ILLINOIS POLLUTION CONTROL BOARD
November 21, 1984

IN THE MATTER OF:	)	
	)	
HAZARDOUS WASTE LISTINGS AND TEST METHODS FOR THE IDENTIFICATION OF TETRACHLORODIBENZO-p-DIOXINS	)	R84-34

FINAL RULE.

OPINION AND ORDER OF THE BOARD (by J. D. Dumelle):

Public Act 83-1235, which became law on July 30, 1984, contains the following mandate for the adoption of Board regulations.

> "Section 22.4
>
> (d) The Board shall adopt regulations within 120 days after the effective date of this amendatory Act which list tetrachlorodibenzo-p-dioxins as hazardous wastes and which provide test methods for identifying the presence of tetrachlorodibenzo-p-dioxins in waste unless a federal regulation listing such dioxins as hazardous wastes and establishing test methods has been promulgated by the U.S. Environmental Protection Agency prior to adoption of such regulations. Any such federal regulations adopted pursuant to subsection (a) shall supersede Board regulations adopted pursuant to this subsection. The provisions of Title VII of this Act and Section 5 of the Illinois Administrative Procedure Act shall not apply to regulations adopted pursuant to this subsection." (Ill. Rev. Stat. 1984, ch. 111½ par. 1022.4.)

This language evinces dual legislative purposes. It demonstrates an intent to list these dioxins as hazardous wastes and adopt test methods under Illinois law as quickly as possible, and, in addition, an intent to have these listings and test methods conform to any federal rule on the same subject. The effect of this listing is to require handlers of wastes containing these dioxins to comply with the Board's hazardous waste regulatory standards. A federal rule containing a listing and test methods for tetrachlorodibenzo-p-dioxins (as well as other listings) was proposed on April 4, 1983 in the Federal Register. At the time that P.A. 83-1235 was enacted,

it was anticipated that the U.S. Environmental Protection Agency (U.S. EPA) would complete its proposed rulemaking and adopt a final rule listing these dioxins as hazardous wastes very shortly. However, as of this date, U.S. EPA has indicated that a final rule will not be published before early 1985. P.A. 83-1235 must be interpreted as having foreseen the possiblity that final federal rulemaking would be delayed. In the event of such a delay, the statutory language requires that Board rules be adopted by November 27, 1984 to meet the immediate concern about the regulation of dioxins and to breach the "gap" until federal regulations are adopted.

In an effort to address the dual intent of P.A. 83-1235, the Board on its own motion proposed that the federal proposal which was published in the Federal Register on April 4, 1983 (48 Fed. Reg. 14514-14529) be adopted as an Interim Rule, but only in so far as it relates to tetrachlorodibenzo-p-dioxins. The logic underlying this approach is obvious. As a rule which is "ear-marked" to be superseded in the near future, this rule should parallel the anticipated final federal rule as closely as possible in order to minimize disruption of the system once a final rule is promulgated. The April 4, 1983 proposed federal rule is our best information as to the content of the final federal rule.

The April 4, 1983 proposed federal rule addressed significantly more than the listings and test methods the General Assembly instructed the Board to adopt in this rulemaking. For example, the federal proposal listed chlorinated dibenzofurans as well as many more isomers of dioxin than are encompassed by the tetrachlorodibenzo-p-dioxin structure. In addition, the federal proposal prescribed special "RCRA" operating standards for the handling of wastes containing these materials. In todays action the Board adopts only that portion of the federal proposal which is necessary to accomplish the purposes of P.A. 83-1235, i.e., the portion relating to the listing and test methods for tetrachlorodibenzo-p-dioxins. This requires amending four sections and three appendices of the Illinois "RCRA" rules, as well as the adoption of a new Appendix I containing the test method.

The Board notes that P.A. 83-1235 provides that neither the rulemaking provisions of the Illinois Administrative Procedure Act nor Title VII of the Illinois Environmental Protection Act apply to this rulemaking. The "waiver" of these procedures, as well as the limited review period, support the position that full Board review of the merits of the federal proposal was not intended. Nonetheless, the Board gave notice of its intended action in the Environmental Register, as well as to persons on an extensive notice list, and provided 30 days for public comment.

Four comments were received during or shortly after the close of the announced comment period. All motions and requests to file comments Instanter are granted. Each of these is discussed below.

The Illinois State Fabricare Association (P.C. #1) pointed out that the wording of the April 4, 1983 federal proposal (which is parallelled in the Board's October 12, 1984 proposal) implies that the small quantity exclusion for acutely hazardous wastes (i.e. 1 kilogram) would now apply to all materials listed in Sections 721.131 and 721.132, as well as the P list contained in 721.133(e). This would extend the effect of that very limited exclusion for acute hazardous wastes to a number of wastes that are listed in Sections 721.131 and 721.132 for reasons other than acute toxicity, e.g. ignitability, toxicity, reactivity, corrosivity. The proposed language in Section 721.105(e)(1), the small quantity exclusion for acute hazardous wastes, refers to "acute hazardous wastes listed in Sections 721.131, 721.132, or 721.133(e)". To avoid enlarging the effect of this proposed amendment beyond the scope of either this rulemaking or the federal proposal, one must interpret this phrase as meaning that only those materials in Sections 721.131 and 721.132 which are identified as "acute hazardous waste" are subject to this particular exclusion. Clarifying language has been added to remedy this problem.

The same question was raised by Chemical Waste Management, Inc. (P.C. #4) regarding Section 721.107(b)(3), which addresses residues in empty containers. Again, the reference to Sections 721.131 and 721.132 in this section is confusing and could be interpreteted as going beyond "acute hazardous wastes". Clarifying language has been added to this section as well.*

Chemical Waste Management's comments also address two other points that they preceive to be logical deficiencies in the federal proposal, i.e. the decontamination of equipment referred to in F022 and the exclusion of wastewater and spent carbon from hydrogen chloride purification. While these may be valid points, the record before the Board in this proceeding has inadequate technical documentation to support that determination.

Finally, the Board received a comment from Marcia A. Kuehl of the U.S. Environmental Protection Agency, Region V,

---

*Illinois Power Company (P.C. #3) pointed out a typographical error in this same section (721.107(b)(3)) involving the inadvertant dropping of the word "acutely." The Board regrets this error which certainly may have increased confusion as to the scope of this Section.

Environmental Services Division (P.C. #2), on the adequacy of Test Method 8280. Ms. Kuehl points out that a more precise method is "due out" within the month. She also notes that certain steps in the method relate only to dibenzofuran detection and could be deleted for purposes of tetrachlorodibenzo-p-dioxin detection. The Board very much appreciates Ms. Kuehl's review of this particular aspect of this rulemaking. Unfortunately, the Board is statutorily required to act in this rulemaking by November 27, 1984. Promulgation of a new federal rule on Method 8280 is likely to require a new federal proposal and to take six months to a year. Once such a change is promulgated as a federal rule, the Board is authorized and required to adopt it as a superseding method. (See Ill. Rev. Stat. 1983, ch. 111½, pars. 1022.4(a) and (c).) Therefore, the language of Method 8280 as proposed in the April 3, 1984 Federal Register, which remains our best information as to the content of the final federal rule, is adopted herein.

