired industrial boilers. Those data were compiled in support of the NESHAP for Industrial, Commercial, and Institutional Boilers and Process Heaters promulgated under Part 63, Subpart DDDDD. EPA used oil-fired industrial boiler emissions data for comparison because fuel oil is the closest analogous fuel to ECF, and ECF could be burned only in industrial or utility boilers.

The above emissions data resulted in comparable emissions for 26 toxic organic compounds that were present in the results for both hazardous waste boilers and oil-fired industrial boilers. The EPA compared the average emission (average of three test runs) of these 26 toxic organic compounds from the hazardous waste boilers to the 95th percentile level of the individual run data of the same compound's emission level from the fuel oil- fired industrial boilers. *(Note: A more valid comparison would seem to be the 95th percentile level of* ***the test run average data*** *instead of the individual test run data from the fuel-oil fired industrial boilers (a more "apples to apples" comparison). However, because of the limited amount of data available, the results of the comparison may be similar.)* As compared, the data show four organic compounds where the emissions from both the hazardous waste boilers and oil-fired industrial boilers would be classified as greater than trace levels (>10-50 ug/dscm), acetaldehyde, benzene, formaldehyde, and toluene (See Table 3-3 of Technical Support Document). Of these four compounds benzene is the most significant in that six of the hazardous waste units show test run average data that exceed the "EPA established industrial boiler benchmark", the 95th percentile level of the industrial boiler individual run test data. This is not surprising in that benzene is a likely product of incomplete combustion from burning aromatic organic compounds. Acetaldehyde and toluene each have one test run average data point that exceed the 95th percentile level of the industrial boiler individual run test data for that compound. Formaldehyde emissions data show one test run average data point that is near the 95th percentile level of the industrial boiler individual run test data. Since this average data is near the benchmark, it is possible that individual run(s) could have exceeded the benchmark although the average of the three runs did not. *(Note, the comparison of a test run average to individual run data means that three times the number of data points likely exceed the industrial boiler benchmark (18 benzene ,3 acetaldehyde, and 3 toluene).* The EPA explains these data (See Table 3-4 of the Technical Support Document), with the exception of formaldehyde (they did not determine this to be an "exceedence" of the benchmark). *The explanations basically justify either through data issues (e.g., compound in the blank), comparison to firing other fossil fuel (natural gas) in the tested industrial boilers, or differences in feed and operating conditions in the hazardous waste boilers (lower hazardous waste feed heating value and higher viscosity than the proposed ECF operating limitation) that the higher emissions of these compounds, although measured, would not be likely in ECF-fired industrial boilers. Although these explanations seem valid, for the most part, for this specific data, they point out that emission measurements could occur that would exceed the benchmark emissions level.* Finally the EPA qualifies the evaluation by stating. **"Notwithstanding this analysis of available emissions data, we acknowledge that,**

when ECF with higher concentrations of certain hydrocarbons and oxygenates than fuel oil is burned even under good combustion conditions, emissions of toxic organics may be somewhat higher than those from burning fossil fuel. This is because combustion is generally a percent-reduction process." The EPA goes on to conclude that these increases would be *de minimis* because operating under the good combustion conditions proposed for ECF boilers **ensures** that emissions of toxic organic compounds would generally be at trace levels (or, for compounds that are present as significant concentrations (e.g., benzene, acetaldehyde) ECF emissions would be comparable to fuel oil or gas emissions). *This evaluation and conclusion suggests that some demonstration of the expected emission, from each boiler intending to feed ECF would be warranted as one cannot ensure that the expected emission of the 26 organic chemicals allowed in the ECF feed would necessarily result in de minimis emissions. This demonstration could initially be a calculation based on 99.99% DRE (or possibly 99.999% since most DRE testing has shown this result) and if the expected levels of emission are within the benchmark concentrations (or at de minimis levels above the benchmark), no further demonstration would be required. If expected levels were above that benchmark level, either a screening risk evaluation, and possibly emission testing to establish actual emission levels, would be appropriate before allowing the ECF to be fed.*

In addition, the hazardous waste boiler emissions data included another 33 toxic organic compounds for which there were not comparable emissions data for the oil-fired boilers. As shown in Table 3-5 of the Technical Support Document, these emissions are at *de minimis* levels with the exception of four compounds (acetophenone, phenol, bis(2-ethylhexly)phthalate, and chloroform). For these four compounds EPA identified statistical outlier data for acetophenone and phenol concluding that the remaining emission level was then *de minimis*. Emissions of bis(2-ethylhexyl)phthalate and chloroform were explained to be above *de minimis* due to operating conditions being less stringent than those proposed for ECF-fired industrial boilers and/or the compound, bis(2-ethylhexly)phthalate, being a common laboratory contaminant. *Although these explanations are valid for this specific data, they again point out that emission measurements could occur that would exceed the benchmark emissions level and as EPA qualified, ECF with higher concentration of certain hydrocarbons and oxygenates than fuel oil will likely emit higher concentrations of those compounds in the stack gas because combustion is generally a percent-reduction process. This evaluation and conclusion suggests that some demonstration of the expected emission, from each boiler intending the feed ECF would be warranted as described above.*

- **Discussion of EPA's Rationale For The Conditions On ECF Burners**

The EPA has determined operating conditions that would be imposed on industrial boilers feeding ECF. The ECF exclusion would be conditioned on feeding to boilers operating under "good combustion conditions". These ECF operating conditions would ensure that the boiler maintains a hot, stable flame, and that ECF is properly atomized and fired into that flame. In addition, post-combustion conditions would minimize the potential for dioxin/furan formation by controlling the combustion gas temperature at the inlet to a dry particulate matter control device for boilers so-equipped. The following conditions are proposed:

(1) Unit must be a watertube steam boiler other than a stoker-fired boiler

(2) Carbon monoxide (CO) must be monitored continuously, must be linked to an automatic ECF feed cutoff system, and must not exceed 100 ppmv on an hourly rolling average (corrected to 7% oxygen)
(3) Unit must fire at least 50% primary fuel on a heat input or volume basis, whichever results in a higher volume of primary fuel, and the primary fuel must be fossil fuel or tall oil with a heating value not less than 8,000 Btu/lb
(4) Boiler load must be 40% or greater
(5) ECF must have an as-fired heating value of 8,000 Btu/lb or greater
(6) ECF must be fired into the primary fuel flame zone
(7) ECF firing system must provide proper atomization
(8) Units equipped with an electrostatic precipitator (ESP) or fabric filter (FF) (with the exception of coal-fired) must continuously monitor the combustion gas temperature at the inlet to the ESP or FF, and must be link this monitored temperature to the automatic ECF feed cutoff system, not to exceed 400°F on an hourly rolling average.

