海外文献

有害廃棄物の焼却：現在までの推移の批判的レビュー（最終回）

Incineration of Hazardous Waste : A Critical Review Update

J. AIR and WASTE, Vol.43, pp.25-73 (1993)

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15. 結 論

有害廃棄物の燃焼に関する知見は、1980年以来急速に広がってきた。それらのレビューから焼却技術、現在の実施状況、モニタリング手法、排出物と性能、および公衆の健康への危険性について多くの結論を引き出すことができ、これ以外にも多くの問題のあることが明らかになった。

- (1) 焼却は、有害廃棄物処理のための利用可能な技術で、かなりの設計経験が存在する。これらの焼却のシステムの技術的な局面をカバーする設計と運転のための指導基準が利用できるようになっている。
- (2) 熱分解性有害廃棄物にたいする多様なプロセス技術が存在する。通常の燃焼炉の設計でも、4種の燃焼室設計方式の1つが組み込まれており、液体注入方式、ロータリーキルン、固定炉床、あるいは流動床である。通常の大気汚染防止システムは、燃焼ガスの冷却、ベンチュリスクラバー（粒子除去）、充填塔吸収装置（酸性ガス除去）およびミスト除去装置を備えている。しかし、より新しいシステムでは、さらに効率のよい大気汚染防止装置を備えており、静電集塵装置、イオン化湿式スクラバー、噴霧乾燥装置、布フィルターおよび管理システムである。
- (3) 有害廃棄物を燃やすことに関して、州の容量解析計画（the state Capacity Analysis Plans）から、最も新しい情報が得られる。この計画では1987年に全米で約130万トンの有害廃棄物が171カ所の焼却施設で焼却された。さらに、約120万トンの有害廃棄物が同じ時期にボイラーや産業用燃焼装置で燃やされたこと

を示している。

- (4) 4ポンドの塩化ダイオキシン化合物で汚染されたミズーリ州の土壌40トンの汚染除去に用いた移動焼却は成功裏に終り、実用可能な車載型や移動式の廃棄物焼却炉が増えている。1990年にスーパーファンド処分地の安定化に約15の会社が約30の装置を提案した。
- (5) 有害固形廃棄物法（HSWA）とスーパーファンド改正と再授權法（SARA）の施行により、産業界が長期間にわたる環境への責任にたいして関心を持つと同時に、増加する有害廃棄物を焼却施設へ向かわせることになった。現在の有害廃棄物の焼却処分量にたいして、国の容量は十分なようにみえるが、この容量は地理的に適切な分布にはなっていない。また、爆発物、「混合廃棄物」（資源保護回復法の廃棄物と放射性廃棄物の両方で汚染されたもの）あるいは固形および汚泥状のもののような特殊な廃棄物に対しては容量が不足している。
- (6) 微量の有機物を煙突からサンプリングする技術は比較的高度なもので、十分な経験と配慮が必要である。文書化されているサンプリング方法と分析方法は、焼却性能の評価に有効である。試験の適切な計画があれば、検出限界は焼却性能の評価にたいして制限要素とはならない。
- (7) 燃焼廃棄物（CO, CO₂, O₂, H₂, HCL, NO_x, 透過度）の連続的な排出監視が有効である。しかし、特定の有機化合物や金属に対する連続監視装置は未開発であり、分解除去効率（DRE）の監視機器もまだ利用できない。
- (8) 1980年代初期のEPA試験で、ある種の焼却炉は資源保護回復法（RCRA）対象の粒子状物質排出限度（180mg/dscm）の達成が困難であった。しかし現在では、この排出限度が達成可能になっている。

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- (9) 燃料として有害廃棄物を使用している大部分のプロセスでは、資源保護回復法(RCRA)の性能基準が達成できるようになっている。
- (10) 初期のボイラー試験では「ヒステリシス効果」がみられ、分解除去効率への大きな影響に関心が持たれた。その後の研究で、この効果はボイラーの分解除去効率の決定には殆ど影響のないことが判った。
- (11) 焼却システムにおける重金属の挙動と有害廃棄物燃焼炉の金属排出防止のための大気汚染防止装置の性能が判り、優れたプロセスが作られるようになった。燃焼プロセスでの金属の分離と回収効率の推定値が多くの大気汚染防止装置について示され、金属の蒸発湿度は金属の分離を予測する上で有効であることが示された。
- (12) 典型的な混乱や設計範囲外の運転条件での有害廃棄物焼却炉(HWI)の排出物は、正常運転の場合と大きな差がない。排出量を最小にするために、このような条件での廃棄物の投入禁止が許可証に示されることになっている。
- (13) 有害廃棄物焼却炉の燃焼副生成物排出量の測定結果から、排出物の吸入にたいするリスクアセスメントが行われ、人間の健康に与える危険性は非常に低いことが示された。限られた物質ではあるが、排出量データの比較から、焼却排出物はその性質も排出量も化石燃料燃焼排出物と良く似ており、危険性の観点から塩素を含まない低分子量の炭化水素であることが示された。
- (14) 現在のデータでは、有害廃棄物焼却炉の塩化ダイオキシンとフランの排出量はそれほど大きくなく、試験した施設で最も有害なダイオキシン異性体(2,3,7,8-TCDD(ジベンゾ-*p*-ダイオキシン))の排出が検出されることは殆どない。有害廃棄物焼却施設の全PCDD(ポリクロロジベンゾ-*p*-ダイオキシン)とPCDF(ポリクロロジベンゾフラン)排出量のレベルは、都市ごみ焼却炉や医療廃棄物焼却炉で報告されるものよりも低いことがある。有害廃棄物焼却炉のダイオキシン排出量測定結果に基づくリスクアセスメントでは、健康に許容出来ないほどの危険性をもたらすものではないことを示している。
- (15) 焼却炉と大気汚染防止装置に関するデータによれば、少量の有機化合物が焼却炉灰と大気汚染防止装置の残留物中に残っている。灰と残留物中の金属濃度は、焼却炉とプロセスの運転(スクラバー水の再利用や追加など)での金属投入量に依存して大きく変動する。残留物の毒性分離手順(Toxicity Characteristics

Leaching Procedure)による抽出物中の金属の大部分は、廃棄物を有害と定義する基準以下の濃度ではあるが、残留物の処分はより厳しい陸上処分規制(LDR)の対象となることがある。このことは、有害廃棄物の焼却で生成する残留物の一部成分は陸上処分基準の対象であるが、処分に先立って安定化や沈澱などの処理を必要とすることになる。

(16) 監視システムを組み合わせた焼却炉の性能を保証する一般的なプロセス制御システムがある。しかし、項目個々の性能モニタリング用の指標は、実際の有機物の分解除去効率とは相関がないようにみえる。COが有機物排出量指標にされるが、COやHCの排出量と分解除去効率の相関が現場スケールの焼却炉では実証されていない。焼却炉の分解除去効率を連続ベースで保証するためには、他の実時間指標(代用化合物の分解のように)と組み合わせることが望ましい。

(17) 化合物の焼却可能性(incinerability)推定の最もよい手順は、現場の経験とは関係ない。経験的な無炎熱安定度のデータか、または低酸素熱安定度(TSLoO₂)の焼却可能性指標の使用が最良の手順にみえるが、ベンチスケールのデータはAppendix 8の有機化合物の約半分で得られているに過ぎない。

(18) 今日までのアセスメントによれば、有害廃棄物燃焼の排出物で人間の健康に対する危険性の増加は殆どない。金属の排出はこれまでの危険度中で最大の意味を持つ。

(19) 60分類の産業で排出される90種の有毒大気汚染物にたいするEPAの解析で、全米の有害廃棄物焼却炉、有害廃棄物を燃やす産業用ボイラー、および産業用燃焼炉による癌の危険性の増加分は、患者年間約0.3人と推定している。一方、60区分全体による癌の増加分は年間1,986人である。

(20) 有害廃棄物焼却炉の分解能力が実証済で、排出物による危険性の増加も非常に低いようにみえるにも拘らず、これらの施設の立地と許可にはかなりの公衆の反対がある。商業的な有害廃棄物焼却炉(HWI)の許可には平均3年を要し、最終的にはさらに長い期間が必要である。許可を得ても公衆が受け入れることには不確実さがある。例えば爆発物、混合廃棄物、固形廃棄物や汚泥など、特定の廃棄物については近い時期に容量が不足する地域が出ることは間違いないだろう。

16. 残された課題と研究の必要性

有機有害廃棄物の処分は、今日、熱分解が最も効率

的で広く利用できる技術であるが、長期間の使用については、未試験廃棄物や特殊な廃棄物に対する分解効率、重金属の排出対策、燃焼副生成物の排出、プロセスの破損の検知、実時間での性能の確認など多くの課題が残されている。

①未試験廃棄物および特殊廃棄物の分解効率

焼却で扱う廃棄物の性格は、最近劇的に変化し始めた。1984年の有害固形廃棄物改正法で必要になった陸上処分規制計画（Land Disposal Restrictions Program）やスーパーファンド処分地での安定化作業（remedial action）の強調が強く影響している。このことは、規制を受ける廃棄物について利用可能な実証技術（BDAT: Best Demonstrated Available Technology）の処理基準が焼却に基礎を置いているためである。この焼却はスーパーファンド処分地の安定化技術として使われ、これらの廃棄物は固形分も水分も多く、物理的・化学的組成が複雑で、無機塩類を含み発熱は低く、潜在的に高いレベルの有害金属、危険度の高い有機物を含むことがある。