The Board recognizes that Method 8280 was designed to detect a broader range of contaminants than simply tetrachlorodibenzo-p-dioxins. However, the Board believes it is wiser to leave this highly technical method "intact", rather than to make revisions without a thorough technical record. Footnote #1 to Method 8280 states that "this method is appropriate for the analysis of Tetra-, penta- and hexachlorinated dibenzo-p-dioxins and dibenzofurans." This rulemaking authorizes the use of this methodology for the detection of tetrachlorodibenzo-p-dioxins. At this time, there is no need to utilize the provisions which are designed to detect other contaminants.

ORDER

The Board hereby orders that the text of Part 721 and accompanying Appendices be amended as follows:

1. Section 721.105 is amended as follows:

Section 721.105 Special Requirements for Hazardous Waste Generated by Small Quantity Generators

a) A generator is a small quantity generator in a calendar month if he generates less than 1000 kilograms of hazardous waste in that month. Part 700 explains the relation of this to the 100 kg/mo exception of Chapter 9.

b) Except for those wastes identified in paragraphs (e) and (f) of this section, a small quantity generator's hazardous wastes are not subject to regulation under Parts 722 through 725 and 40 CFR Parts 122 and 124, and the notification requirements of Section 3010 of RCRA, provided the generator complies with the requirements of paragraph (g) of this section.

c) Hazardous waste that is beneficially used or re-used or legitimately recycled or reclaimed and that is excluded from regulation by §721.106(a) is not included in the quantity determinations of this section, and is not subject to any requirements of this section. Hazardous waste that is subject to the special requirements of §721.106(b) is included in the quantity determinations of this section and is subject to the requirements of this section.

d) In determining the quantity of hazardous waste he generates, a generator need not include:

1) His hazardous waste when it is removed from on-site storage; or

2) Hazardous waste produced by on-site treatment of his hazardous waste.

e) If a small quantity generator generates acutely hazardous waste in a calendar month in quantities greater than set forth below, all quantities of that acutely hazardous waste are subject to regulation under Parts 722 through 725 and 40 CFR Parts 122 and 124, and the notification requirements of Section 3010 of RCRA:

1) A total of one kilogram of ~~commercial chemical product and manufacturing chemical intermediates having the generic names listed in §721.133(e), and off-specification commercial chemical products and manufacturing chemical intermediates which, if they met specifications, would have the generic names listed in §721.133(e),~~ or hazardous wastes which are identified as acute hazardous wastes (H) in Sections 721.131, 721.132, or 721.133(e); or

2) A total of 100 kilograms of any residue or contaminated soil, water or other debris resulting from the clean-up of a spill, into or on any land or water, of any ~~commercial chemical products or manufacturing chemical intermediates having the generic names listed in §721.133(e), or any residue or contaminated soil, water or other debris resulting from the clean up of a spill, into or on any land or water, of any off-specification commercial chemical products or manufacturing chemical intermediates which, if they met specifications, would have the generic names listed in §721.133(e),~~ hazardous wastes which are identified as hazardous wastes (H) in Sections 721.131, 721.132, or 721.133(e).

f) A small quantity generator may accumulate hazardous waste on-site. If he accumulates at any time more than a total

of 1000 kilograms of his hazardous waste, or his acutely hazardous wastes in quantities greater than set forth in paragraphs (e)(1) or (e)(2) of this section, all of those accumulated wastes for which the accumulation limit was exceeded are subject to regulation under Parts 722 through 725 and 40 CFR Parts 122 and 124, and the notification requirements of Section 3010 of RCRA. The time period of §722.134 for accumulation of wastes on-site begins for a small quantity generator when the accumulated wastes exceed the applicable exclusion level.

g) In order for hazardous waste generated by a small quantity generator to be excluded from full regulation under this section, the generator must:

1) Comply with §722.111;

2) If he stores his hazardous waste on-site, store it in compliance with the requirements of paragraph (f) of this section; and

3) Either treat or dispose of his hazardous waste in an on-site facility, or ensure delivery to an off-site storage, treatment or disposal facility, either of which is:

A) Permitted under 40 CFR Part 122;

B) In interim status under Part 725 and 40 CFR Part 122;

C) Authorized to manage hazardous waste by a State with a hazardous waste management program approved under 40 CFR Part 123;

D) Permitted, licensed or registered by a State to manage municipal or industrial solid waste; or

E) A facility which:

i) Beneficially uses or re-uses, or legitimately recycles or reclaims his waste; or

ii) Treats his waste prior to beneficial use or re-use, or legitimate recycling or reclamation.

h) Hazardous waste subject to the reduced requirements of this section may be mixed with non-hazardous waste and remain subject to these reduced requirements even though the resultant mixture exceeds the quantity limitations identified in this section, unless the mixture meets any of the characteristics of hazardous wastes identified in Subpart C.

i) If a small quantity generator mixes a solid waste with a hazardous waste that exceeds a quantity exclusion level of this section, the mixture is subject to full regulation.

(Source. Amended at 6 Ill. Reg. 4828, effective as noted in §700.106; amended at _____Ill. Reg._____, effective _____.)

2. Section 721.107 is amended as follows:

Section 721.107 Residues of Hazardous Waste In Empty Containers

a) 1) Any hazardous waste remaining in either an empty container or an inner liner removed from an empty container, as defined in paragraph [b] of this section, is not subject to regulation under Parts 721 through 725 or 40 CFR Part 122 or 124 or to the notification requirements of Section 3010 of RCRA.

2) Any hazardous waste in either a container that is not empty or an inner liner removed from a container that is not empty, as defined in paragraph [b] of this section, is subject to regulations under Parts 721 through 725 and 40 CFR Parts 122 and 124 and to the notification requirements of Section 3010 of RCRA.

b) 1) A container or an inner liner removed from a container that has held any hazardous waste, except a waste that is compressed gas or that is identified ~~in Section 721.133(e)~~ as an acute hazardous waste (H) in Sections 721.131, 721.132, or 721.133(e), is empty if:

A) All wastes have been removed that can be removed using the practices commonly employed to remove materials from that type of container, e.g., pouring, pumping, and aspirating, and

B) No more than 2.5 centimeters (one inch) of residue remain on the bottom of the container or inner liner.

2) A container that has held a hazardous waste that is a compressed gas is empty when the pressure in the container approaches atmospheric.