The EPA feels that the above conditions are consistent with oil-fired industrial boiler design and operating **conditions that ensure good combustion (and post-combustion control of dioxin/furan) and ensure that emissions from burning ECF are comparable to fuel oil emissions.**

This section of the review will discuss further whether EPA's conclusions about these operating conditions as they relate to the reviewer's charge are shared by the reviewer.

In the reviewer's experience, control of CO at or below 100 ppmv on an hourly rolling average (corrected to 7% oxygen) is a key component of minimizing organic emission and operating under "good combustion conditions". EPA's conclusion that DRE testing can be waived under this operating condition and the others listed ((3) – (7) above) is valid based on the information presented by their "Rationale for Conditions" and on regulatory requirements for hazardous waste boilers that operate under the DRE waiver in *§ 266.110.* The proposed operating conditions are consistent with preventing DRE failure. It is noted that hazardous waste boilers that do not operate under this waiver would likely have additional operating conditions relative combustion chamber temperature, maximum stack gas flow rate or production rate and/or other parameters specific to the individual units. EPA is relying on conditions (3) – (6) above to maintain good combustion conditions rather than alternative conditions that are required by the hazardous waste units that operate under RCRA, MACT/CAA but do not qualify waiver of the DRE performance test. *Although EPA's reliance on operating conditions (3) – (6) may be valid, these conditions are not the same as RCRA, MACT/CAA conditions and may or may not be more stringent. It is difficult to make this judgment without evaluation of the specific units where ECF will be fired, how these operating conditions will be continuously demonstrated, what quality assurance and quality control will be required on the associated instrumentation, and what the associated waste feed analysis requirements will be. Very specific requirements in each of these areas would apply the ECF fired into RCRA, MACT/CAA regulated units.*

Relative to the post-combustion control for dioxin/furan, the proposed operating condition is consistent with that proposed for hazardous waste units where it has been successful in controlling emissions for most units. *The exemption EPA proposes for coal-fired units needs* *further qualification to assure that the expected concentration of sulfur in the stack gas for an individual unit is at or above that concentration the EPA has data to show the sulfur to be an inhibitor of the dioxin/furan. If there is not significant data to show this inhibition, a one-time emission test would be suggested or an acceptance by the coal-fired unit of operating condition (8) that is required of non-coal-fired boilers.*

Relative to emissions from ECF burning being comparable to fuel oil emissions, both the proposed operating conditions and the level of each organic component in the ECF feed would affect the conclusion of whether the emissions from ECF burning would be comparable to fuel oil emissions. *Based on the presentation of information by EPA as described in the above two paragraphs, one can conclude that the proposed operating conditions **could** ensure good combustion conditions. However, as reviewed under the Discussion of the Summary of Analysis of Emission Data, one cannot necessarily conclude that these operating conditions would result in emissions of the 26 specific organic compounds allowed to be present in the ECF that are comparable without conducting unit-specific screening..* It is noted that EPA proposes additional feed restrictions on ECF containing benzene and acrolein that would help to approach comparability for these two compounds.

- **Discussion of the Technical Support Document for Comparable Emissions Peer Review**

The Technical Support document for Comparable Emissions Peer Review provided information used in the above discussions.

Section 1

Section 1 of the document provides background information on industrial boilers, the types of fuels typically used, the heat transfer configuration, the burner design, and expected emissions. *Emission data evaluated is **limited** as it contained emissions information from fewer than 2000 of the 57,000 industrial, commercial and institutional (ICI) boilers operating*. The most common data available was CO data. However, much of that data (75%) was not measured using a continuous emissions monitoring system (CEMS) as would be required for industrial boilers feeding ECF. All of the CO data for oil-fired only and coal/coke-fired only units show measured levels of CO less than 100 ppmv (See Table 1-3). Other units that could fire ECF (natural gas-fired, or coal/coke w gas fuel-fired) show a significant percentage of CO measurements above 100 ppmv (See Table 1-3). The EPA evaluates emissions of methane compared to the emissions of CO (See Figure 1-4). This evaluation shows 100 ppmv to be a conservative CO limit for control of methane emissions (an indicator of organic compound combustion efficiency). Limited data on dioxin/furan emissions is also presented. It shows very low emissions for the limited amount of data.

Based on the data and discussion presented in this section of the Technical Support Document it must be pointed out that *the comparative data from the ICI boiler database is from a limited number of these units and may or may not be representative of the ICI units that choose to feed ECF under the proposed exclusion*. Including more units in the database could increase or decrease the benchmark emissions levels developed and discussed in Section 3 of the Technical Support Document. Controlling CO emissions using a CEMS for ECF-fired units could actually improve the organic compound emissions levels used to establish the benchmark. If units firing natural gas utilize ECF as a fuel and control CO using a CEMS to less that 100 ppmv organic emissions levels may actually be better controlled in those units.