この問題のために、「未試験廃棄物および特殊廃棄物」という言葉で有機物、プラスチック、無機物、および多種の産業廃棄物が埋められているスーパーファンド処分地の汚染土壌や、その他の廃棄物が表現される。この言葉はまた、以前は決して焼却処理されなかった廃殺虫剤や廃工業化学物質のような資源保護回復法対象廃棄物にも使う。どの場合も十分に理解されていないことは、廃棄物の焼却が次のものを含んでいることである。すなわち、かなりの濃度の有毒金属、これまで焼却した記録のない種々の有機物、有機物の脱着特性が明らかでない無機材料に吸着した有機物である。無機塩や、例えばプラスチックや汚泥などを含む廃棄物は焼却炉で問題を起こす可能性がある。

焼却で有害廃棄物を高いレベルで分解できると思われ、固定施設では過去に焼却された廃棄物には十分な経験や分解データの蓄積がある一方で、有機物、無機物、廃棄物、土壌が焼却対象として考えられ、このような状況では取扱い易さと性能の試験が必要になる。その目的は、未試験廃棄物の分解と除去性能の保証、焼却プロセスの限界と廃棄物の予備処理の把握、焼却プロセス残留物の安全性と処理の決定、新しい廃棄物投入時の焼却炉性能の予測手段の開発にある。

②重金属の排出対策

焼却炉排出物による人間の健康への危険性は小さいとはいっても、金属の排出は危険性レベル中に占め

る支配的な要因である。燃焼プロセス中の金属の挙動や「分解（“partitioning”）」、金属の排出を防止する大気汚染防除装置（APCD）の有効性にたいする理解が相当進歩してきたが、未解決の問題も多い。

有機物と金属の混合廃棄物の焼却における挙動の研究は日が浅い。同様に、開発の初期段階では、焼却プロセスで金属の固定に加える土壤材、あるいは無機材（石炭、ポルトランドセメント灰、フライアッシュ等）の影響に関する知見とともに、特定の金属種の化学的形態（純金属、酸化物、塩化物、合金、有機金属、それぞれの原子価）の把握が重要である。さらに、従来型のロータリーキルンの運転方法の改良が魅力的となる可能性がある。この改良は、一次燃焼室を低温度で、再燃焼装置で分解する前に有機物を取り除くものである。

③燃焼副生成物の排出量

現在の情報で、有害廃棄物焼却による有機物の燃焼副生成物排出量は公衆の健康への危険度が大きいと示されていない。しかし、排出量データの完全さについては疑問が持たれている。したがって、これらのデータを用いたリスクアセスメントには疑問が持たれており、焼却炉の許可と施設の立地における関心事である。

今日までの排出物試験は焼却炉の煙突排出物中の成分を「全部」同定したものではない。未確認有機物の大部分が非塩素系で低分子量の炭化水素で、健康への危険性にはほとんど関心がなく、利用できるデータも十分ではない。しかし、あるフルスケールの試験では、53～91%の有機物が同定され、メタンとエチレンが同定排出物の33～97%に達している。

有害廃棄物施設が他の汚染対策や産業施設よりも高い危険性をもたらすとして、排出物に注意が払われている。したがって、排出物の高度に有害な主要成分が見過ごされてはいないが、関心を持つ人のすべてを満足させるほどにはデータがない。EPA科学諮問委員会は、有機物の排出による問題が存在するのか、しないのか、存在するとすれば問題の源（単数または複数）を、そしてその問題を最小にするにはどうするかについて、もっとよい決め方をするように勧告した。一方、全ての潜在的に有害な成分の検出には費用に限界がある。

今日までのリスクアセスメントの大部分は、有害廃棄物焼却炉の排出物の吸入を基本としている。しかし、食物連鎖の経路が人体影響に重要な寄与を示すことがあり、評価の方法論と特定のケースへのあてはめの問題についてさらに努力が必要である。

④プロセスの故障の検出

燃焼副生成物排出のもう一つの問題は、施設が混乱した条件（遷移状態や故障状態）で運転される場合の排出量と排出物の化学的特性についてはほんのわずかの試験しか行われていない^{115, 145, 234} ことである。いくつかの試験によって、意味のある運転条件の範囲や「みかけ上」の故障の運転条件では、主要な有機有害成分の分解除去効率にほとんど変化がないと示されている。しかし同時に、未燃焼の炭化水素排出量の測定値や黒煙は典型的に増える。これらの「故障モード」の排出物が危険をもたらすかどうかの研究が必要である。問題を解決する方法の一つは、排出物の主な化学成分の同定により費用効率のよい手段として短期間のバイオアッセイと、バイオアッセイを基本とした化学分析で、排出物の相対的な能力を調べることである。短期間のバイオアッセイには制約条件や限界はあるが、異なる燃焼発生源について混合物の癌発生能力を比較するのに有用である。「良好」な条件と設計外の条件のもとで、有害廃棄物を試験すれば、排出物の能力が運転条件の関数として明らかになり、これによって自動車のような通常の燃焼発生源との比較ができる。

⑤実時間の性能確認

焼却炉排出物が公衆の健康にかなりの意味を持つと、効率のよい運転が維持されていることを確認する方法が必要になる。焼却炉の性能を示す指標や、その代替指標に多様なものが使われている。しかし、「実時間ベース」で直接に特定の有機物や金属を同定し、その排出量を測定できるものではなく、本当の故障条件ではほとんど評価されていない。

低酸素熱安定度（ $TSLoO_2$ ）の焼却可能性ランク指標は見込みのあるように見えるが、さらに実験室での評価が必要で、残された有機有害成分についても行う必要がある。主要有機有害成分（ $POHC$ ）を特定できるか、または、特定の代用指標成分が連続モニタリングシステムとして使えるかについては、さらに調査が必要である。

SF₆の添加は分解除去効率（DRE）の連続確認に良い方法らしいが、必ずしもSF₆が常に有機物分解の指標でない場合があり、他のパラメータと組み合わせる必要がある。分解除去率確認のためにSF₆およびそれに似た化合物についてはさらに調査研究が必要である。

焼却炉の性能と「相関」を持ち、簡単にモニターできる項目の発見は困難であるが、プロセス故障発生の検出項目との組み合わせは可能であろう。プロセスの故

障の予測手法や、実時間のモニタリングシステムは、さらに研究が必要である。フーリエ変換赤外スペクトル法（FTIR: Fourier transform infrared spectroscopy）²⁷⁴とレーザー技術を用いて、特定の有機物と金属の「リアルタイム」検出機器開発が進行中である。このような技術の利用で、これらの施設が公衆に受け入れられるのに有利な影響を及ぼし、行政当局の適合性監視が有効に行える。また、排出量連続監視装置（CEM）は塩化水素や透過度（opacity）に有効で、これらの監視によって有害廃棄物焼却炉（HWI）の塩化水素と粒子状物質対策を連続ベースで確認できる。

⑥技術革新の役割

資源回復保護法（RCRA）^{275, 276}の通過以来、有害廃棄物技術の範囲が広がり、その多くは熱分解プロセスである。これらのプロセスの持つ熱分解能力と費用効果性は周知のものとなってきた。技術の中で新しいものは、pyrolysis、高温プラズマ、および低温プラズマ、熔融炉、熔融ガラス炉および金属熔融炉である。過去3～5年間に試験されスーパーファンド法対象土壌に应用された考え方の一つが、Rollins Environmental Serviceが特許を持つ「ロータリーリアクター」（rotary reactor）²⁷⁷である。このシステムは基本的にはロータリーキルンで、機械的に攪拌、回収、再使用する砂、または混合媒体の炉床を内部に追加する改良を施している。

より革新的な方式の採用のために従来型焼却施設の許可を延期すべきであるという人が多い。また、そのような方式を開発する側は、従来のシステムよりも分解除去効率が高く、費用が安いと主張する。特殊な廃棄物（汚染土壌とかPCBのような）に、多くの革新的システムが従来のシステムと同等の性能を実証している。いくつかのシステムは、特殊な廃棄物について利点が多いと言われるが、実際の現場経験とシステムの寿命データが十分でなく、システムの真の費用効果性には、かなりの不確定さがある。

革新的な浄化技術開発と全国のスーパーファンド処分地での利用を加速するために、EPAはスーパーファンド革新技術評価（SITE）計画を作成した。最近の報告²⁷⁸は、72の技術が実証、あるいは提唱され、この革新技術評価計画で評価を受けていると述べており、提唱されている技術のうち13%と、実証予定技術の20%が熱分解技術に関するものである。