3) A container or an inner liner removed from a container that has held a hazardous waste ~~identified in §721.133(e)~~ which is identified as an acute hazardous waste (H) in Sections 721.131, 721.132 or 721.133(e) is empty if:

A) the container or inner liner has been triple rinsed using a solvent capable of removing the commercial chemical product or manufacturing chemical intermediate;

B) the container or inner liner has been cleaned by another method that has been shown in the scientific literature, or by tests conducted by the generator, to achieve equivalent removal; or

C) in the case of a container, the inner liner that prevented contact of the commercial chemical product or manufacturing chemical intermediate with the container, has been removed.

(Source: Amended at 6 Ill. Reg. 4828, effective as noted in §700.106; amended at _____Ill. Reg._____effective_____.)

3. Section 721.131 is amended as follows:

Section 721.131 Hazardous Wastes From Nonspecific Sources

Industry and EPA hazardous waste No.	Hazardous Waste	Hazard code
Generic:		
F001	The following spent halogenated solvents used in degreasing: tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, and chlorinated fluorocarbons; and sludges from the recovery of these solvents in degreasing operations.	(T)
F002	The following spent halogenated solvents: tetrachloroethylene, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, chlorobenzene, 1,1,2-trichloro-1,2,2-trifluoroethane, ortho-dichlorobenzene, and trichlorofluoromethane; and the still bottoms from the recovery of these solvents.	(T)
F003	The following spent non-halogenated solvents: xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol; and the still bottoms from the recovery of these solvents.	(I)
F004	The following spent non-halogenated solvents: cresols and cresylic acid, and nitrobenzene; and the still bottoms from the recovery of these solvents.	(T)
F005	The following spent non-halogenated solvents: toluene, methyl ethyl ketone, carbon disulfide, isobutanol, and pyridine; and the still bottoms from the recovery of these solvents.	(I, T)
F006	Wastewater treatment sludges from electroplating operations except from the following processes: (1) sulfuric acid anodizing of aluminum; (2) tin plating on carbon steel; (3) zinc plating (segregated basis) on carbon steel; (4) aluminum or zinc-aluminum plating on carbon steel; (5) cleaning/stripping associated with tin, zinc and aluminum plating on carbon steel; and (6) chemical etching and milling of aluminum.	(T)
F019	Wastewater treatment sludges from the chemical conversion coating of aluminum.	(T)
F007	Spent cyanide plating bath solutions from electroplating operations (except for precious metals electroplating spent cyanide plating bath solutions).	(R, T)
F008	Plating bath sludges from the bottom of plating baths from electroplating operations where cyanides are used in the process (except for precious metals electroplating plating bath sludges).	(R, T)

Industry and EPA hazardous waste No.	Hazardous Waste	Hazard code
Generic.		
F009	Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process (except for precious metals electroplating spent stripping and cleaning bath solutions).	(R, T)
F010	Quenching bath sludge from oil baths from metal heat treating operations where cyanides are used in the process (except for precious metals heat-treating quenching bath sludges).	(R, T)
F011	Spent cyanide solutions from salt bath pot cleaning from metal heat treating operations (except for precious metals heat treating spent cyanide solutions from salt bath pot cleaning).	(R, T)
F012	Quenching wastewater treatment sludges from metal heat treating operations where cyanides are used in the process (except for precious metals heat treating quenching wastewater treatment sludges).	(T)
F020	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tri-, tetra-, or pentachlorophenol, or of intermediates used to produce their derivatives. (This listing does not include wastes from the production of Hexachlorophene from highly purified 2, 4, 5-trichlorophenol.)	(H)
F021	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tetra-, penta-, or hexachlorobenzenes under alkaline conditions.	(H)
F022	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production of materials on equipment previously used for the production or manufacturing use (as a reactant, chemical intermediate or component in a formulating process) of materials listed under F020 and F021.	(H)
F023	Discarded unused formulations containing tri-, tetra-, or pentachlorophenol or discarded unused formulations containing compounds derived from these chlorophenols.	(H)

(Comment: The primary hazardous properties of these materials have been indicated by the letters T (Toxicity), R (Reactivity), I (Ignitability), and C (Corrosivity). The letter H indicates Acute Hazardous Waste.)

4. Section 721.133 is amended as follows:

Section 721.133 Discarded Commercial Chemical Products, Off-Specification Species, Containers and Spill Residues

The following materials or items are hazardous wastes if and when they are discarded or intended to be discarded:

a) Any commercial chemical product, or manufacturing chemical intermediate having the generic name listed in paragraphs (e) or (f).

b) Any off-specification commercial chemical product or manufacturing chemical intermediate which, if it met specifications, would have the generic name listed in paragraphs (e) or (f).

c) Any container or inner liner removed from a container that has been used to hold any commercial chemical product or manufacturing chemical intermediate having the generic names listed in paragraph (e), or any container or inner liner removed from a container that has been used to hold any off-specification chemical product and manufacturing chemical intermediate which, if it met specifications, would have the generic name listed in paragraph (e), unless:

1) The container or inner liner has been triple rinsed using a solvent capable of removing the commercial chemical product or manufacturing chemical intermediate;

2) The container or inner liner has been cleansed by another method that has been shown in the scientific literature, or by tests conducted by the generator, to achieve equivalent removal; or

3) In the case of a container, the inner liner that prevented contact of the commercial chemical product or manufacturing chemical intermediate with the container, has been removed.

d) Any residue or contaminated soil, water or other debris resulting from the cleanup of a spill, into or on any land or water of any commercial chemical product or manufacturing chemical intermediate having the generic name listed in paragraph (e) or (f), or any residue or contaminated soil, water or other debris resulting from the cleanup of a spill, into or on any land or water, of any off-specification chemical product or manufacturing chemical intermediate which, if it met specifications, would have the generic name listed in paragraph (e) or (f).

(Comment: The phrase "commercial chemical product or manufacturing chemical intermediate having the generic name listed in ..." refers to a chemical substance which is manufactured or formulated for commercial or manufacturing use which consists of the commercially pure grade of the chemical, any technical grades of the chemical that are produced or marketed, and all formulations in which the chemical is the sole active ingredient. It does not refer to a material, such as a manufacturing process waste, that contains any of the substances listed in paragraphs (e) or (f).

Where a manufacturing process waste is deemed to be a hazardous waste because it contains a substance listed in paragraphs (e) or (f), such waste will be listed in either §§721.131 or 721.132 or will be identified as a hazardous waste by the characteristics set forth in Subpart C of this part.)

e) The commercial chemical products, manufacturing chemical intermediates or off-specification commercial chemical products or manufacturing chemical intermediates referred to in paragraphs (a) through (d) of this section, are identified as acute hazardous waste (H) and are subject to the small quantity exclusion defined in §721.105(e).