Section 2

This section of the document develops and supports the use of CO as and indicator of good combustion and a surrogate for organic HAP emissions. *The information presented supports the waiver of DRE testing as DRE failure has seldom occurred even when CO measurements exceed 100 ppmv.*

Section 3

This section of the document develops and presents the comparative emissions from oil-fired ICI boilers and hazardous waste-fired industrial boilers. Since emission data for ECF-fired ICI boilers does not exist, the EPA proposes that use of organic emissions data from watertube steam boilers (that were not stoker-fired) burning hazardous waste as a surrogate for ECF-fired ICI boilers. Data from the 27 boilers used in the comparison are listed in Table 3-1. As the title notes the selected emission data was collected during "Risk Burn Testing". *This essentially points out one of the difficulties in the assumption that the emissions are a good surrogate. From the standpoint of the types of fuels typically used, the heat transfer configuration, and the burner design the comparison is equal or conservative. However, from the standpoint of regulatory oversight and the safety of stack emissions the comparison may not be valid as the regulatory oversight for the ICI boilers may or may not be as extensive as that of the RCRA/MACT/CAA industrial boilers feeding hazardous waste. Extensive risk evaluations have likely been conducted on these hazardous waste units both by the operators of the units and by the regulators. Without that same type of evaluation it is difficult to know whether ICI boilers that feed ECF would have acceptable comparable emissions. As discussed previously, it is suggested that emissions estimates, potentially a risk screen, and potentially emissions measurement would be warranted for the ICI boilers before ECF is allowed to be fed.* The data presented in 3-3, 3-4, and 3-5 was cited in the evaluations made in the discussion of the Summary of Analysis of Emissions Data.

Section 3.2 develops the EPA's rationale for control of dioxin/furan emissions from ECF-fired boilers. As with hazardous waste units the most dominant mechanisms for dioxin/furan formation in the combustion process equipment are the heterogeneous (gas-solid) condensation reactions between gas phase precursors and a catalytic particle surface and the de novo synthesis. The de-nova synthesis is heterogeneous surface-catalyzed reactions between carbon-containing particles and organic or inorganic chlorine. The key requirements for both of the formation mechanisms are the presence of chlorine or chlorinated organics in the fuel feed and particulate holdup in the temperature window of 400 – 750 ^{o}F. Since there may be some chlorine in both the primary fossil fuel and a limited amount in the ECF, chlorine or chlorinated organics will be present. For boiler units using a dry air pollution control device (APCD), particulate holdup could be in the critical temperature window unless monitoring and feed controls prevent this from occurring. *The EPA thus concludes a limit on the maximum temperature entering the APCD is warranted. However, they exempt coal-fired boilers because coal contains sulfur which inhibits this formation mechanism. Without the presentation of required sulfur concentration to inhibit the dioxin/furan formation one must question if this exemption for coal-*

fired units should not be qualified. A proposal is made in the discussion of the Rationale for the Conditions on ECF Burners presented above.

- **Key Conclusions and Recommendations of this Peer Review**

1. Since the EPA is proposing to allow 26 organic compounds to be present in the waste feed of an ECF-fired boiler one cannot conclude from either the data presented or from one's knowledge of the combustion process that emissions of these compounds will necessarily be *de minimis* because some residual of these compounds will remain in the stack gases even when that combustion unit is operated under good combustion conditions. *This evaluation and conclusion suggests that some demonstration of the expected emission, from each boiler intending to feed ECF would be warranted. This demonstration could initially be a calculation based on 99.99% DRE (or possibly 99.999% since most DRE testing has shown this result) and if the expected levels of emission are within the benchmark concentrations (or at de minimis levels above the benchmark), no further demonstration would be required.* ***If expected levels were above that benchmark level, either a screening risk evaluation, and possibly emission testing to establish actual emission levels, would be appropriate before allowing the ECF to be fed.***

2. The EPA used hazardous waste emission data from 27 boilers as a surrogate for ECF-fired boilers in their comparison. The data was collected during "Risk Burn Testing." EPA then suggested that some of these emissions, where they exceed benchmark emissions, would likely not occur in ECF-fired industrial boilers as the proposed conditions for firing ECF in these boilers are more restrictive than the conditions for firing and operating the hazardous waste boilers. *This review notes that the proposed operating conditions for ECF-fired industrial boilers are identical to those required of hazardous waste boilers operating under § 266.110, with the exception of a slightly more restrictive viscosity specification but,* ***as the EPA states, the proposed limits are less restrictive than those imposed on hazardous waste boilers not qualifying for operation under § 266.110. Therefore one cannot conclude that "other ECF boiler controls are more restrictive than controls that apply to hazardous waste boilers***.

3. The EPA relies heavily in their emission expectations on the proposed operating conditions for the ECF-fired industrial boilers. *Although EPA's reliance on these operating conditions may be valid, these conditions are not the same as RCRA, MACT/CAA conditions and may or may not be more stringent. It is difficult to make this judgment without evaluation of the specific units where ECF will be fired****, how these operating conditions will be continuously demonstrated, what quality assurance and quality control will be required on the associated instrumentation, and what the associated waste feed analysis requirements will be. Very specific requirements in each of these areas would apply the ECF fired into RCRA, MACT/CAA regulated units.***

4. Relative to the post-combustion control for dioxin/furan, the proposed operating condition is consistent with that proposed for hazardous waste units where it has been successful in controlling emissions for most units. ***The exemption EPA proposes for coal-fired units needs further qualification*** *to assure that the expected concentration of sulfur in the stack gas for an individual unit is at or above that concentration the EPA has data to show the sulfur to be an inhibitor of the dioxin/furan.* ***If there is not significant data to show this inhibition, a one-time emission test would be suggested or an acceptance by the coal-fired unit of the dry APCD inlet temperature limit required of non-coal-fired boilers.***

5. It is noted in the review that the emission data for the industrial boiler community was limited *as it contained emissions information from fewer than* ***2000 of the 57,000*** *industrial, commercial and institutional (ICI) boilers operating*. This reviewer concludes that because *the comparative data from the ICI boiler database is from a limited number of units it may or may not be representative of the ICI units that choose to feed ECF under the proposed exclusion*. Including more units in the database could increase or decrease the benchmark emissions levels developed by EPA and used in the comparison requested in this review.

Attachment D: Panel Member 2, Donald Corwin, comments

Draft Charge Questions for Peer Review

PEER REVIEW by Donald Corwin: RATIONALE FOR EXCLUSION OF EMISSION-COMPARABLE FUEL

Overview:

Comparable fuels are secondary materials (i.e., materials that otherwise would be hazardous wastes) which have fuel value and characteristics (i.e., physical properties related to burning, and levels of toxic constituent levels) comparable to those of fuel oil.