提唱されているシステムの多くは、将来の有害廃棄物管理戦略の役割を担うであろう。しかしながら、対

策立案者、公的機関および産業の決定機関は、革新的システムの需要と利便性および稼働性がはっきりと確認できるまで行動が遅れる。

参考文献

A ; 背景

- 1) U.S. EPA, "Land Disposal Restrictions for Third Third Scheduled Wastes; Rule," *Federal Register*, 55 (No.106), 22520-22720, June 1, 1990.
- 2) E.T. Oppelt, "Hazardous waste destruction," *Environ. Sci. Technol.* 20:312 (1986).
- 3) U.S. EPA, "Assessment of Incineration as a Treatment Method for Liquid Organic Hazardous Wastes-Background Report V; Public Concerns Regarding Land-Based and Ocean-Based Incineration," March 1985, U. S. GPO, 1985-526-778/30376.
- 4) Greenpeace, *The Rush to Burn*, video tape.
- 5) P. Costner, J. Thornton, "Playing With Fire, Hazardous Waste Incineration," A Greenpeace Report, Washington, DC, October 5, 1991.
- 6) Greenpeace Australia, "Say No to the Toxic Oven," Greenpeace Australia, August 1990.
- 7) R. Ginsburg, "Beyond the Rush to Burn, Alternatives to Hazardous Waste Incineration," A National Toxics Campaign Fund Report, Boston, MA, February 1992.
- 8) *The Bible* (Old Testament), Kings 23:10.
- 9) R. Hering, S.A. Greely, *Collection and Disposal of Municipal Refuse*, McGraw Hill, New York, 1921.
- 10) R.C. Corey, *Principles and Practices of Incineration*, John Wiley and Sons, New York, 1969.
- 11) F.L. Cross, H.E. Hesketh, *Controlled Air Incineration*, Technomic Publishing Co., 1985.
- 12) C. Seracu, "New Incineration Facilities at Dow Midland," in *Proceedings of the Fourteenth Industrial Waste Conference*, pp. 612-621, Purdue University, Lafayette, Indiana, May 5-7, 1959.
- 13) U.S. EPA, "Standards of Performance for New Stationary Sources and Final Guidelines; Final Rules," *Federal Register*, 56 (No.28), 5488-5527, February 11, 1991.
- 14) J. Kilgroe, U.S. EPA, Air and Energy Engineering Research Laboratory, Research Triangle Park, North Carolina, personal communication, February 13, 1992.
- 15) U.S. EPA, "Hazardous Waste Proposed Guidelines and Regulations and Proposal on Identification and Listing," *Federal Register*, 43 (243, Part IV) : 58946-59028, December 18, 1978.
- 16) U.S. EPA, "Hazardous Waste Management System: Identification and Listing of Hazardous Waste," *Federal Register*, 45 (No.98), 33084-33137, May 19, 1980.
- 17) U.S. EPA, "Incinerator Standards for Owners and Operators of Hazardous Waste Management Facilities; Interim Final Rule and Proposed Rule," *Federal Register*, 46 (No.15), 7666-7690, January 23, 1981.
- 18) U.S. EPA, "Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities; Consolidated Permit Regulations," *Federal Register*, 47 (No.122), 27516-27535, June 24, 1982.
- 19) U.S. EPA, "Guidance Manual for Hazardous Waste Incinerator Permits," EPA-SW-966, NTIS PB 84-100577, March 1983.
- 20) U.S. EPA, "Guidance on Setting Permit Conditions and Reporting Trial Burn Results," EPA/625/689/019, January 1989.
- 21) U.S. EPA, "Standards for Owners and Operators of Hazardous Waste Incinerators and Burning of Hazardous Wastes in Boilers and Industrial Furnaces; Proposed Rule, Supplemental Proposed Rule, Technical Corrections, and Request for Comments," *Federal Register*, 55 (No.82), 17862-17921, April 27, 1990.
- 22) U.S. EPA, "Sham Recycling Policy," *Federal Register*, 48:11157, March 16, 1983.
- 23) U.S. EPA, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," *Federal Register*, 50 (No.3) 665, January 4, 1985.
- 24) U.S. EPA, "Hazardous Waste Management System; Burning of Waste Fuel and Used Oil Fuel in Boilers and Industrial Furnaces," *Federal Register*, 50 (No.230) 49164-49211, November 29, 1985.
- 25) U.S. EPA, "Burning of Hazardous Waste in Boilers and Industrial Furnaces; Proposed Rule," *Federal Register*, 52 (No.87), 16982-17050, May 6, 1987.
- 26) U.S. EPA, "Burning of Hazardous Waste in Boilers and Industrial Furnaces; Supplement to Proposed Rule," *Federal Register*, 54 (No.206), 43718-43763, October 26, 1989.
- 27) U.S. EPA, "Burning of Hazardous Waste in Boilers and Industrial Furnaces; Final Rule," *Federal Register*, 56 (No.35), 7134-7240, February 21, 1991.
- 28) U.S. EPA, "Burning of Hazardous Wastes in Boilers and Industrial Furnaces, Final Rule," *Federal Register*, 56 (No.166), 42504-42517, August 27, 1991.
- 29) U.S. EPA, "Guidance on Metals and Hydrogen Chloride Controls for Hazardous Waste Incinerators, Volume IV of the Hazardous Waste Incineration Guidance Series," Draft Final Report, August 1989.
- 30) U.S. EPA, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," *Federal Register*, 44, 31514, May 31, 1979.
- 31) U.S. EPA, "Hazardous Waste Management System; Dioxin-Containing Wastes; Rule," *Federal Register*, 50 (No.9), 1978-2006, January 14, 1985.

B ; 焼却技術の現況

- 32) G. Vogel, *et al.*, "Composition of Hazardous Waste Streams Currently Incinerated," Mitre Corp., U.S. EPA, April 1983.
- 33) S. Tejada, "The blue goose flies!," *EPA Journal*, October 1985.
- 34) J.J. Yezzi *et al.*, "Results of the Initial Trial Burn of the EPA-ORD Mobile Incineration System," in *Proceedings of the ASME 1984 National Waste Processing Conference*, Orlando, FL, June 1984.
- 35) H. Mortensen, *et al.*, "Destruction of Dioxin Contaminated Solids and Liquids by Mobile Incineration," EPA Final Report, EPA/600/R2-87/033, NTIS PB 87-188512/AS, June 1987.
- 36) F. Freestone, *et al.*, "Evaluation of On-Site Incineration for Cleanup of Dioxin-Contaminated Materials," *Nuclear and Chemical Waste Management*, Vol. 7, pp 3-20, 1987.
- 37) D.A. Oberacker, J.J. Cudahy, M.R. Richards, "Remediation (Clean-Up) of Contaminated Uncontrolled Superfund Dumpsites by Incineration and Other Popular Technologies," presented at the *1990 Pacific Basin Conference on Hazardous Waste*, Honolulu, Hawaii, November 12-16, 1990.
- 38) J.J. Cudahy, W.L. Troxler, "1991 Thermal Treatment Remediation Industry Contractor Survey," presented at the *AWMA 85th Annual Meeting & Exhibition*, Kansas City, Missouri, June 21-26, 1992.
- 39) U.S. EPA, "Hazardous Waste Generation and Commercial Hazardous Waste Management Capacity," SW-894, December 1980.
- 40) G. Vogel, *et al.*, "Incineration and cement kiln capacity for hazardous waste treatment," in *Proceedings of the 12th Annual Research Symposium, Incineration and Treatment of Hazardous Wastes*, NTIS PB 87-110896, Cincinnati, Ohio, April 1986.
- 41) U.S. EPA, "A Profile of Existing Hazardous Waste Incineration Facilities and Manufacturers in the United States," NTIS PB 84-157072, February 1984.
- 42) U.S. EPA, "Assessment of Incineration as a Treatment Method for Liquid Organic Hazardous Wastes-Background Report III: Assessment of the Commercial Hazardous Waste Incineration Market," U.S. Government Printing Office, 1985-526-778/30376, March 1985.
- 43) U.S. EPA, "National Survey of Hazardous Waste Generator and Treatment, Storage and Disposal Facilities Regulated Under RCRA in 1981," U.S. Government Printing Office, 055000-00239-8, 1984.
- 44) U.S. Congress, Congressional Budget Office, "Hazardous Waste Management: Recent Changes and Policy Alternatives," U.S. Government Printing Office, 1985.
- 45) U.S. Congress, Office of Technology Assessment, "Technologies and Management Strategies for Hazardous Waste Control," U.S. Government Printing Office, Washington, DC, OTA-196, March 1983.
- 46) U.S. EPA, "1986 National Screening Survey of Hazardous Waste Treatment, Storage, Disposal and Recycling Facilities," December 1986.
- 47) U.S. EPA, "1987 National Biennial RCRA Hazardous Waste Report," EPA/530-SW-91-061, July 1991.
- 48) U.S. EPA, "Fact Sheet on Waste Treatment Capacity," Office of Solid Waste and Emergency Response, November 1989.