(Comment: For the convenience of the regulated community the primary hazardous properties of these materials have been indicated by the letters T (Toxicity), and R (Reactivity). Absence of a letter indicates that the compound only is listed for acute toxicity. These wastes and their corresponding EPA Hazardous Waste Numbers are:)

Hazardous waste No.	Substance
P023	Acetaldehyde, chloro-
P002	Acetamide, N-(aminothioxomethyl)-
P057	Acetamide, 2-fluoro-
P058	Acetic acid, fluoro-, sodium salt
P066	Acetimedic acid, N-[(methylcarbamoyl)oxy]thio-, methyl ester
P001	3-(alpha-acetonylbenzyl)-4-hydroxycoumarin and salts
P002	1-Acetyl-2-thiourea
P003	Acrolein
P070	Aldicarb
P004	Aldrin
P005	Allyl alcohol
P006	Aluminum phosphide
P007	5-(Aminomethyl)-3-isoxazolol
P008	4-Aminopyridine
P009	Ammonium picrate (R)
P119	Ammonium vanadate
P010	Arsenic acid
P012	Arsenic (III) oxide
P011	Arsenic (V) oxide
P011	Arsenic pentoxide
P012	Arsenic trioxide
P038	Arsine, diethyl-
P054	Aziridine
P013	Barium cyanide
P024	Benzenamine, 4-chloro-
P077	Benzenamine, 4-nitro-

Hazardous waste No.	Substance
P028	Benzene, (chloromethyl)-
P042	1,2-Benzenediol, 4-[1-hydroxy-2-(methylamino)ethyl]-
P014	Benzenethiol
P028	Benzyl chloride
P015	Beryllium dust
P016	Bis(chloromethyl) ether
P017	Bromoacetone
P018	Brucine
P021	Calcium cyanide
P123	Camphene, octachloro-
P103	Carbamidoselenoic acid
P022	Carbon bisulfide
P022	Carbon disulfide
P095	Carbonyl chloride
P033	Chlorine cyanide
P023	Chloroacetaldehyde
P024	p-Chloroaniline
P026	1-(o-Chlorophenyl)thiourea
P027	3-Chloropropionitrile
P029	Copper cyanides
P030	Cyanides (soluble cyanide salts), not elsewhere specified
P031	Cyanogen
P033	Cyanogen chloride
P036	Dichlorophenylarsine
P037	Dieldrin
P038	Diethylarsine
P039	O,O-Diethyl S-[2-(ethylthio)ethyl] phosphorodithioate
P041	Diethyl-p-nitrophenyl phosphate
P040	O,O-Diethyl O-pyrazinyl phosphorothioate
P043	Diisopropyl fluorophosphate
P044	Dimethoate
P045	3,3-Dimethyl-1-(methylthio)-2-butanone, O-[(methylamino) carbonyl] oxime
P071	O,O-Dimethyl O-p-nitrophenyl phosphorothioate
P082	Dimethylnitrosamine
P046	alpha, alpha-Dimethylphenethylamine
P047	4,6-Dinitro-o-cresol and salts
P034	4,6-Dinitro-o-cyclohexylphenol
P048	2,4-Dinitrophenol
P020	Dinoseb
P085	Diphosphoramide, octamethyl-
P039	Disulfoton
P049	2,4-Dithiobiuret
P109	Dithiopyrophosphoric acid, tetraethyl ester
P050	Endosulfan
P088	Endothall
P051	Endrin

Hazardous waste No.	Substance
P042	Epinephrine
P046	Ethanamine, 1,1-dimethyl-2-phenyl-
P084	Ethenamine, N-methyl-N-nitroso-
P101	Ethyl cyanide
P054	Ethylenimine
P097	Famphur
P056	Fluorine
P057	Fluoroacetamide
P058	Fluoroacetic acid, sodium salt
P065	Fulminic acid, mercury (II) salt (R,T)
P059	Heptachlor
P051	1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8, 8a-octahydro-endo,endo-1,4:5,8-dimethanonaphthalene
P037	1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8, 8a-octahydro-endo,exo-1,4:5,8-dimethanonaphthalene
P060	1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro- 1,4:5,8-endo, endo-dimethanonaphthalene
P004	1,2,3,4,10,10,-Hexachloro-1,4,4a,5,8,8a-hexahydro- 1,4:5,8-endo,exo-dimethanonaphthalene
P060	Hexachlorohexahydro-exo,exo-dimethanonaphthalene
P062	Hexaethyl tetraphosphate
P116	Hydrazinecarbothioamide
P068	Hydrazine, methyl-
P063	Hydrocyanic acid
P063	Hydrogen cyanide
P096	Hydrogen phosphide
P064	Isocyanic acid, methyl ester
P007	3(2H)-Isoxazolone, 5-(aminomethyl)-
P092	Mercury, phenyl-, acetate
P065	Mercury fulminate (R,T)
P016	Methane, oxybis(chloro-
P112	Methane, tetranitro- (R)
P118	Methanethiol, trichloro-
P059	4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro- 3a,4,7,7a-tetrahydro-
P066	Methomyl
P067	2-Methylaziridine
P068	Methyl hydrazine
P064	Methyl isocyanate
P069	2-Methyllactonitrile
P071	Methyl parathion
P072	alpha-Naphthylthiourea
P073	Nickel carbonyl
P074	Nickel cyanide
P074	Nickel(II) cyanide
P073	Nickel tetracarbonyl
P075	Nicotine and salts

Hazardous waste No.	Substance
P076	Nitric oxide
P077	p-Nitroaniline
P078	Nitrogen dioxide
P076	Nitrogen(II) oxide
P078	Nitrogen(IV) oxide
P081	Nitroglycerine (R)
P082	N-Nitrosodimethylamine
P084	N-Nitrosomethylvinylamine
P050	5-Norbornene-2,3-dimethanol, 1,4,5,6,7,7-hexachloro, cyclic sulfite
P085	Octamethylpyrophosphoramide
P087	Osmium oxide
P087	Osmium tetroxide
P088	7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
P089	Parathion
P034	Phenol, 2-cyclohexyl-4,6-dinitro-
P048	Phenol, 2,4-dinitro-
P047	Phenol, 2,4,-dinitro-6-methyl-
P020	Phenol, 2,4-dinitro-6-(1-methylpropyl)-
P009	Phenol, 2,4,6-trinitro-, ammonium salt (R)
P036	Phenyl dichloroarsine
P092	Phenylmercuric acetate
P093	N-Phenylthiourea
P094	Phorate
P095	Phosgene
P096	Phosphine
P041	Phosphoric acid, diethyl p-nitrophenyl ester
P044	Phosphorodithioic acid, O,O-dimethyl S-[2-(methylamino)-2-oxoethyl]ester
P043	Phosphorofluoric acid, bis(1-methylethyl)ester
P094	Phosphorothioic acid, O,O-diethyl S-(ethylthio)methyl ester
P089	Phosphorothioic acid, O,O-diethyl O-(p-nitrophenyl) ester
P040	Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester
P097	Phosphorothioic acid, O,O-dimethyl O-[p-((dimethylamino)-sulfonyl)phenyl]ester
P110	Plumbane, tetraethyl-
P098	Potassium cyanide
P099	Potassium silver cyanide
P070	Propanal, 2-methyl-2-(methylthio)-, O-[(methylamino) carbonyl]oxime
P101	Propanenitrile
P027	Propanentrile, 3-chloro-
P069	Propanenitrile, 2-hydroxy-2-methyl-
P081	1,2,3-Propanetriol, trinitrate- (R)
P017	2-Propanone, 1-bromo-