EPA has established specifications for comparable fuels in Table 1 to §261.38. Comparable fuels meeting the prescribed specifications are not solid wastes, and hence not hazardous wastes, provided they are burned in specified units.

We are considering a proposal to expand the comparable fuel exclusion for fuels that are produced from hazardous waste but which we believe generate emissions that are comparable to emissions from burning fuel oil when such fuels are burned in an industrial boiler operating under good combustion conditions. Such excluded fuel would be called emission-comparable fuel (ECF). ECF would be subject to the same specifications that currently apply to comparable fuels[8], except that the specifications for certain hydrocarbons and oxygenates would not apply. The ECF exclusion would be conditioned on requirements including design and operating conditions for the ECF boiler to ensure that the ECF is burned under the good combustion conditions typical for oil-fired industrial boilers.

We believe that available data and information indicate that emissions from burning ECF under the proposed, prescribed conditions would be comparable to emissions from an oil-fired industrial watertube steam boiler operating under good combustion conditions. In addition, we believe that the ECF boiler design and operating conditions would ensure that toxic organic emissions would be comparable to emissions that would result if the waste fuel were burned in a "hazardous waste boiler"—a boiler subject to the RCRA requirements of Subpart H, Part 266, or the CAA requirements of Subpart EEE. Given that these analyses and information provide a principle component of the rationale for the proposed exclusion of ECF and, as such, are influential scientific information, a peer review of these findings is appropriate.

Charge:

- <u>Question 1</u>: Based on the supporting documents provided, is there reason to conclude that the types and concentrations of emissions of organic compounds from burning ECF in the specified industrial boilers under the specified operating conditions are likely to be significantly different from the types and concentrations of organic emissions from

[8] See Table 1 to §261.38.

burning the same waste fuel in an industrial boiler under the RCRA requirements of Subpart H, Part 266, or the MACT/CAA requirements of Subpart EEE of Part 63.

- Response: The burning of a hazardous waste in a good combustion system other than a hazardous waste incinerator will produce comparable results as the hazardous waste units listed in the review. Several operational parameters must be incorporated into the review to assure that all of the appropriate parameters are included. The coal fired hazardous waste units need to be identified separately if coal boiler (no stokers) are to be considered as to be utilized for burning ECF. All of the baseline parameters of the hazardous waste units need to be incorporated to allow for analysis of potential operational limitations that may be needed in addition to the 100 ppm CO. While this is an excellent method of defining the total combustion capability of a unit, if the waste stream is a small percentage of the total firing rate, the CO from the ECF stream may be masked by the other fuel. The method of mixing the ECF with the other fuel is extremely important and should be incorporated into the analysis.
- Question 2: Based on the supporting documents provided, is there reason to conclude that burning ECF in the specified industrial boilers under the specified operating conditions would result in either: (1) higher than trace levels (e.g., >10-50 ug/dscm) of organic compounds other than those that may be emitted from burning either fuel oil or natural gas[9] in an industrial boiler operating under typical good combustion conditions; or (2) significantly higher concentrations of the types of organic compounds that may be emitted from burning either fuel oil or natural gas in an industrial boiler operating under typical good combustion conditions.
- Response: The emissions from an ECF fuel will provide the same proximal emissions as a distillate or natural gas system if the atomization system is similar to the ones utilized in the hazardous waste units and the geometry is equivalent. A well tuned boiler operating at a low oxygen concentration will have emission rates less than the standards shown in the AP42 listing. The hourly variation in the fuel must be kept at a minimum to assure stable flame pattern in the boiler to achieve these low emission rates.

Background:

- Special conditions of the exclusion would include the following design and operating conditions for the ECF burner:
  1. The burner must be (mounted on) a watertube steam boiler other than a stoker-fired boiler; is there an upper limit on the BTU release of the boiler that would eliminate large power plant boilers. The location of the ECF injector will be critical to the defining the combustion characteristics of the system. Proper location will insure the complete (better than documented) oxidization of organics in the feed stream. Poor location may meet the regulatory standard, but will not provide the optimum destruction/energy recovery of the ECF.
  2. Carbon monoxide (CO) must be monitored continuously, must be linked to an automatic ECF feed cutoff system, and must not exceed 100 ppmv on an hourly rolling average (corrected to 7% oxygen); a boiler typically operates at 2 to 3%

[9] Even if ECF emissions may be higher than fuel oil emissions for a particular compound (e.g., acetaldehyde), we would nonetheless conclude that ECF emissions would likely be comparable to industrial boilers burning clean (i.e., oil or gas) fossil fuels if the ECF emissions would not likely be higher than natural gas emissions.

oxygen. Incinerators with the lower heat value waste and other criteria generally operate at 5 to 9% oxygen. The heat transfer requirements of an incinerator are different from a boiler. This distinction should be part of the evaluation.

3. The boiler must fire at least 50% primary fuel on a heating value or volume basis, whichever results in a higher volume of primary fuel, and the primary fuel must be fossil fuel or tall oil with a heating value not less than 8,000 Btu/lb;
4. The boiler load must be 40% or greater;
5. The ECF must have an as-fired heating value of 8,000 Btu/lb or greater; is as fired determined at the point that it enters the burner or exits the nozzle. Can fuel oil or other materials be mixed with the ECF in a blending operation to obtain the BTU and other characteristics prior to it entering or exiting the burner nozzle. It appears that inline blending of a waste stream with a fuel stream would meet the requirements of this system. How will fuel blenders utilized this in a manner that is not appropriate.
6. ECF must be fired into the primary fuel flame zone; for a larger boiler with a large center section flame zone, will a completely separate injection of the ECF be within the bounds of this limitation.
7. The ECF firing system must provide proper atomization;[10] the injection system configuration was not provided in the review to allow for incorporation into the evaluation and
8. If the boiler is equipped with an electrostatic precipitator (ESP) or fabric filter (FF) and does not fire coal as the primary fuel, the combustion gas temperature at the inlet to the ESP or FF must be continuously monitored, must be linked to the automatic ECF feed cutoff system, and must not exceed 400°F on an hourly rolling average.
    a. Is the firing of this material in a pulverized coal industrial burner to be accepted.
    b. Will the grinding of the material to be less than the 200 mess allow solids to be injected through a slurry system.
    c. Will a new burner be allowed on a fired system to handle just the ECF stream independent of the existing burner? Need the fuels be co-fired through the existing fossil fuel burner?
    d. What limitations are there to be on the injection nozzles if any?
    e. Will there be a restriction on the firing of ECF in non-forced draft units. It appears that all of the data is from forced draft systems.
    f. Do any of the tested units utilize a rotary cup at the atomization device?
    g. For the fabric filter, if the existing system has high temperature bags and there is no chlorine in the ECF, why is there a temperature limit?
    h. The chlorine concentration in the ECF or the total feed to the boiler is not defined in the package provided.