- 49) Environmental Information, Ltd., "Interchange of Hazardous Wastes Management Services Among States," National Solid Wastes Management Association, December 31, 1990.
- 50) R. Holloway, "An Overview of Waste Combustion in Boilers and Industrial Furnaces: History, Current Practices and Future Prospects," presented at *Waste Combustion in Boilers and Industrial Furnaces Conference of the Air and Waste Management Association*, Kansas City, MO, April 1990.
- 51) Westat, Inc., "Used or Waste Oil and Waste-Derived Fuel Material Burner Questionnaire for 1983," U.S. EPA, 1984.
- 52) N. Behmanesh, D.T. Allen, J.L. Warren, "Flow Rates and Compositions of Incinerated Waste Streams in the United States," *Journal of the Air & Waste Management Association* 42(4):437-442, April 1992.
- 53) Environmental Resources Management, Inc., "New Jersey Hazardous Waste Facilities Plan," New Jersey Waste Facilities Siting Commission, Trenton, NJ, March 1985, p. 170.
- 54) ICF, Inc., "Survey of Selected Firms in the Commercial Hazardous Waste Management Industry: 1984 Update," U.S. EPA, September 1985.
- 55) Office of Appropriate Technology, "Alternatives to the Land Disposal of Hazardous Wastes, An Assessment for California," Toxic Waste Assessment Group, Governor's Office of Appropriate Technology, Sacramento, CA, 1981.
- 56) W. Gruber, "Hazardous Waste Incineration: 1990," *E I Digest*, pp 7-15, April 1990.
- 57) K. Highum, "The Incineration Picture Based on the Capacity Assurance Plans," *E I Digest*, pp 16-35, April 1990.
- 58) U.S. EPA, Region IX, "Commercial RCRA Hazardous Waste Incinerators and Boilers & Industrial Furnace in the USA," draft, May 30, 1991.
- 59) Sonya Sasseville, U.S. EPA, Office of Solid Waste, Wash., DC personal communication, September 1990.
- 60) Nahid Zoveshtagh, U.S. EPA, Office of Solid Waste, Wash., DC personal communication, December 4, 1991.
- 61) S. Garg, U.S. EPA, Office of Solid Waste, Washington, DC, personal communication, February 12, 1992.
- 62) U.S. EPA, "Engineering Handbook on Hazardous Waste Incineration," SW-889, NTIS PB 81-248163, September 1981.
- 63) W.R. Niessen, *Combustion and Incineration Processes*, Marcel and Dekker, 1978.
- 64) C.A. Brunner, *Incineration Systems and Selection and Design*, Van Nostrand Reinhold Reinhold Co., 1984.
- 65) C.A. Brunner, *Handbook of Incineration Systems*, McGraw-Hill Inc., 1991.
- 66) D.G. Ackerman, J.F. McGaughey, D.E. Wagoner, "At-Sea Incineration of PCB-Containing Wastes On Board the M/T Vulcanus," U.S. EPA, 600/783-024, NTIS PB 83-207647, April 1983.
- 67) Y.H. Kiang, "Total hazardous waste disposal through combustion," *Industrial Heating* 14:9, 1977.
- 68) Y.H. Kjang, A.A. Metry, *Hazardous Waste Processing Technology*, Ann Arbor Science, Ann Arbor, MI, 1982.
- 69) R.D. Reed, *Furnace Operations*, Third Edition, Gulf Publishing, Houston, Texas, 1981.
- 70) W.S. Rickman, N.D. Holder, D.T. Young, "Circulating bed incineration of hazardous wastes," *Chemical Engineering Progress* 81:3:34 (March 1985).
- 71) A. Trenholm, "Summary of Testing Program at Hazardous Waste Incinerators," in *Proceedings of the 11th Annual Research Symposium, Incineration and Treatment of Hazardous Waste*, EPA/600/9-85/028, NTIS PB 86-199403, September 1985.
- 72) J.J. Santoleri, "Energy Recovery-A By-Product of Hazardous Waste Incineration Systems," in *Proceedings of the 15th Mid-Atlantic Industrial Waste Conference on Toxic and Hazardous Waste*, 1983.
- 73) R.G. Novak, W.L. Troxler, T.H. Dehnke, "Recovering energy from hazardous waste incineration," *Chemical Engineering* 91:6:146 (1984).
- 74) J.J. Moller, O.B. Christiansen, "Dry Scrubbing of Hazardous Waste Incineration Flue Gas by Spray Dryer Adsorption," in *Proceedings of the 77th Annual APCA Meeting*, 1984.
- 75) P. Gorman, et al., "Practical Guide-Trial Burns for Hazardous Waste Incineration," U.S. EPA, EPA/600/R2-86/050 NTIS PB 86-190246/AS, November 1985.
- 76) U.S. EPA, "Hazardous Waste Incineration Measurement Guidance Manual," EPA/625/6-89/021, June 1989.
- 77) U.S. EPA, "Guidance on PIC Controls for Hazardous Waste Incineration," EPA/530-SW-90-040, April 1990.
- 78) U.S. EPA, "Burning of Hazardous Waste in Boilers and Industrial Furnaces; Final Rule:Correction; Technical Amendments," *Federal Register*, Vol.56 (No.137), 32688-32886, July 17, 1991.
- 79) U.S. EPA, "Handbook: Quality Assurance/Quality Control (QA/QC) Procedures for Hazardous Waste Incineration," EPA/625/689/023, NTIS PB 91-145979, January 1990.
- 80) L.D. Johnson, "Trial Burns: Methods Perspective," *Journal of Hazardous Materials*, 22:2,143 (1989).
- 81) L.D. Johnson, R.H. Jones, *Sampling and Analysis of Hazardous Waste*, Standard Handbook for Hazardous Wastes Treatment and Disposal, H.M. Freeman, Editor, McGraw Hill, New York, 1988.
- 82) D.G. Ackerman, et al., "Guidelines for the Disposal of PCB's and PCB Items by Thermal Destruction," U.S. EPA, NTIS PB 81-182339, May 1980.
- 83) J.C. Harris, D.J. Larsen, C.E. Rechsteiner, K.E. Thrun, "Sampling and Analysis Methods for Hazardous Waste Combustion," U.S. EPA, EPA-600/8-84/002, PB 84-155545, February 1984.
- 84) U.S. EPA, "Methods Manual for Compliance with the BIF Regulations," EPA/530-SW-91-010, NTIS PB 90-120-006, December 1990.
- 85) U.S. EPA, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," Second Edition, SW-846, July 1982.
- 86) U.S. EPA, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," Third Edition, SW-846, November 1986.
- 87) E.R. devera, B.P. Simmons, R.D. Stephens, D.L. Storm, "Samplers and Sampling Procedures for Hazardous Waste Streams," U.S. EPA, EPA-600/2-80/018, PB 80-135353, January 1980.
- 88) K.W. Baughman, et al., "Problem POHC Reference Directory," Final Report, EPA 600/3-90/094, NTIS PB 91-201061/AS and PB 91-507749/AS, U.S. EPA, Atmospheric Research and Exposure Assessment Laboratory, Research Triangle Park, NC, January 1991.
- 89) M.D. Jackson, "Source Sampling and Analysis: A Methods Directory," *Symposium Proceedings: Seventh Annual Waste Testing and Quality Assurance Symposium*, Washington, DC, July 1991.
- 90) R.H. James, R.E. Adams, J.M. Finkel, H.C. Miller, L. D. Johnson, "Evaluation of analytical methods for the determination of POHC in combustion products," *JAPCA* 35:959 (1985).
- 91) R.E. Adams, R.H. James, L.B. Farr, M.M. Thomason, H.C. Miller, L.D. Johnson, "Analytical methods for determination of selected principal organic hazardous constituents in combustion products," *Environ. Sci. Technol.* 20:711 (1986).
- 92) D.A. Stern, B.M. Myatt, J.F. Lachowski, K.T. McGregor, "Speciation of Halogen and Hydrogen Halide Compounds in Gaseous Emissions," in *Proceedings of the 9th Annual Research Symposium on Incineration and Treatment of Hazardous Wastes*, U.S. EPA, EPA-600/9-84/015, PB 84-234525, July 1984.
- 93) L.M. Schlickerrieder, J.W. Adams, K.E. Thrun, "Modified Method 5 Train and Source Assessment Sampling System Operators Manual," U.S. EPA, EPA-600/8-85-003, NTIS No PB 85-169878, February 1985.
- 94) G.A. Jungclaus, et al., "Development of a Volatile Organic Sampling Train (VOST)," in *Proceedings of the 9th Annual Research Symposium on Incineration and Treatment of Hazardous Waste*, EPA-600/9-84-015, PB 84-234525, pp 1-27, July 1984.
- 95) E.M. Hansen, "Protocol for the Collection and Analysis of Volatile POHC's Using VOST," U.S. EPA, EPA-600/8-84-007, PB 84-170042, March 1984.
- 96) L.D. Johnson, R.G. Merrill, "Stack sampling for organic emission," *Toxicol. Environ. Chem.* 6:109 (1983).
- 97) L.D. Johnson, "Detecting waste combustion emissions," *Environ. Sci. Technol.* 20:223 (1986).
- 98) J. Prohoska, T.J. Logan, R.G. Fuerst, M.R. Midgett, "Validation of the Volatile Organic Sampling Train (VOST) Protocol: Volume I, Laboratory Phase," U.S. EPA, EPA-600/4-86/014a, PB 86-145547, January 1986.
- 99) J. Prohoska, T.J. Logan, R.G. Fuerst, M.R. Midgett, "Validation of the Volatile Organic Sampling Train (VOST) Protocol: Volume II, Field Validation Phase," U.S. EPA, EPA-600/4-86/014b, PB 86-145554, Janua-

C ; プロセス性能の測定

- 75) P. Gorman, et al., "Practical Guide-Trial Burns for Hazardous Waste Incineration," U.S. EPA, EPA/600/R2-86/050 NTIS PB 86-190246/AS, November 1985.