Hazardous waste No.	Substance
P102	Propargyl alcohol
P003	2-Propenal
P005	2-Propen-1-ol
P067	1,2-Propylenimine
P102	2-Propyn-1-ol
P008	4-Pyridinamine
P075	Pyridine, (S)-3-(1-methy-2-pyrrolidinyl)-, and salts
P111	Pyrophosphoric acid, tetraethyl ester
P103	Selenourea
P104	Silver cyanide
P105	Sodium azide
P106	Sodium cyanide
P107	Strontium sulfide
P108	Strychnidin-10-one, and salts
P018	Strychnidin-10-one, 2,3-dimethoxy-
P108	Strychnine and salts
P115	Sulfuric acid, thallium(I) salt
P109	Tetraethyldithiopyrophosphate
P110	Tetraethyl lead
P111	Tetraethylpyrophosphate
P112	Tetranitromethane (R)
P062	Tetraphosphoric acid, hexaethyl ester
P113	Thallic oxide
P113	Thallium(III) oxide
P114	Thallium(I) selenite
P115	Thallium(I) sulfate
P045	Thiofanox
P049	Thioimidodicarbonic diamide
P014	Thiophenol
P116	Thiosemicarbazide
P026	Thiourea, (2-chlorophenyl)-
P072	Thiourea, 1-naphthalenyl-
P093	Thiourea, phenyl-
P123	Toxaphene
P118	Trichloromethanethiol
P119	Vanadic acid, ammonium salt
P120	Vanadium pentoxide
P120	Vanadium(V) oxide
P001	Warfarin
P121	Zinc cyanide
P122	Zinc phosphide (R, T)

f) The commercial chemical products, manufacturing chemical intermediates or off-specification commercial chemical products referred to in paragraphs (a) through (d), are identified as toxic wastes (T) unless otherwise designated and are subject to the small quantity exclusion defined in Section 721.105(a) and (f).

(Comment: For the convenience of the regulated community, the primary hazardous properties of these materials have been indicated by the letters T (Toxicity), R (Reactivity), I (Ignitability) and C (Corrosivity). Absence of a letter indicates that the compound is only listed for toxicity. These wastes and their corresponding EPA Hazardous Waste Numbers are:)

Hazardous waste No.	Substance
U001	Acetaldehyde (I)
U034	Acetaldehyde, trichloro-
U187	Acetamide, N-(4-ethoxyphenyl)-
U005	Acetamide, N-9H-fluoren-2-yl-
U112	Acetic acid, ethyl ester (I)
U144	Acetic acid, lead salt
U214	Acetic acid, thallium(I) salt
U002	Acetone (I)
U003	Acetonitrile (I,T)
U004	Acetophenone
U005	2-Acetylaminofluorene
U006	Acetyl chloride (C,R,T)
U007	Acrylamide
U008	Acrylic acid (I)
U009	Acrylontrile
U150	Alanine, 3-[p-bis(2-chloroethyl)amino] phenyl-, L-
U011	Amitrole
U012	Aniline (I,T)
U014	Auramine
U015	Azaserine
U010	Azirino(2',3':3,4)pyrrolo(1,2-a)indole-4,7-dione, 6-amino-8-[((aminocarbonyl)oxy)methyl]-1,1a, 2,8,8a,8b-hexahydro-8a-methoxy-5-methyl-,
U157	Benz[j]aceanthrylene, 1,2-dihydro-3-methyl-
U016	Benz(c)acridine
U016	3,4-Benzacridine
U017	Benzal chloride
U018	Benz[a]anthracene
U018	1,2-Benzanthracene
U094	1,2-Benzanthracene, 7,12-dimethyl-
U012	Benzenamine (I,T)
U014	Benzenamine, 4,4'-carbonimidoylbis(N,N-dimethyl-
U049	Benzenamine, 4-chloro-2-methyl-
U093	Benzenamine, N,N'-dimethyl-4-phenylazo-
U158	Benzenamine, 4,4'-methylenebis(2-chloro-
U222	Benzenamine, 2-methyl-, hydrochloride
U181	Benzenamine, 2-methyl-5-nitro
U019	Benzene (I,T)
U038	Benzeneacetic acid, 4-chloro-alpha-(4-chlorophenyl)- alpha-hydroxy, ethyl ester

Hazardous waste No.	Substance
U030	Benzene, 1-bromo-4-phenoxy-
U037	Benzene, chloro-
U190	1,2-Benzenedicarboxylic acid anhydride
U028	1,2-Benzenedicarboxylic acid, [bis(2-ethylhexyl)] ester
U069	1,2-Benzenedicarboxylic acid, dibutyl ester
U088	1,2-Benzenedicarboxylic acid, diethyl ester
U102	1,2-Benzenedicarboxylic acid, dimethyl ester
U107	1,2-Benzenedicarboxylic acid, di-n-octyl ester
U070	Benzene, 1,2-dichloro-
U071	Benzene, 1,3-dichloro-
U072	Benzene, 1,4-dichloro-
U017	Benzene, (dichloromethyl)-
U223	Benzene, 1,3-diisocyanatomethyl-(R,T)
U239	Benzene, dimethyl-(I,T)
U201	1,3-Benzenediol
U127	Benzene, hexachloro-
U056	Benzene, hexahydro-(I)
U188	Benzene, hydroxy-
U220	Benzene, methyl-
U105	Benzene, 1-methyl-2,4-dinitro-
U106	Benzene, 1-methyl-2,6-dinitro-
U203	Benzene, 1,2-methylenedioxy-4-allyl-
U141	Benzene, 1,2-methylenedioxy-4-propenyl-
U090	Benzene, 1,2-methylenedioxy-4-propyl-
U055	Benzene, (1-methylethyl)- (I)
U169	Benzene, nitro- (I,T)
U183	Benzene, pentachloro-
U185	Benzene, pentachloronitro-
U020	Benzenesulfonic acid chloride (C,R)
U020	Benzenesulfonyl chloride (C,R)
U207	Benzene, 1,2,4,5-tetrachloro-
U023	Benzene, (trichloromethyl)-(C,R,T)
U234	Benzene, 1,3,5-trinitro- (R,T)
U021	Benzidine
U202	1,2-Benzisothiazolin-3-one, 1,1-dioxide
U120	Benzo[j,k]fluorene
U022	Benzo[a]pyrene
U022	3,4-Benzopyrene
U197	p-Benzoquinone
U023	Benzotrichloride (C,R,T)
U050	1,2-Benzphenanthrene
U085	2,2'-Bioxirane (I,T)
U021	(1,1'-Biphenyl)-4,4'-diamine
U073	(1,1'-Biphenyl)-4,4'-diamine, 3,3'-dichloro-
U091	(1,1'-Biphenyl)-4,4'-diamine, 3,3'-dimethoxy-
U095	(1,1'-Biphenyl)-4,4'-diamine, 3,3'-dimethyl-
U024	Bis(2-chloroethoxy) methane