- The specification levels in Table 1 to §261.38 would <u>not</u> apply to the following hydrocarbons and oxygenates:
    27. Benzene (CAS No. 71-43-2)
    28. Toluene (CAS No. 108-88-3)
    29. Acetophenone (CAS No. 98-86-2)

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[10] The acceptable atomization systems are air, steam, mechanical, or rotary cup atomization systems. The as-fired ECF must pass through a 200 mesh screen.

30. Acrolein (CAS No. 107-02-8)
31. Allyl alcohol (CAS No. 107-18-6)
32. Bis(2-ethylhexyl)phthalate [Di-2-e thylhexyl phthalate] (CAS No.117-81-7)
33. Butyl benzyl phthalate (CAS No. 85-68-7)
34. o-Cresol [2-Methyl phenol] (CAS No. 95-48-7)
35. m-Cresol [3-Methyl phenol] (CAS No. 108-39-4)
36. p-Cresol [4-Methyl phenol] (CAS No.106-44-5)
37. Di-n-butyl phthalate (CAS No. 84-74-2)
38. Diethyl phthalate (CAS No. 84-66-2)
39. 2,4-Dimethylphenol (CAS No. 105-67-9)
40. Dimethyl phthalate (CAS No. 131-11-3)
41. Di-n-octyl phthalate (CAS No. 117-84-0)
42. Endothall (CAS No. 145-73-3)
43. Ethyl methacrylate (CAS No. 97-63-2)
44. 2-Ethoxyethanol [Ethylene glycol monoethyl ether] (CAS No. 110-80-5)
45. Isobutyl alcohol (CAS No. 78-83-1)
46. Isosafrole (CAS No. 120-58-1)
47. Methyl ethyl ketone [2-Butanone] (CAS No. 78-93-3)
48. Methyl methacrylate (CAS No. 80-62-6)
49. 1,4-Naphthoquinone (CAS No. 130-15-4)
50. Phenol (CAS No. 108-95-2)
51. Propargyl alcohol [2-Propyn-1-ol] (CAS No. 107-19-7)
52. Safrole (CAS No. 94-59-7)

- The ECF firing rate would be restricted for benzene and acrolein:
    - If the as-fired concentration of benzene or acrolein in the emission-comparable fuel exceeds 2% by mass, the firing rate of ECF could not exceed 25% of the total fuel input to the boiler on a heat or volume input basis, whichever results in a lower volume input of ECF.

Supporting Documents

- Summary of Analysis of Emissions Data
- Technical Support Document for Comparable Emissions Peer Review

TECHNICAL SUPPORT DOCUMENT FOR COMPARABLE EMISSIONS PEER REVIEW[11]
(January 16, 2007)

		1,1,1-Trichloroethane	2-Methylnaphthalene	Acenaphthene	Acetaldehyde	Acrolein	Anthracene	Benz(a)anthracene	Benzene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(b,k)fluoranthene	Benzo(g,h,i)perylene	Chrysene
	CAS	71-55-6	91-57-6	83-32-9	75-07-0	107-02-8	120-12-7	56-55-3	71-43-2	50-32-8	205-99-2	56832-73-6	191-24-2	218-01-9
	MW	133	142	154	44	56	178	228	78	252	252	252	276	228
AP 42 Emission Factors	lb/1000 gal	2.4E-04		2.1E-05			1.2E-06	4.0E-06	2.1E-04			1.5E-06	2.3E-06	2.4E-06
	ug/dscm @ 7% O2	1.8		0.16			0.009	0.031	1.7			0.011	0.018	0.018
Industrial Boiler Database Emissions (ug/dscm @7%O2)	# of runs	5	32	26	5	3	19	6	32	1	4	4	6	14
	Average	1.4	0.15	0.21	48.1	18.2	0.03	0.14	20.2	0.005	0.01	0.07	0.08	0.09
	Min	0.52	0.01	0.00	10.0	17.7	0.002	0.05	0.4	0.005	0.01	0.05	0.03	0.012
	95%ile	2.2	0.92	0.73	70.5	18.9	0.08	0.28	133	0.005	0.02	0.10	0.17	0.23
	Max	2.3	1.45	0.94	71.3	19.0	0.11	0.28	198	0.005	0.03	0.10	0.17	0.32
HWC Boiler Average Emissions by source-(detects only) (ug/dscm @ 7% O2)	1000	ND	ND	ND	NM	NM	ND	ND	ND	ND	ND	ND	ND	ND
	1018	ND	ND	ND	99.9	6.61	ND	ND	43.7	ND	ND	ND	ND	ND
	2000	ND	ND	ND	NM	NM	ND	ND	ND	ND	ND	ND	ND	ND
	2007	NM	NM	0.02	NM	NM	0.03	0.004	28	0.01	NM	NM	NM	0.01
	2008C20	ND	0.07	ND	NM	NM	ND	ND	2.26	ND	ND	ND	ND	ND
	2008C21	NM	0.09	ND	NM	NM	ND	ND	NM	ND	ND	ND	ND	ND
	2012	ND	ND	ND	NM	NM	ND	ND	ND	ND	ND	ND	ND	ND
	2013	ND	ND	ND	NM	NM	ND	ND	193	ND	ND	ND	ND	ND
	2016	ND	ND	ND	NM	NM	ND	ND	ND	ND	ND	ND	ND	ND
	2021	ND	ND	ND	3.98	NM	ND	ND	0.4	ND	ND	ND	ND	ND
	720	ND	ND	ND	ND	7.14	ND	ND	4.9	ND	ND	ND	ND	ND
	721	ND	ND	ND	2.93	1.08	ND	ND	12.0	ND	ND	ND	ND	ND
	741C20	ND	0.51	0.01	NM	NM	0.01	ND	10.2	ND	ND	ND	0.002	ND
	741C21	ND	0.12	0.01	NM	NM	0.01	ND	16.6	ND	ND	ND	0.004	0.005
	753	0.40	ND	ND	NM	NM	ND	ND	1.9	ND	ND	ND	ND	ND
	756	ND	ND	ND	NM	NM	ND	ND	325	ND	ND	ND	ND	ND
	759	ND	ND	ND	NM	NM	ND	ND	157	ND	ND	ND	ND	ND
	760	ND	ND	ND	NM	NM	ND	ND	177	ND	ND	ND	ND	ND
	761	ND	ND	ND	NM	NM	ND	ND	13	ND	ND	ND	ND	ND
	767	ND	ND	ND	ND	ND	ND	ND	1	ND	ND	ND	ND	ND
	818	ND	0.40	ND	NM	NM	ND	ND	91	ND	ND	ND	ND	ND
	822	ND	ND	ND	NM	NM	ND	ND	189	ND	ND	ND	ND	ND
	828	0.16	ND	ND	NM	NM	ND	ND	7	ND	ND	ND	ND	ND
	833	ND	ND	ND	ND	NM	ND	ND	256	ND	ND	ND	ND	ND
	836	0.27	ND	ND	NM	NM	ND	ND	69	ND	ND	ND	ND	ND
	843	ND	1.01	0.12	NM	NM	0.21	0.20	ND	ND	ND	ND	ND	ND
	910	ND	ND	ND	22.11	ND	ND	ND	14	ND	ND	ND	ND	ND
	MERCK	ND	ND	ND	NM	NM	ND	ND	5.1	ND	ND	ND	ND	ND
	AVERAGE	0.27	0.37	0.04	32.23	4.94	0.06	0.10	63.3	0.01			0.00	0.01