- ry 1986.
- 100) J. Bursey, M. Hartman, J. Homolya, R. McAllister, J. McGaughey, D. Wagoner, "Laboratory and Field Evaluation of the Semi-Vost Method" U.S. EPA, Vol. I, EPA-600/4-85-075a, PB 86-123551/AS, and Vol. II, EPA-600/4-85-075b, NTIS PB 86-123569/AS, September 1985.
 - 101) J. Podlenski, E. Peduto, *et al.*, "Feasibility Study for Adapting Present Combustion Source Continuous Monitoring Systems to Hazardous Waste Incinerators," U.S. EPA, EPA-600/8-84-011a, NTIS PB 84-187814, March 1984.
- D ; 有害廃棄物焼却での排出
- 102) J.J. Cudahy, *et al.*, "Thermodynamic Equilibrium of Halogen and Hydrogen Halide during the Combustion of Halogenated Organics," presented at the *Sixth National Conference on the Management of Uncontrolled Hazardous Waste Sites*, Washington, DC, November 4-6, 1985.
 - 103) U.S. EPA, "Final Standards for Hazardous Waste Incineration-Background Document," January 1981.
 - 104) U.S. EPA, "Determination of Incinerator Operating Conditions Necessary for Safe Disposal of Pesticides," July 1975.
 - 105) U.S. EPA, "Destroying Chemical Wastes in Commercial-Scale Incinerators," NTIS PB-267 987/6 and PB-278 816/4, 1977.
 - 106) E.T. Oppelt, "Performance Assessment of Incinerators and High Temperature Industrial Processes Disposing Hazardous Waste in the U.S.," in *Hazardous and Industrial Solid Waste Testing and Disposal*, ASTM Standard Publication 933, (1986).
 - 107) U.S. EPA, "Performance Evaluation of Full-Scale Hazardous Waste Incineration," 5 volumes, NTIS, PB 85-129500, November 1984.
 - 108) U.S. EPA, "Engineering Assessment Report-Hazardous Waste Co-firing in Industrial Boilers," 2 volumes, NTIS PB 85 197838/A05 and PB 85 197838/A08, June 1984.
 - 109) U.S. EPA, "A Technical Overview of the Concept of Disposing of Hazardous Wastes in Industrial Boilers," June 1984.
 - 110) U.S. EPA, Hazardous Wastes Engineering Research Laboratory, Cincinnati, OH, "Hazardous Waste Combustion in Industrial Processes: Cement and Lime Kilns," EPA/600/2-87/095, NTIS PB 88-126412, February 1988.
 - 111) U.S. EPA, "Evaluation of Hazardous Waste Incineration in Aggregate Kilns," NTIS PB 85-189066, February 1985.
 - 112) U.S. EPA, "Permit Writers Guide to Test Burn Data-Hazardous Waste Incineration," EPA-625/6-86/012, September 1986.
 - 113) U.S. EPA, "Pilot Scale ESP and Scrubber Parametric Tests for Particulates, Metals, and HCl Emissions: John Zink Company Research Facility, Tulsa, OK," Radian Corp., NTIS # PB 90 129362, June 1989.
 - 114) U.S. EPA, "A Performance Test on a Spray Dryer, Fabric Filter and Wet Scrubber System; APTUS Incinerator at Coffeyville, KS," Radian Corp., NTIS PB 90 120544, October 1989.
 - 115) U.S. EPA, "Measurement of Particulates, Metals and Organics at a Hazardous Waste Incinerator; (covers testing at the Mobay facility in Kansas)," Midwest Research Institute, NTIS # PB 89 230668, November 15, 1988.
 - 116) U.S. EPA, "Emissions Testing of a Wet Cement Kiln at Hannibal, Missouri," Final Draft Report, EPA/530-SW-91-017, NTIS # PB 91-130203, December 1990.
 - 117) U.S. EPA, "Emission Testing of a Precalciner Cement Kiln at Louisville, Nebraska," EPA/530-SW-91-016, NTIS # PB 91-130195, November 1990.
 - 118) A. Trenholm, P.G. Gorman, B.Smith, D.A. Oberacker, "Emission Test Results for a Hazardous Waste Incineration RIA," in *Proceedings of the 9th Annual Research Symposium on Incineration and Treatment of Hazardous Waste*, U.S. EPA, EPA-600/9-84/015, NTIS PB 84-234525, pp 160-170, July 1984.
 - 119) P.G. Gorman, A. Trenholm, D.A. Oberacker, B. Smith, "Particulate and Hydrogen Chloride Emissions from Hazardous Waste Incinerators," in *Proceedings of the 9th Annual Research Symposium on Incineration and Treatment of Hazardous Waste*, U.S. EPA, EPA-600/9-84/015, NTIS PB 84-234525, pp 151-159, July 1984.
 - 120) R.E. Mournighan, J.A. Psters, M.R. Branscome, "Effects of Burning Hazardous Wastes in Cement Kilns on Conventional Pollutant Emissions," in *Proceedings of the 78th APCA Annual Meeting*, Vol.5, 85-86.1, 1985.
 - 121) R.A. Olexsey, "Air Emissions from Industrial Boilers Burning Hazardous Waste Material," in *Proceedings of the 77th APCA Annual Meeting*, Vol.1, 84-18.3, 1984.
 - 122) L. Edwards, *et al.*, "Trace Metals and Stationary Conventional Combustion Processes: Volume I, Technical Report," U.S. EPA, EPA-600/7-80-155a, NTIS PB 80-216161, 1980.
 - 123) J. Kaakinen, *et al.*, "Trace elements behavior in coal-fired power plants," *Environ. Sci. Technol.* 9:862, (1975).
 - 124) D. Klein, *et al.*, "Pathways of thirty-seven trace elements through coal-fired power plant," *Environ. Sci. Technol.* 9:973, (1975).
 - 125) R.D. Smith, "The trace element chemistry of coal during combustion and the emissions from coal-fired plants," *Progress in Energy and Combustion Science* 6:53, (1980).
 - 126) M. Neville and A.F. Sarofim, "The Stratified Composition of Inorganic Submicron Particles Produced During Coal Combustion," in *Proceedings: Nineteenth International Symposium on Combustion*, The Combustion Institute, 1982, p. 1441.
 - 127) S.L. Law and G.E. Gordon, "Sources of Metals in Municipal Incinerator Emissions," *Environmental Science and Technology*, 13(4):432, 1979.
 - 128) R.J. Quann and A.F. Sarofim, "Vaporization of Refractory Oxides During Pulverized Coal Combustion," in *Proceedings: Nineteenth International Symposium on Combustion*, The Combustion Institute, 1982, p.1429.
 - 129) H. Vogg, H. Braun, M. Metzger, and J. Schneider, "The Specific Role of Cadmium and Mercury in Municipal Solid Waste Incineration," *Waste Management and Research*, 4:65-74, 1986.
 - 130) R.C. Flagan, "Submicron Particles from Coal Combustion," in *Proceedings: Seventeenth Symposium on Combustion*, The Combustion Institute, 1978.
 - 131) W.P. Linak and T.W. Peterson, "Effect of Coal Type and Residence Time on the Submicron Aerosol Distribution from Pulverized Coal Combustion," *Aerosol Science and Technology*, 3, 1984.
 - 132) R.G. Barton, P.M. Maly, W.D. Clark, W.R. Seeker, and W.S. Lanier, "Prediction of the Fate of Toxic Metals in Hazardous Waste Incinerators," U.S. EPA Contract 68-03-3365, 1988.
 - 133) D.J. Fournier, *et al.*, "The Behavior of Trace Metals in Rotary Kiln Incineration: Results of Incineration Research Facility Studies," in *Proceedings of the Seventeenth Annual RREL Hazardous Waste Research Symposium*, EPA/600/9-91/002, NTIS PB 91-233267, 1991.
 - 134) R.G. Barton, *et al.*, "Development and Validation of a Surrogate Metals Mixture," in *Proceedings of the Fifteenth Annual Research Symposium: Remedial Action, Treatment and Disposal of Hazardous Waste*, EPA/600/9-90/006, NTIS PB 91-145524, February 1990.
 - 135) W.R. Seeker, "Waste Combustion," in *Proceedings of the Twenty-Third Symposium(International) on Combustion*, The Combustion Institute, pp. 867-885, 1990.
 - 136) D.J. Fournier, *et al.*, "The Fate of Trace Metals in a Rotary Kiln Incinerator with a Venturi/Packed-Column Scrubber," Volumes I & II, EPA Final Report, EPA/600/R2-90/043, NTIS PB 90-263864 and PB 90-263872, February 1991.
 - 137) D.J. Fournier and L.R. Waterland, "The Fate of Trace Metals in a Rotary Kiln Incinerator with a Single-Stage Ionizing Wet Scrubber," Volumes I & II, EPA Final Report, EPA/600/R2-91/032, NTIS PB 91-223388 & PB 91-223396, September 1991.
 - 138) U.S. EPA, "Metals Control Efficiency Test at a Dry Scrubber and Baghouse Equipped Hazardous Waste Incinerator; Test Report for TWI unit #4 at Sauget, IL," EPA/530-SW91-004, NTIS # PB 91-101865, September 1990.
 - 139) C. King and L.R. Waterland, "Pilot-Scale Incineration of Arsenic-Contaminated Soil from the Baird and McGuire Superfund Site," EPA Final Report prepared by Acurex Environmental Corporation, NTIS PB 91-226308, 1990.
 - 140) J.P. Stumber, *et al.*, "The Fate of Heavy Metals in EPA's Mobile Incineration System," presented at the