Hazardous waste No.	Substance
U027	Bis(2-chloroisopropyl) ether
U244	Bis(dimethylthiocarbamoyl) disulfide
U028	Bis(2-ethylhexyl) phthalate
U246	Bromine cyanide
U225	Bromoform
U030	4-Bromophenyl phenyl ether
U128	1,3-Butadiene, 1,1,2,3,4,4-hexachloro-
U172	1-Butanamine, N-butyl-N-nitroso-
U035	Butanoic acid, 4-[Bis(2-chloroethyl)amino] benzene-
U031	1-Butanol (I)
U159	2-Butanone (I,T)
U160	2-Butanone peroxide (R,T)
U053	2-Butenal
U074	2-Butene, 1,4-dichloro- (I,T)
U031	n-Butyl alcohol (I)
U136	Cacodylic acid
U032	Calcium chromate
U238	Carbamic acid, ethyl ester
U178	Carbamic acid, methylnitroso-, ethyl ester
U176	Carbamide, N-ethyl-N-nitroso-
U177	Carbamide, N-methyl-N-nitroso-
U219	Carbamide, thio-
U097	Carbamoyl chloride, dimethyl
U215	Carbonic acid, dithallium (I) salt
U156	Carbonochloridic acid, methyl ester (I,T)
U033	Carbon oxyfluoride (R,T)
U211	Carbon tetrachloride
U033	Carbonyl fluoride (R,T)
U034	Chloral
U035	Chlorambucil
U036	Chlordane, technical
U026	Chlornaphazine
U037	Chlorobenzene
U039	4-Chloro-m-cresol
U041	1-Chloro-2,3-epoxypropane
U042	2-Chloroethyl vinyl ether
U044	Chloroform
U046	Chloromethyl methyl ether
U047	beta-Chloronapthalene
U048	o-Chlorophenol
U049	4-Chloro-o-toluidine, hydrochloride
U032	Chromic acid, calcium salt
U050	Chrysene
U051	Creosote
U052	Cresols
U052	Cresylic acid
U053	Crotonaldehyde

Hazardous waste No.	Substance
U055	Cumene (I)
U246	Cyanogen bromide
U197	1,4-Cyclohexadienedione
U056	Cyclohexane (I)
U057	Cyclohexanone (I)
U130	1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro-
U058	Cyclophosphamide
U240	2,4-D, salts and esters
U059	Daunomycin
U060	DDD
U061	DDT
U142	Decachlorooctahydro-1,3,4-metheno-2H-cyclobuta[c,d]-pentalen-2-one
U062	Diallate
U133	Diamine (R,T)
U221	Diaminotoluene
U063	Dibenz[a,h]anthracene
U063	1,2:5,6-Dibenzanthracene
U064	1,2:7,8-Dibenzopyrene
U064	Dibenz[a,i]pyrene
U066	1,2-Dibromo-3-chloropropane
U069	Dibutyl phthalate
U062	S-(2,3-Dichloroallyl) diisopropylthiocarbamate
U070	o-Dichlorobenzene
U071	m-Dichlorobenzene
U072	p-Dichlorobenzene
U073	3,3'-Dichlorobenzidine
U074	1,4-Dichloro-2-butene (I,T)
U075	Dichlorodifluoromethane
U192	3,5-Dichloro-N-(1,1-dimethyl-2-propynyl) benzamide
U060	Dichloro diphenyl dichloroethane
U061	Dichloro diphenyl trichloroethane
U078	1,1-Dichloroethylene
U079	1,2-Dichloroethylene
U025	Dichloroethyl ether
U081	2,4-Dichlorophenol
U082	2,6-Dichlorophenol
U240	2,4-Dichlorophenoxyacetic acid, salts and esters
U083	1,2-Dichloropropane
U084	1,3-Dichloropropene
U085	1,2:3,4-Diepoxybutane (I,T)
U108	1,4-Diethylene dioxide
U086	N,N-Diethylhydrazine
U087	O,O-Diethyl-S-methyl-dithiophosphate
U088	Diethyl phthalate
U089	Diethylstilbestrol
U148	1,2-Dihydro-3,6-pyradizinedione

Hazardous waste No.	Substance
U090	Dihydrosafrole
U091	3,3'-Dimethoxybenzidine
U092	Dimethylamine (I)
U093	Dimethylaminoazobenzene
U094	7,12-dimethylbenz[a]anthracene
U095	3,3'-Dimethylbenzidine
U096	alpha, alpha-Dimethylbenzylhydroperoxide (R)
U097	Dimethylcarbamoyl chloride
U098	1,1-Dimethylhydrazine
U099	1,2-Dimethylhydrazine
U101	2,4-Dimethylphenol
U102	Dimethyl phthalate
U103	Dimethyl sulfate
U105	2,4-Dinitrotoluene
U106	2,6-Dinitrotoluene
U107	Di-n-octyl phthalate
U108	1,4-Dioxane
U109	1,2-Diphenylhydrazine
U110	Dipropylamine (I)
U111	Di-N-propylnitrosoamine
U001	Ethanal (I)
U174	Ethanamine, N-ethyl-N-nitroso-
U067	Ethane, 1,2-dibromo-
U076	Ethane, 1,1-dichloro-
U077	Ethane, 1,2-dichloro-
U114	1,2-Ethanediylbiscarbamodithioic acid
U131	Ethane, 1,1,1,2,2,2-hexachloro-
U024	Ethane, 1,1'-[methylenebis(oxy)]bis(2-chloro-
U247	Ethane, 1,1,1-trichloro-2,2-bis(p-methoxyphenyl)-
U003	Ethanenitrile (I,T)
U117	Ethane, 1,1'-oxybis- (I)
U025	Ethane, 1,1'-oxybis(2-chloro-
U184	Ethane, pentachloro-
U208	Ethane, 1,1,1,2-tetrachloro-
U209	Ethane, 1,1,2,2-tetrachloro-
U218	Ethanethioamide
U227	Ethane, 1,1,2-trichloro-
U043	Ethene, chloro-
U042	Ethene, 2-chloroethoxy-
U078	Ethene, 1,1-dichloro-
U079	Ethene, trans-1,2-dichloro-
U210	Ethene, 1,1,2,2-tetrachloro-
U173	Ethanol, 2,2'-(nitrosoimino)bis-
U004	Ethanone, 1-phenyl-
U006	Ethanoyl chloride (C,R,T)
U112	Ethyl acetate (I)
U113	Ethyl acrylate (I)