		Dibenz(ah)anthracene	Dichloromethane (Methylene Chloride)	Ethylbenzene	Fluoranthene	Fluorene	Formaldehyde	Indeno(1,2,3-cd)pyrene	Naphthalene	o-Xylene	Phenanthrene	Pyrene	Toluene	Xylenes
	CAS	53-70-3	75-09-2	100-41-4	206-44-0	86-73-7	50-00-0	193-39-5	91-20-3	95-47-6	85-01-8	129-00-0	108-88-3	1330-20-7
	MW	278	85	106	202	166	30	276	128	106	178	202	92	106
AP 42 Emission Factors	lb/1000 gal	1.7E-06		6.4E-05	4.8E-06	4.5E-06	3.3E-02	2.1E-06	1.1E-03	1.1E-04	1.1E-05	4.3E-06	6.2E-03	
	ug/dscm @ 7% O2	0.013		0.49	0.038	0.035	256	0.02	8.77	0.85	0.081	0.033	48	
Industrial Boiler Database Emissions (ug/dscm @7%O2)	# of runs	6	5	5	33	36	54	6	72	5	58	28	32	3
	Average	0.03	37	0.41	0.14	0.08	335	0.07	40	0.66	0.21	0.07	58	2993
	Min	0.009	21	0.22	0.00	0.01	2.1	0.02	0.08	0.37	0.01	0.00	1.8	15
	95%ile	0.06	58	0.62	0.49	0.43	795	0.15	304	1.20	0.78	0.20	227	6196
	Max	0.06	61	0.66	0.94	0.64	9668	0.15	347	1.33	3.17	0.28	728	6624
HWC Boiler Average Emissions by source-(detects only) (ug/dscm @ 7% O2)	1000	ND	20	ND	ND	ND	NM	ND	ND	ND	ND	ND	22.8	NM
	1018	ND	2	0.39	ND	ND	659	ND	ND	ND	ND	ND	2.0	ND
	2000	ND	ND	ND	ND	ND	NM	ND	1.37	ND	0.48	ND	ND	ND
	2007	0.001	22	NM	NM	NM	NM	0.03	0.57	NM	NM	0.091	2.1	NM
	2008C20	ND	23	2.34	0.01	0.01	NM	ND	ND	ND	0.04	0.01	1.4	4.51
	2008C21	ND	NM	NM	0.01	0.01	NM	ND	0.12	NM	0.04	0.0117	NM	NM
	2012	ND	76	ND	ND	ND	NM	ND	ND	ND	ND	ND	39.0	ND
	2013	ND	58	ND	ND	ND	NM	ND	ND	ND	ND	ND	2.1	ND
	2016	ND	50	ND	ND	ND	NM	ND	ND	ND	ND	ND	4.1	ND
	2021	ND	3	ND	ND	ND	3.0	ND	ND	NM	ND	ND	0.3	ND
	720	ND	5	0.17	ND	ND	ND	ND	ND	0.24	ND	ND	2.0	0.40
	721	ND	109	ND	ND	ND	11.3	ND	ND	NM	ND	ND	0.9	ND
	741C20	ND	33	7.50	0.00	0.01	NM	ND	0.96	0.71	0.02	0.0028	62.8	2.54
	741C21	ND	462	0.53	0.03	0.01	NM	ND	2.41	0.61	0.19	0.0223	152.5	2.74
	753	ND	52	0.28	ND	ND	NM	ND	0.92	NM	0.26	ND	6.2	2.20
	756	ND	17	ND	ND	ND	NM	ND	1.12	ND	0.22	ND	ND	ND
	759	ND	1119	ND	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND
	760	ND	144	ND	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND
	761	ND	99	ND	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND
	767	ND	0.5	0.03	NM	NM	5.5	ND	0.48	0.05	ND	ND	0.9	0.11
	818	ND	108	ND	ND	ND	NM	ND	16.05	ND	0.46	ND	**852**	ND
	822	ND	10	ND	ND	ND	NM	ND	1.08	ND	ND	ND	6.9	ND
	828	ND	54	0.61	ND	ND	NM	ND	0.53	0.24	ND	ND	6.5	0.63
	833	ND	69	ND	ND	ND	23	ND	ND	ND	ND	ND	5.6	ND
	836	ND	18	0.20	ND	ND	NM	ND	3.04	0.31	0.13	ND	4.0	0.68
	843	ND	9	NM	0.27	1.19	NM	ND	12.25	NM	**2.36**	ND	ND	NM
	910	ND	7	ND	ND	0.23	113	ND	0.60	NM	0.44	ND	11.0	4.63
	MERCK	ND	24	ND	ND	ND	NM	ND	ND	NM	ND	ND	3.7	ND
	AVERAGE	0.00	100	1.34	0.06	0.24	135.85	0.03	2.96	0.36	0.42	0.03	56.6	2.05