- American Flame Research Committee 1989 International Symposium on Combustion in Industrial Furnaces and Boilers.*
- 141) U.S. EPA, Science Advisory Board, "Report on the Incineration of Liquid Hazardous Wastes," April 1985.
 - 142) U.S. EPA, "Report of the Products of Incomplete Combustion Subcommittee of the Science Advisory Board; Review of OSW Proposed Controls for Hazardous Waste Incineration Products of Incomplete Combustion," EPA-SAB EC-90-004, January 1990.
 - 143) E.T. Oppelt, "Remaining Issues Over Hazardous Waste Thermal Destruction," presented at the 79th APCA Annual Meeting, Minneapolis, MN, June 24, 1986.
 - 144) Midwest Research Institute, "Products of Incomplete Combustion from Hazardous Waste Combustion," U.S. EPA, draft final report, June 1986.
 - 145) U.S. EPA, "Total Mass Emissions from a Hazardous Waste Incinerator," Final Report, Midwest Research Institute, EPA-600/S2-87/064, NTIS PB 87-228508/A S, June 12, 1987.
 - 146) D.S. Duval, W.A. Ruby, "Laboratory Evaluation of High-Temperature Destruction of Kepone and Related Pesticides," U.S. EPA, EPA-600/2-76-299, NTIS PB-264 892/1, December 1976.
 - 147) D.S. Duval, W.A. Ruby, "Laboratory Evaluation of High-Temperature Destruction of Polychlorinated Biphenyls and Related Compounds," U.S. EPA, EPA 600/2-77-228, NTIS PB-279 139/0, December 1977.
 - 148) B. Dellinger, *et al.*, "Determination of the Thermal Decomposition Properties of 20 Selected Hazardous Organic Compounds," U.S. EPA, EPA-600/2-84-138, NTIS PB 84-232487, August 1984.
 - 149) S. Senken, *et al.*, "Combustion/Incineration Characteristics of Chlorinated Hydrocarbons," AIChE Annual Meeting, New Orleans, LA, November 8-12, 1981.
 - 150) B. Dellinger, *et al.*, "PIC Formation Under Pyrolytic and Starved Air Conditions," U.S. EPA Final Report prepared by the University of Dayton Research Institute, NTIS PB 86-145422, October 1985.
 - 151) J.C. Kramlich, *et al.*, "Laboratory-Scale Flame Mode Hazardous Waste Thermal Destruction Research," in *Proceedings of the 9th Annual Research Symposium on Incineration and Treatment of Hazardous Waste*, EPA-600/9-84/015, NITS PB 84-234525, pp 79-94, July 1984.
 - 152) B. Dellinger, "Minimization and Control of Hazardous Combustion Byproducts," EPA/600/R-90/039, NTIS PB 90-259854/AS, August 1990.
 - 153) A. Trenholm, R. Hathaway, "Products of Incomplete Combustion from Hazardous Waste Incinerators," in *Proceedings of the 10th Annual Research Symposium on Incineration and Treatment of Hazardous Waste*, U.S. EPA, EPA-600/9-84/022, NTIS PB 85-116291, 84-95, September 1984.
 - 154) R.A. Olexsey, *et al.*, "Emission and Control of By-Products from Hazardous Waste Combustion Processes," in *Proceedings of the 11th Annual Research Symposium on Incineration and Hazardous Waste*, U.S. EPA, EPA-600/9-85/028, NTIS PB 86-199403, pp 8-15, September 1985.
 - 155) A.R. Trenholm, *et al.*, "Organic Products of Incomplete Combustion from Hazardous Waste Combustion," presented at the A/WMA 85th Annual Meeting & Exhibition, Kansas City, Missouri, June 21-26, 1992.
 - 156) M.H. Keating, "National Dioxin Study: Tier 4-Combustion Sources, Final Literature Review," U.S. EPA, NTIS PB 86-232857, June 1986.
 - 157) J. Exner, "Solving Hazardous Waste Problems: Learning from Dioxins," *American Chemical Society*, Washington, DC, 1987.
 - 158) NRCC (National Research Council of Canada), "Polychlorinated Dibenzo-p-dioxins: Criteria for their Effects on Man and his Environment," *NRCC/CNRC Associate Committee on Scientific Criteria for Environmental Quality*, Ottawa, Canada, No NRCC 18574, ISSN 0316-0114 (1981).
 - 159) U.S. EPA, "Health Assessment Document for Polychlorinated Dibenzo-p-Dioxins," EPA/600/8-84-914F, NTIS PB 86-122546, p. 11-128, September 1985.
 - 160) U.S. EPA, "A Cancer Risk-Specific Dose Estimate for 2,3,7,8-TCDD," External Review Draft, EPA/600/6-88/007, National Technical Information Service, Springfield, VA, PB 88-231204 (1988).
 - 161) WHO (World Health Organization), "Assessment of Health Risks in Infants Associated with Exposure to PCBs, PCDDs, and PCDFs in Breast Milk," Copenhagen, Denmark (1988).
 - 162) U.S. EPA, "Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-Dioxins and -Dibenzofurans (CDDs and CDFs) and 1989 Update," EPA/625/3-89/016, NTIS PB 90-145756, March 1989.
 - 163) M.A. Fingerhut, *et al.*, "Cancer Mortality in Workers Exposed to 2,3,7,8-Tetrachlorodibenzo-p-Dioxin," *The New England Journal of Medicine*, pp 212-218, January 24, 1991.
 - 164) U.S. EPA, "The Risk Assessment Guidelines of 1986," EPA/600/8-87/045, NTIS PB 88-113261, Office of Health and Environmental Assessment, Washington, DC, August 1987.
 - 165) "Inside EPA's Environmental Policy Alert", Vol. VIII, No 8, April 17, 1991.
 - 166) U.S. EPA, "Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-Dioxins and Dibenzofurans (CDDs and CDFs)," EPA/625/3-87/012, March 1987.
 - 167) K. Olie, P.L. Vermeulen, O. Hutzinger, "Chlorodibenzo-p-dioxins and chlorodibenzofurans are trace components of fly ash and flue gas of some municipal incinerators in the Netherlands," *Chemosphere* 6:455 (1977).
 - 168) H.R. Buser, C. Rappe, "Identification of substitution patterns in polychlorinated dibenzo-p-dioxins (PCDD's) by mass spectrometry," *Chemosphere* 7:199 (1978).
 - 169) G.A. Eiceman R.E. Clement, F.W. Karasek, "Analysis of fly ash from municipal incinerators for trace organic compounds," *Anal. Chem.* 51:2343 (1979).
 - 170) F.W. Karasek, "Dioxins from garbage: previously unknown source of toxic compounds is being uncovered using advanced analytical instrumentation," *Canadian Research*, September 1980.
 - 171) R.R. Bumb, *et al.*, "Trace chemistries of fire: a source of chlorinated dioxins," *Science* 210: (1980).
 - 172) A. Cavallaro, G. Bandi, G. Invernizzi, L. Luciani, E. Mongini, A. Gorni, "Sampling occurrence and evaluation of PCDD's and PCDF's from incinerated solid urban waste," *Chemosphere* 9:611 (1980).
 - 173) J.W. Lustenhouwer, K. Olie, O. Hutzinger, "Chlorinated dibenzo-p-dioxins and related compounds in incinerator effluents: a review of measurement and mechanisms of formation," *Chemosphere* 9:501 (1980).
 - 174) Y. Masuda, *et al.*, "Chlorinated Dioxins and Related Compounds: 1986," in *Proceedings of the Sixth International Symposium held at Fukuoka, Japan*, September 16-19, 1986, *Chemosphere* Vol.16 Nos. 8-9 (1987).
 - 175) A.D. Little, Inc., "Study on the State-of-the-Art of Dioxin from Combustion Sources," American Society of Mechanical Engineers, 1981.
 - 176) Camp, Dresser and McKee, Inc., "Dioxin Emissions from Resource Recovery Facilities and Summary of Health Effects," U.S. EPA, November 1986.
 - 177) Ontario Ministry of the Environment, "Scientific Criteria Document for Standard Development No.4-84, Polychlorinated Dibenzo-p-dioxins (PCDDs) and Polychlorinated Dibenzo-p-furans," September 1985.
 - 178) J.R. Visalli, "Hazardous Waste Management, A Comparison of Dioxin, Furan and Combustion Gas Data from Test Programs at Three MSW Incinerators," *Journal of the Air Pollution Control Association*, 37(5):1451-1463, December 1987.
 - 179) U.S. EPA, "National Dioxin Study: Tier 4-Combustion Sources, Project Summary Report," EPA-450/4-84-014g, NTIS PB 88-107743, September 1987.
 - 180) C. Castaldini, "Dioxin Emissions from Industrial Boilers Burning Hazardous Materials," U.S. EPA, NTIS PB 86-150620, April 1985.
 - 181) M. Branscome, *et al.*, "Evaluation of Waste Combustion in a Wet Process Cement Kiln at General Portland, Inc., Paulding, Ohio," U.S. EPA, February 1985.
 - 182) M. Branscome, *et al.*, "Evaluation of Waste Combustion in a Dry Process Cement Kiln at Lone Star Industries, Oglesby, Illinois," U.S. EPA, December 1984.
 - 183) D.R. Day, L.A. Cox, R.E. Mournighan, "Evaluation of Hazardous Waste Incineration in a Lime Kiln: Rockwell Lime Company," U.S. EPA, EPA-600/S2-84-132, NTIS PB 84-230044, November 1984.
 - 184) L.A. Stretz, *et al.*, "Controlled Air Incineration of PCP-Treated Wood," U.S. EPA, NTIS PB 84-189851, September 1982.
 - 185) D.G. Ackerman, J.F. Mc-Gaughey, D.E. Wagoner, "At-Sea Incineration of PCB-Containing Wastes Onboard the M/T Vulcanus," EPA-600/S7-83-024, NTIS PB 83-207647, June 1983.
 - 186) U.S. EPA, "PCB Disposal by Thermal Destruction," EPA/906/9-82-003, NTIS, PB 82-241860, June 1981.