Hazardous waste No.	Substance
U238	Ethyl carbamate (urethan)
U038	Ethyl 4,4'-dichlorobenzilate
U114	Ethylenebis(dithiocarbamic acid)
U067	Ethylene dibromide
U077	Ethylene dichloride
U115	Ethylene oxide (I,T)
U116	Ethylene thiourea
U117	Ethyl ether (I)
U076	Ethylidene dichloride
U118	Ethylmethacrylate
U119	Ethyl methanesulfonate
U139	Ferric dextran
U120	Fluoranthene
U122	Formaldehyde
U123	Formic acid (C,T)
U124	Furan (I)
U125	2-Furancarboxaldehyde (I)
U147	2,5-Furandione
U213	Furan, tetrahydro- (I)
U125	Furfural (I)
U124	Furfuran (I)
U206	D-Glucopyranose, 2-deoxy-2-(3-methyl-3-nitrosoureido)-
U126	Glycidylaldehyde
U163	Guanidine, N-nitroso-N-methyl-N'-nitro
U127	Hexachlorobenzene
U128	Hexachlorobutadiene
U129	Hexachlorocyclohexane (gamma isomer)
U130	Hexachlorocyclopentadiene
U131	Hexachloroethane
U132	Hexachlorophene
U243	Hexachloropropene
U133	Hydrazine (R,T)
U086	Hydrazine, 1,2-diethyl-
U098	Hydrazine, 1,1-dimethyl-
U099	Hydrazine, 1,2-dimethyl-
U109	Hydrazine, 1,2-diphenyl-
U134	Hydrofluoric acid (C,T)
U134	Hydrogen fluoride (C,T)
U135	Hydrogen sulfide
U096	Hydroperoxide, 1-methyl-1-phenylethyl- (R)
U136	Hydroxydimethylarsine oxide
U116	2-Imidazolidinethione
U137	Indeno[1,2,3-cd]pyrene
U139	Iron dextran
U140	Isobutyl alcohol (I,T)
U141	Isosafrole

Hazardous waste No.	Substance
U142	Kepone
U143	Lasiocarpene
U144	Lead acetate
U145	Lead phosphate
U146	Lead subacetate
U129	Lindane
U147	Maleic anhydride
U148	Maleic hydrazide
U149	Malononitrile
U150	Melphalan
U151	Mercury
U152	Methacrylonitrile (I,T)
U092	Methanamine, N-methyl- (I)
U029	Methane, bromo-
U045	Methane, chloro- (I,T)
U046	Methane, chloromethoxy-
U068	Methane, dibromo-
U080	Methane, dichloro-
U075	Methane, dichlorodifluoro-
U138	Methane, iodo-
U119	Methanesulfonic acid, ethyl ester
U211	Methane, tetrachloro-
U121	Methane, trichlorofluoro-
U153	Methanethiol (I,T)
U225	Methane, tribromo-
U044	Methane, trichloro-
U121	Methane, trichlorofluoro-
U123	Methanoic acid (C,T)
U036	4,7-Methanoindan, 1,2,4,5,6,7,8,8-octachloro-3a,4,7,7a-tetrahydro-
U154	Methanol (I)
U155	Methapyrilene
U154	Methyl alcohol (I)
U029	Methyl bromide
U186	1-Methylbutadiene (I)
U045	Methyl chloride (I,T)
U156	Methyl chlorocarbonate (I,T)
U226	Methylchloroform
U157	3-Methylcholanthrene
U158	4,4'-Methylenebis(2-chloroaniline)
U132	2,2'-Methylenebis(3,4,6-trichlorophenol)
U068	Methylene bromide
U080	Methylene chloride
U122	Methylene oxide
U159	Methyl ethyl ketone (I,T)
U160	Methyl ethyl ketone peroxide (R,T)
U138	Methyl iodide

Hazardous waste No.	Substance
U161	Methyl isobutyl ketone (I)
U162	Methyl methacrylate (I,T)
U163	N-Methyl-N'-nitro-N-nitrosoguanidine
U161	4-Methyl-2-pentanone (I)
U164	Methylthiouracil
U247	Methoxychlor
U010	Mitomycin C
U059	5,12-Naphthacenedione, (8S-cis)-8-acetyl-10-[(3-amino-2,3,6-trideoxy-alpha-L-lyxo-hexapyranosyl)oxyl]-7,8,9,10-tetrahydro-6,8,11-trihydroxy-1-methoxy-
U165	Naphthalene
U047	Naphthalene, 2-chloro-
U166	1,4-Naphthalenedione
U236	2,7-Naphthalenedisulfonic acid, 3,3'-[(3,3'-dimethyl-(1,1'-biphenyl)-4,4'-diyl)]-bis (azo)bis(5-amino-4-hydroxy)-, tetrasodium salt
U166	1,4-Naphthaquinone
U167	1-Naphthylamine
U168	2-Naphthylamine
U167	alpha-Naphthylamine
U168	beta-Naphthylamine
U026	2-Naphthylamine, N,N'-bis(2-chloromethyl)-
U169	Nitrobenzene (I,T)
U170	p-Nitrophenol
U171	2-Nitropropane (I)
U172	N-Nitrosodi-n-butylamine
U173	N-Nitrosodiethanolamine
U174	N-Nitrosodiethylamine
U111	N-Nitroso-N-propylamine
U176	N-Nitroso-N-ethylurea
U177	N-Nitroso-N-methylurea
U178	N-Nitroso-N-methylurethane
U179	N-Nitrosopiperidine
U180	N-Nitrosopyrrolidine
U181	5-Nitro-o-toluidine
U193	1,2-Oxathiolane, 2,2-dioxide
U058	2H-1,3,2-Oxazaphosphorine, 2-[bis(2-chloroethyl)amino]tetrahydro-, oxide 2-
U115	Oxirane (I,T)
U041	Oxarane, 2-(chloromethyl)-
U182	Paraldehyde
U183	Pentachlorobenzene
U184	Pentachloroethane
U185	Pentachloronitrobenzene
~~U242~~	~~Pentachlorophenol~~
U186	1,3-pentadiene (I)