Table 3-3: Toxic Organic Emissions from Hazardous Waste Boilers for Compounds for Which Emissions Data for Oil-Fired Industrial Boiler Are Available

11 These are excerpts from USEPA, "Draft Technical Support Document for Expansion of the Comparable Fuel Exclusion," May 2007.

3.1.3 Exceedances of Industrial Boiler Benchmark

Moreover, we note that only five of the 15 boilers had exceedances that were not suspect because of known or suspected lab contamination and that were at significant concentration levels. Four of the exceedances were for benzene and one was for acetaldehyde. None of those five boilers were operating under the conditions that would be required for ECF boilers, however. Although this is not unexpected because these boilers were not required to operate under those conditions, operating under combustion conditions less stringent than would required for ECF boilers could result in higher organic emissions. Three of these boilers burned hazardous waste fuel with a heating value of 2,000 Btu/lb or below while ECF must have an as-fired heating value of 8,000 Btu/lb. One boiler fired less than 20% primary fuel (natural gas) while ECF must be fired with at least 50% primary fuel. Is this a weight, volume or BTU basis. And, the hazardous waste fired in one boiler had virtually no heat content and had a viscosity of 165 cs, while ECF must have an as-fired viscosity of 50 cs.

3.2.3 PCDD/F Emissions from Boilers burning Hazardous Waste

We have nine test conditions for PCCD/F from units with wet APCDs. Two units measured PCDD/Fs greater than 0.4 ng TEQ/dscm. Both of these are fire tube units and one of them burns waste fuel containing 60% chlorine.

The Rubicon unit appears to be the NAB unit that had a very high nickel loading due to the process and is not representative of waste streams. This unit also has a separate combustor unit pryor to the watertube boiler. It is not typical of a boiler with the burner mounded on the boiler. It should be clarified as to the location of the burner relative to the radiant section of the boiler. The characterization of the waste stream should be incorporated into the analysis.

Attachment E: Panel Member 3, David Wilson, comments

Re: Peer Review of David Wilson:

Syracuse Research Corporation (SRC)

PEER REVIEW: RATIONALE FOR EXCLUSION OF EMISSION-COMPARABLE FUEL (ECF)

SRC Subcontract Number: FDO52.CF999
Reviewer David Wilson
Wilson Global Environmental Consultations
04/04/07

A peer review of five (5) documents provided by SRC was accomplished to answer the two charges in relation to "Rationale for Exclusion of Emission-Comparable Fuel" at the request of the Environmental Protection Agency (EPA). Appendix C, as referenced in "Technical Support Document for Comparable Emissions Peer Review", January 16, 2007, page 29, was not found in the documents given for review, thus this information is not addressed in this review.
The Charge given was:
Charge:

- Question 1: Based on the supporting documents provided, is there reason to conclude that the types and concentrations of emissions of organic compounds from burning ECF in the specified industrial boilers under the specified operating conditions are likely to be significantly different from the types and concentrations of organic emissions from burning the same waste fuel in an industrial boiler under the RCRA requirements of Subpart H, Part 266, or the MACT/CAA requirements of Subpart EEE of Part 63.

Based on the review of the five documents presented, a clear conclusion may be made that there will be no significant differences in the types and concentrations of organic emissions from burning ECF in the specified industrial boilers under the specified operating conditions under the RCRA requirements of Subpart H, Part 266, or the MACT/CAA requirements of Subpart EEE of Part 63.

The design and operating conditions presented in document A are far more restrictive than current industrial boiler design or operating standards. Based on professional experience, where carbon monoxide (CO) monitoring has been used for control purposes, emissions have been reduced and operational problems have been identified and then minimized. The EPA operating standard calls for CO values to be adjusted to 7% oxygen, but most of these types of industrial boilers operate at less than 4% oxygen for higher energy recovery. Thus, the operator will be reviewing the data for CO very carefully in real time to assure that operational problems are not being missed due to dilution to 7% oxygen by the EPA rolling hour average. The reviewer expects an extreme exponential learning curve for operations that begin using CO monitoring at their facilities.

Since the EPA standards require that an ECF boiler be at 50% primary fuel and above 40% load, the addition of ECF into the operating mode will not cause a sudden operational surge. Emissions may be reduced or maybe even lower than boilers only burning oil and or natural gas due to the tighter regulatory controls.

Since CO monitoring is required, the operator will learn quickly if flame quenching is taking place as the ECF is added into the flame zone and primary fuel is ramped back. Where quenching may be an issue, the CO monitoring will help in identifying this issue, and refractory lining extensions in the combustion zone may be added to reduce or eliminate these operational problems if found. Burner design changes that give better mixing and hot gas recycle in the flame zone are also viable ways of dealing with CO levels when above the operating EPA standard.

- Question 2: Based on the supporting documents provided, is there reason to conclude that burning ECF in the specified industrial boilers under the specified operating conditions would result in either: (1) higher than trace levels (e.g., >10-50 ug/dscm) of organic compounds other than those that may be emitted from burning either fuel oil or natural gas[12] in an industrial boiler operating under typical good combustion conditions; or (2) significantly higher concentrations of the types of organic compounds that may be emitted from burning either fuel oil or natural gas in an industrial boiler operating under typical good combustion conditions.