- 187) W.E. Whitworth and L.R. Waterland, "Pilot-Scale Incineration of PCB-Contaminated Sediments from the New Bedford Harbor Superfund Site," EPA/600/R-92/068, NTIS PB 92-178953/AS, April 1992.
- 188) T.G. Brna, "Controlling PCDD/PCDF Emissions from Incinerators by Flue Gas Cleaning," presented at the *International Conference on Organohalogen Compounds, 10th International Meeting - Dioxin 90*, Bayreuth, Federal Republic of Germany, September 10-14, 1990.
- 189) J.A. Eddinger, U.S. EPA, Office of Air Quality Planning and Standards, draft results from the field testing of medical waste incinerators at facilities A, B, K & W, July 1991.
- 190) J. D. Kilgroe, "Combustion Control of PCDD/PCDF Emissions from Municipal Waste Incineration in North America," presented at the *International Conference on Organohalogen Compounds, 10th International Meeting - Dioxin 90*, Bayreuth, Federal Republic of Germany, September 10-14, 1990.
- 191) K.R. Durkee and J.A. Eddinger, "Status of EPA Regulatory Program for Medical Waste Incinerators: Test Program and Characterization of Emissions," presented at the *1991 Incineration Conference*, Knoxville, TN, May 13-17, 1991.
- 192) U.S. EPA, "Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Toxicity Characteristic Revisions; Final Rule; Corrections," *Federal Register*, Vol. 55 (No.126), 26986-26998, June 29, 1990.
- 193) D. Van Buren, G. Poe, C. Castaldini, "Characterization of Hazardous Waste Incineration Residuals," U.S. EPA, NTIS PB 87-168159, January 1987.
- 194) U.S. EPA, "Onsite Engineering Report of Treatment Technology Performance and Operation for Incineration of K001-Pentachlorophenol Waste," Cincinnati, 1987.
- 195) U.S. EPA, "Draft Onsite Engineering Report of Treatment Technology Performance and Operation for Incineration of K001-Creosote Waste," Cincinnati, 1987.
- 196) U.S. EPA, "Onsite Engineering Report of Treatment Technology Performance and Operation for Incineration of K024 Waste," Cincinnati, 1987.
- 197) U.S. EPA, "Onsite Engineering Report of Treatment Technology Performance and Operation for Incineration of K037 Waste," Cincinnati, 1987.
- 198) J. Ayer and L. Waterland, "Pilot-Scale Incineration Tests of Solvent Sludges and Washes from Ink-Formulating Processes: K086," U.S. EPA Contract No. 68-03-3267, Cincinnati, 1988.
- 199) U.S. EPA, "Proposed - Best Demonstrated Available Technology (BDAT) Background Document for K 011, K013, and K014," Washington, 1988.
- 200) U.S. EPA, "Proposed - Best Demonstrated Available Technology (BDAT) Background Document for K 087," Washington, 1988.
- 201) U.S. EPA, "Draft - BDAT Incineration of CERCLA SARMS at the John Zink Co. Test Facility," Cincinnati, 1987.
- 202) L. Waterland and J. Lee, "Technology Evaluation Report: SITE Program Demonstration Test-The American Combustion Pyretron Thermal Destruction System at the U.S. EPA's Combustion Research Facility," EPA/540/5-89/008, NTIS PB 89 167894, April 1989.
- 203) G. Carroll and D. Oberacker, "Characteristics of Pilot- and Full-Scale Hazardous Waste Incinerator Ash," presented at the *1989 Incineration Conference*, Knoxville, 1989.
- 204) P. Daley, "Slagging and Nonslagging Incinerator Ash," presented at the *1989 Incinerator Conference*, Knoxville, 1989.
- 205) R. Schlegel, "Residues from High Temperature Rotary Kilns and Their Leachability," *Forum on Innovative Hazardous Waste Treatment Technologies: Domestic and International*, Atlanta, 1989.
- 206) C.C. Lee, G.L. Huffman, S.M. Sasseville, "Incinerability ranking systems for RCRA hazardous constituents," *Hazardous Waste & Hazardous Materials*, Vol.7, No.4, 1990.
- 207) B. Dellinger, et al., "Examination of Fundamental Incinerability Indices for Hazardous Waste Destruction," in *Proceedings of the 11th Annual Research Symposium on Incineration and Treatment of Hazardous Waste*, EPA/600/9-85/028, NTIS PB 86-199403, pp 160-170, September 1985.
- 208) J.J. Cudahy, W.L. Troxler, "Autoignition temperature as an indicator of thermal oxidation stability," *J. Hazardous Materials* 8: (1983).
- 209) W. Tsang, W. Shaub, "Chemical processes in the incineration of hazardous materials," *Detoxification of Hazardous Waste*, Chapter 2, Ann Arbor Science, Ann Arbor, MI, 1982, p. 41.
- 210) J.C. Kramlich, M.P. Heap, W.R. Seeker, G.S. Samuelsen, "Flame Mode Destruction of Hazardous Waste Compounds," in *Proceedings of the International Symposium on Combustion*, NTIS PB 86-225042, 1985.
- 211) D.L. Miller, et al., "Incinerability Characteristics of Selected Chlorinated Hydrocarbons," in *Proceedings of the 9th Annual Research Symposium on Solid and Hazardous Waste Disposal*, EPA 600/9-84/015, NTIS PB 84-234525, pp 113-128, July 1984.
- 212) B. Dellinger, et al., "Determination of the thermal decomposition properties of 20 selected hazardous organic compounds," *Hazardous Waste*, 1:137, NTIS PB 84-232487, 1984.
- 213) P.H. Taylor, B. Dellinger, C.C. Lee, "Development of a thermal stability based ranking of hazardous organic compound incinerability," *Environmental Science & Technology*, Vol.24, No.3, 1990.
- 214) J.W. Lee, et al., "Pilot-scale evaluation of the thermal stability POHC incinerability ranking," EPA/600/R-92/065, NTIS PB 92-166966, May 1992.
- 215) Midwest Research Institute, "Field Test of a Surrogate and Incinerability Ranking for Hazardous Waste Incineration," draft final report to EPA, April 4, 1991.
- 216) B. Dellinger, P.H. Taylor, "Pilot and Full-scale Evaluations of a Thermal Stability-Based Ranking of Hazardous Organic Compound Incinerability," draft report to EPA, July 1991.
- 217) *Chemical and Engineering News*, American Chemical Society, Washington, D.C., p. 24, January 30, 1984.
- 218) J.L. Graham, D.L. Hall, B. Dellinger, "Laboratory investigation of thermal degradation of a mixture of hazardous organic compounds," *Environ. Sci. Technol.* 20:703 (1986).
- 219) D.P.Y. Chang, et al., "Evaluation of a Pilot-Scale Circulating Bed Combustor as a Potential Hazardous Waste Incinerator," presented at the *78th Annual Air Pollution Control Association Meeting*, Detroit, MI, June 1985.
- 220) M.L. Berger, C. Proctor II, "Sulfur Hexafluoride as a Surrogate for Verification of Destruction Removal Efficiency," presented at the *Conference on the Chemical/Physical Processes of Combustion*, 1985.
- 221) M.L. Berger, C. Proctor II, "A Tracer Gas Ratio Technique to Determine Boiler Suitability for Hazardous Waste Incineration," presented at the *Conference on the Chemical/Physical Processes of Combustion*, 1985.
- 222) R.C. Thurnau, "Incinerability Index: A Measure of Incinerator Performance," *Waste Management*, Vol. 10, pp 185-195, NTIS PB 89-223663, 1990.
- 223) D.C. Wolbach, et al., "Nonsteady Industrial Boiler Waste Cofiring Tests," in *Proceedings of the 11th Annual Research Symposium on Incineration and Treatment of Hazardous Waste*, EPA 600/9-84/015, NTIS PB 84-234525, pp 217-226, September 1985.
- 224) B. Dellinger, D. Hall, "The viability of using surrogate compounds for monitoring the effectiveness of incineration systems," *JAPCA* 36:179 (1986).
- 225) L.R. Waterland, "Pilot-Scale Investigation of Surrogate Means of Determining POHC Destruction," Presented at the *77th Annual Meeting of the Air Pollution Control Association*, San Francisco, CA, June 1984.
- 226) D. Hall, et al., "Thermal decomposition of a twelve-component organic mixture," *Hazardous Waste and Hazardous Materials* (1985).
- 227) S.L. Daniels, et al., "Experience in Continuous Monitoring of a Large Rotary Kiln Incinerator for CO, CO₂, and O₂," presented at the *78th Annual Meeting of the Air Pollution Control Association*, Detroit, MI, June 1985.
- 228) R.K. Lafond, et al., "Evaluation of continuous performance monitoring techniques for hazardous waste incinerators," *JAPCA* 35:658 (1985).
- 229) L.J. Staley, "Carbon Monoxide and DRE: How Well Do They Correlate," in *Proceedings of the 11th*