The extensive test burn results summaries, table summaries, and figure plots as given in the Documents B through E as indicated in the listing of documents for review, provid the basis for concluding that trace levels of organic compounds will not be higher when burning ECF than when burning fuel oil or natural gas. The document B provides a reasonable summary of the data basis, and explanation for values that may be above the EPA standards. The overriding professional conclusion of the reviewer is that CO monitoring, adding more refractory in some cases and burner design modifications will reduce any emission concerns below or to the same level as those facilities burning oil and or natural gas.

Most of the industrial boilers burning oil and or natural gas may or may not use oxygen monitoring for some type of control, but this measurement is in the percent range where as, CO monitoring will reveal operational changes much quicker than the oxygen monitoring. Many of the ECF boiler facilities who may not have a good oxygen monitor will have to install at least one extremely reliable one to be able to make the 7% oxygen correction for the hourly CO values. Improved combustion and thus reduced emissions would be expected by the reviewer from the instrumentation upgrades whether the boilers are burning ECF, oil and or natural gas.

The reviewer offers the following additional comments concerning the documents asked to be reviewed. Please note that these comments are not inclusive but only give some of the issues that EPA may want to address before going public with additional rule making. Viscosity units used in the documents use (cS), (cs) and in other places (cSt), both in discussions as well as tables.

Typos, incomplete sentences, words left out of the sentence or in the explanation were found in many of the document pages reviewed.
Acronym definitions are not given consistently in the documents.
References to reports or papers in some cases did not identify publication location or complete identifier.
Comments are given under each of these five documents where the reviewer felt it was warranted to do so.

Documents reviewed as titled by EPA were:

A. PEER REVIEW: RATIONALE FOR EXCLUSION OF EMISSION-COMPARABLE FUEL, 3 Pages

B. SUMMARY OF ANALYSIS OF AVAILABLE EMISSIONS DATA: DO AVAILABLE DATA AND INFORMATION SUPPORT A COMPARABLE EMISSIONS FINDING? (1-17-07), 4 PAGES

C. TECHNICAL SUPPORT DOCUMENT FOR COMPARABLE EMISSIONS PEER REVIEW (January 16, 2007), 36 Pages

Page 2-3 Fuel oil is indexed for discussion and review, but then on page 3 gasoline, page 4-5 oxygenates, and on page 5 coal are covered in the discussion. What is the point that EPA wants to make in support of the ECF rule making?
Page 7-8 EPA uses some very nice diagrams, but no references are given for where these diagrams came from.
Page 7-8 Firetube boilers are discussed, but EPA has already ruled them out for using ECF. What is the reason for spending time on subjects that are not related to ECF rule making?
On page 12, CO emissions for boilers burning solid/sludge are plotted. EPA may want to review the following three reports concerning emissions from these types of units for additional data comparisons.
Report 1- PCDD/PCDF Emissions from Coal Fired Power Plants, Riggs, Karen B. et al, Battelle, Columbus, OH., 15th International Symposium on Chlorinated Dioxins and Related Compounds, August 21-25, 1995, Edmonton, Canada, Volume 24, Page 51-54.
Report 2- A Comprehensive Assessment of Toxic Emissions from Coal-Fired Power Plants, Phase 1 Results, from the U.S. Department of Energy Study. Prepared for Pittsburgh Energy Technology Center, U.S. Department of Energy. September 1996.
Extensive emission data is given for many trace compounds in this report. The dioxin and furan emissions are not reported as the lab blanks were subtracted from the results found. This is contrary to the reporting of values that the EPA uses and requires from other emission sources. EPA sampling and analysis methods were used for this report, but emissions values are reported in values that the public does not use or understand.
This data base might help EPA develop risk burn data that is missing as indicated on page 20 of this document.
Report 3- The EPA National Air Quality and Emissions Trends Report, 2003 Special Study Edition, has Volatile Organic Compounds Emissions Estimates given in Table A-5 for coal, gas and oil. Later reports may be available. This data base may have actual emission tests which are not included in the current evaluations.

On page 16, CO vs DRE, no flame research data is discussed. Flame research data that does not have an actual flame does not represent what takes place in a combustion system at flame temperatures. For example, in the burner or the flame zone, inorganics become molten or are vaporized.

On page 36, two units are indicated as being above the PCDD/F's standard of 0.4 ng TEQ/dscm (at 7% O2 is left out of the sentence). On the table summary on page 35, three data points are given that are above this value. Is the EPA reporting on the number of units or on the number of data points?

No EPA discussion is given on page 36 for the data given in the table on page 35 for the boilers that have no air pollution control system.

D. Appendix A to the Technical Support Document for Comparable Emissions Peer Review: Supplement to CO/HC and DRE Evaluation, 15 pages

On page 8, Figure 3 at the bottom of the page is really Figure 4 as discussed on page 7. When this correction is made then the other figures in the following pages are not labeled correctly.

On page 10, the discussion of the Solutia data switches from degrees Fahrenheit operating conditions to a discussion and comparison of degrees Celsius at starved air conditions. In the opinion of this reviewer this is not good science, not a reliable way to try to explain these results and starved air does not represent good operating conditions.

On page 12, solid fuel boilers and HCl production furnaces are discussed together and data is shown in tables and figures on page 13. The EPA is referred back to comments given for report C concerning solid fuel units, i.e., coal.

The reviewer would not combine solid fuel boilers and HCl production furnaces data, but would report the information as two different unit operation systems.

Also, on page 12, no reference is given as to where this data came from or where it may be found for review.

No facility tracking numbers or test result numbers are listed for the plot on page 13.

E. WHAT IS THE RATIONALE FOR THE CONDITIONS ON ECF BURNERS? (3-15-07), 12 Pages

On page 1, "as discussed in the previous section" is stated, but the section is not identified. Also, the statement "can experience poor combustion conditions at lower loads" is stated, but no reference is given.

On page 2, item number 3 states "boilers clearly operating under poor combustion conditions, as evidence, for example, by smoke emissions, still achieved 99.99 percent DRE", but no reference is given.

On page 6, section 3., The Boiler Must Fire at Least 50% Primary Fuel, a good discussion is carried out for coal burning, but the EPA rule only currently applies to liquids. Again, on page 7, a good discussion is given for burning solids, i.e. subbituminous coal, which is not covered by the EPA rule making.