E ; 焼却性能の予測

- Annual Research Symposium on Incineration and Treatment of Hazardous Waste*, EPA/600/9-85/028, NTIS 86-199403, pp 23-35, September 1985.
- 230) L.J. Staley, *et al.*, "Incinerator Operating Parameters which Correlate with Performance," EPA/600/2-86/091, NTIS PB 87-104626, June 1986.
 - 231) D.P.Y. Chang, *et al.*, "Spray Combustion Studies of Surrogate Hazardous Waste Incineration," EPA Report, PB 88-246095, March 1988.
 - 232) L.J. Staley, *et al.*, "On the relationship between CO, POHC, and PIC emissions from a simulated hazardous waste," *JAPCA*, Vol.39, No.3, 1989.
 - 233) U.S. EPA - OSHA Joint Task Force, "Evaluation of Worker Health and Safety at Hazardous Waste Incinerators," draft report, May 23, 1991.
 - 234) W.E. Whitworth, *et al.*, "Evaluation of the Impacts of Incineration Waste Feed Cutoffs," EPA Draft Report, August 1992.
 - 235) H. Lips, C. Castaldini, "Engineering Assessment Report: Hazardous Waste Cofiring in Industrial Boilers Under Non-Steady-State Operating Conditions," U.S. EPA, August 1986.
 - 236) Midwest Research Institute, "Boiler Hysteresis Study: Sorption and Desorption of POHCs and PICs in a Full-Scale Boiler under Sooting Conditions," EPA Draft Summary Report, August 13, 1990.
 - 237) G.D. Hinshaw, *et al.*, "Sorption and Desorption of POHCs and PICs in a Full-Scale Boiler Under Sooting Conditions," in *Proceedings of the 16th Annual RREL Hazardous Waste Research Symposium on Remedial Action, Treatment, and Disposal of Hazardous Waste*, EPA/600/9-90-037, NTIS PB 91-148379, pp 23-38, August 1990.
- F ; 環境, 公衆衛生の意味**
- 238) U.S. EPA, "Assessment of Incineration as a Treatment Method for Liquid Organic Hazardous Waste: Background Report IV, Comparison of Risks from Land-Based and Ocean-Based Incinerators," March 1985.239. J.C. Ingwersen, *et al.*, "Analysis of the Off-Site Impacts of Hypothetical Accidents at a Hazardous Waste Incineration Facility," in *Proceedings, 3rd International Symposium on Operating European Hazardous Waste Management Facilities*, Odense, Denmark, September 1986.
 - 240) J. Toffer-Clausen, "Safety Programs," in *Proceedings, 3rd International Symposium on Operating European Hazardous Waste Management Facilities*, Odense, Denmark, September 1986.
 - 241) K.E. Kelly, "Methodologies for assessing the health risks of hazardous waste incinerator stack emissions to surrounding populations," *Hazardous Waste* 1:507 (1984).
 - 242) U.S. EPA, "Guideline on Air Quality Models (Revised)," EPA-450/2-78-027R, NTIS PB 86 245248 July 1986.
 - 243) U.S. EPA, "Supplement B to the Guideline on Air Quality Models (Revised)," draft, September 1990.
 - 244) U.S. EPA, "Health Risk Assessment Methodologies for RCRA Regulatory Analysis," draft report, November 1983.
 - 245) J.F. Bowers, *et al.*, "Industrial Source Complex (ISC) Dispersion Model User's Guide," U.S. EPA, EPA-450/4-79-030, NTIS PB 80-133051, December 1979.
 - 246) U.S. EPA, "Industrial Source Complex (ISC) Dispersion Model User's Guide, Second Edition, Volumes 1 and 2," EPA-450/4-86-005a, and 005b, NTIS PB86 234259 and PB86 234267, 1986.
 - 247) U.S. EPA, "Industrial Source Complex (ISC) Dispersion Model; Addendum to the User's Guide," NTIS PB 88-171475, 1987.
 - 248) F.R. O'Donnell, G.A. Holton, "Automated Methodology for Assessing Inhalation Exposure to Hazardous Waste Incinerator Emissions," in *Proceedings of the Ninth Annual Research Symposium on Incineration and Treatment of Hazardous Waste*, EPA-600/9-84/015, NTIS PB 84-234525, pp 225-234, July 1984.
 - 249) F.R. O'Donnell, *et al.*, "Users Guide for the Automated Inhalation Exposure Methodology (IEM)," U.S. EPA, EPA-600/2-83-29, NTIS PB 83-187468, June 1983.
 - 250) G.A. Holton, C.C. Travis, E.L. Etnier, F.R. O'Donnell, "Inhalation Pathway Risk Assessment of Hazardous Waste Incineration Facilities," presented at the *77th APCA Annual Meeting*, Vol. 6, 84-102.3, NTIS DE 84003408, 1984.
 - 251) Peer Consultants, "Supporting Documentation for the RCRA Incinerator Regulations 40 CFR 264, Subpart O-Incinerators," U.S. EPA, NTIS PB 86-110293, October 1984.
 - 252) U.S. EPA, "Integrated Risk Information System (IRIS) - Appendix A: Reference Dose (RfD): Description and Use in Health Risk Assessments," On-Line, 1992.
 - 253) B.D. Goldstein, "Toxic substances in the atmospheric environment," *JAPCA* 33:454 (1983).
 - 254) *Federal Register*, Vol.51, No.185, p. 33992-34504, September 1986.
 - 255) U.S. EPA, "Risk Assessment Guidance for Superfund, Human Health Evaluation Manual Part A, Volume 1, Interim Final," EPA/540/1-89/002, NTIS PB 90-155581, December 1989.
 - 256) U.S. EPA, "Risk Assessment Guidance for Superfund, Environmental Evaluation Manual, Volume 2, Interim Final," EPA/540/1-89/001, NTIS PB 90-155599, March 1989.
 - 257) W.D. Ruckelshaus, "Science, risk and public policy," *Science* 221:1026 (1983).
 - 258) Weinberger, L., *et al.*, "Supporting Documentation for the RCRA Incinerator Regulations, 40 CFR 265, Subpart O - Incinerators," EPA Contract No.68-01-6901, 1984.
 - 259) C.C. Taylor, *et al.*, "Health Risk Assessment for Metals Emissions from Hazardous Waste Incinerators," presented at *79th APCA Annual Meeting*, Minneapolis, MN, June 1986.
 - 260) K.E. Kelly, "Comparison of Metal Emissions Data from Hazardous Waste Incineration Facilities," presented at *78th APCA Annual Meeting*, Detroit, MI, June 1985.
 - 261) E.K. Mantus, "All Fired Up, Burning Hazardous Waste in Cement Kilns," *Environmental Toxicology International (ETI)*, Inc., Seattle, WA, 1992.
 - 262) *Texas Air Control Board*, "Control District News," *Journal of Air & Waste Management Association* 42 (7):950-951, July 1992.
 - 263) G.A. Holton, *et al.*, "Inhalation Pathway Risk Assessment of Hazardous Waste Incineration Facilities," in *Proceedings, 77th APCA Annual Meeting*, San Francisco, CA, June 1984.
 - 264) G.A. Holton, C.C. Travis, E.L. Etnier, F.R. O'Donnell, D.M. Hetrick, E. Dixon, "Multiple-Pathways Screening-Level Assessment of a Hazardous Waste Incineration Facility," Oak Ridge National Laboratory, ORNL/TM-8652, DE85000156.
 - 265) C.C. Travis, E.L. Etnier, G.A. Holton, F.R. O'Donnell, D.M. Hetrick, E. Dixon, E.S. Harrington, "Inhalation Pathway Risk Assessment of Hazardous Waste Incineration Facilities," ORNL/TM-9096, Oak Ridge National Laboratory, 1984.
 - 266) U.S. EPA, "Methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions, Interim Final," EPA/600/6-90/003, NTIS PB 90-187055, January 1990.
 - 267) M.Y. Anastas, "Control Technology Assessment of Hazardous Waste Disposal Operations in Chemicals Manufacturing: Indepth Survey Report of E.I. duPont de Nemours and Nemours and Company, Chambers Works Incinerator, Deepwater, New Jersey," U.S. EPA, NTIS PB 84-242577, 1984.
 - 268) M. Anastas, "Control Technology Assessment of Hazardous Waste Disposal Operations in Chemicals Manufacturing: At 3 M Company Chemolite Incinerator, Cottage Grove, MN, Indepth Survey Report," U.S. EPA, NTIS, PB 84-241959, 1984.
 - 269) J. Lewtas, "Comparative Potency of Complex Mixtures: Use of Short-Term Genetic Bioassays in Cancer Risk Assessment," in *Short-Term Bioassays in the Analysis of Complex Environmental Mixture IV*, Plenum Publishing Corp., 1985.
 - 270) Dempsey, C.R., "A Comparison: Organic Emissions from Hazardous Waste Incinerators Versus the 1990 Toxics Release Inventory Air Releases," presented at the *AWMA 85th Annual Meeting & Exhibition*, Kansas City, Missouri, June 21-26, 1992.
 - 271) U.S. EPA, "Toxics Release Inventory," On-Line, 1992.
 - 272) U.S. EPA, "Cancer Risk from Outdoor Exposure to Air Toxics," EPA-450/1-90-004a, NTIS PB-91-159624, September 1990.
 - 273) American Cancer Society, "Cancer Facts & Figures - 1991," Atlanta, GA, 1991.
- G ; 今後の課題**
- 274) J.D. Demirgian, C.L. Hammer, "Comparison of Passive-Remote and Conventional Fourier Transform Infrared Systems for Continuously Monitoring Incine-

- rator Emissions," presented at the 1992 Incineration Conference, Albuquerque, NM, May 11-15, 1992.
- 275) H. Freeman, *Innovative Thermal Processes for Treating Hazardous Wastes*, Technomic Publishing Company, Lancaster, PA, 1986.
- 276) H. Freeman, *Thermal Processes: Innovative Hazardous Waste Treatment Technology Series*, Technomic Publishing Company, Lancaster, PA, 1990.
- 277) P.W. Falcone, "Incineration of Low Btu Hazardous

- Wastes Using a Rotary Reactor," presented at the 1991 Incineration Conference, Knoxville, TN, May 13-17, 1991.
- 278) U.S. EPA, "The Superfund Innovative Technology Evaluation Program: Technology Profiles," EPA/540/5-90/006, November 1990.
- 279) E.T. Oppelt, "Incineration: A Critical Review," *Journal of the Air Pollution Control Association* 37 (5):558-586, 1987.

＜新刊図書＞

—身近な環境問題—

『環境と人にやさしい洗剤をもとめて』

発行 環境技術研究協会 A5判 約195頁 定価 2,000円(税込)

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