Hazardous waste No.	Substance
U187	Phenacetin
U188	Phenol
U048	Phenol, 2-chloro-
U039	Phenol, 4-chloro-3-methyl-
U081	Phenol, 2,4-dichloro-
U082	Phenol, 2,6-dichloro-
U101	Phenol, 2,4-dimethyl-
U170	Phenol, 4-nitro-
~~U242~~	~~Phenol, pentachloro-~~
~~U212~~	~~Phenol, 2,3,4,6-tetrachloro-~~
~~U230~~	~~Phenol, 2,4,5-trichloro-~~
~~U231~~	~~Phenol, 2,4,6-trichloro-~~
U137	1,10-(1,2-phenylene)pyrene
U145	Phosphoric acid, lead salt
U087	Phosphorodithioic acid, O,O-diethyl-, S-methyl ester
U189	Phosphorous sulfide (R)
U190	Phthalic anhydride
U191	2-Picoline
U192	Pronamide
U194	1-Propanamine (I,T)
U110	1-Propanamine, N-propyl- (I)
U066	Propane, 1,2-dibromo-3-chloro-
U149	Propanedinitrile
U171	Propane, 2-nitro- (I)
U027	Propane, 2,2'-oxybis[2-chloro-
U193	1,3-Propane sultone
U235	1-Propanol, 2,3-dibromo-, phosphate (3:1)
U126	1-Propanol, 2,3-epoxy-
U140	1-Propanol, 2-methyl- (I,T)
U002	2-Propanone (I)
U007	2-Propenamide
U084	Propene, 1,3-dichloro-
U243	1-Propene, 1,1,2,3,3,3-hexachloro-
U009	2-Propenenitrile
U152	2-Propenenitrile, 2-methyl- (I,T)
U008	2-Propenoic acid (I)
U113	2-Propenoic acid, ethyl ester (I)
U118	2-Propenoic acid, 2-methyl-, ethyl ester
U162	2-Propenoic acid, 2-methyl-, methyl ester (I,T)
~~U233~~	~~Propionic acid, 2-(3,4,5-trichlorophenoxy)-~~
U194	n-Propylamine (I,T)
U083	Propylene dichloride
U196	Pyridine
U155	Pyridine, 2-[2-(dimethylamino)-2-phenylamino]-
U179	Pyridine, hexahydro-N-nitroso-
U191	Pyridine, 2-methyl-

Hazardous waste No.	Substance
U164	4(1H)-Pyrimidinone, 2,3-dihydro-6-methyl-2-thioxo-
U180	Pyrrole, tetrahydro-N-nitroso-
U200	Reserpine
U201	Resorcinol
U202	Saccharin and salts
U203	Safrole
U204	Selenious acid
U204	Selenium dioxide
U205	Selenium disulfide (R,T)
U015	L-Serine, diazoacetate (ester)
~~U233~~	~~Silvex~~
U089	4,4'-Stilbenediol, alpha, alpha'-diethyl-
U206	Streptozotocin
U135	Sulfur hydride
U103	Sulfuric acid, dimethyl ester
U189	Sulfur phosphide (R)
U205	Sulfur selenide (R,T)
~~U232~~	~~2,4,5-T~~
U207	1,2,4,5-Tetrachlorobenzene
U208	1,1,1,2-Tetrachloroethane
U209	1,1,2,2-Tetrachloroethane
U210	Tetrachloroethylene
~~U212~~	~~2,3,4,6-Tetrachlorophenol~~
U213	Tetrahydrofuran (I)
U214	Thallium (I) acetate
U215	Thallium (I) carbonate
U216	Thallium (I) chloride
U217	Thallium (I) nitrate
U218	Thioacetamide
U153	Thiomethanol (I,T)
U219	Thiourea
U244	Thiram
U220	Toluene
U221	Toluenediamine
U223	Toluene diisocyanate (R,T)
U222	o-Toluidine hydrochloride
U011	1H-1,2,4-Triazol-3-amine
U226	1,1,1-Trichloroethane
U227	1,1,2-Trichloroethane
U228	Trichloroethene
U228	Trichloroethylene
U121	Trichloromonofluoromethane
~~U230~~	~~2,4,5-Trichlorophenol~~
~~U231~~	~~2,4,6-Trichlorophenol~~
~~U232~~	~~2,4,5-Trichlorophenoxyacetic acid~~
U234	sym-Trinitrobenzene (R,T)

Hazardous waste No.	Substance
U182	1,3,5-Trioxane, 2,4,5-trimethyl-
U235	Tris(2,3-dibromopropyl) phosphate
U236	Trypan blue
U237	Uracil, 5[bis(2-chloromethyl)amino]-
U237	Uracil mustard
U043	Vinyl chloride
U239	Xylene (I)
U200	Yohimban-16-carboxylic acid, 11,17-dimethoxy-18-[(3,4,5-trimethoxybenzoyl)oxy]-, methyl ester

(Source: Amended at 7 Ill. Reg. 2518, effective February 22, 1983.)

5. Appendix C of Part 721, which formerly referenced Appendix III to 40 CFR 261, is printed out and amended as follows:

Appendix C--Chemical Analysis Test Methods

Tables 1, 2, and 3 specify the appropriate analytical procedures described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" (incorportated by reference, see § 260.11), which shall be used in determining whether the waste in question contains a given toxic constituent. Table 1 identifies the analytical class and the approved measurement techniques for each organic chemical listed in Appendix VII. Table 2 identifies the corresponding methods for the inorganic species. Table 3 identifies the specific sample preparation and measurement instrument introduction techniques which may be suitable for both the organic and inorganic species as well as the matrices of concern.

Prior to final selection of the analytical method the operator should consult the specific method descriptions in SW-846 for additional guidance on which of the approved methods should be employed for a specific waste analysis situation.

TABLE I--Analytical Characteristics of Organic Chemicals

Compound	Sample handling class/fraction	Non-GC methods	Measurement techniques		
			GC/MS	Conventional	
				GC	Detector
Acetonitrile	Volatile		8.24	8.03	NSD
Acrolein	Volatile		8.24	8.03	NSD
Acrylamide	Volatile		8.24	8.01	FID
Acrylonitrile	Volatile		8.24	8.03	NSD
Benzene	Volatile		8.24	8.02	PID
Benz(a)anthracene	Extractable/BN	8.10(HPLC)	8.25	8.10	FID
Benzo(a)pyrene	Extractable/BN	8.10(HPLC)	8.25	8.10	FID
Benzotrichloride	Extractable/BN		8.25	8.12	ECD

Compound	Sample handling class/fraction	Non-GC methods	Measurement techniques		
			GC/MS	Conventional GC	Detector
Benzyl chloride	Volatile or Extractable/BN		8.24 8.25	8.01 8.12	HSD ECD
Benz(b)fluoranthene	Extractable/BN	8.10(HPLC)	8.25	8.10	FID
Bis(2-chloroethoxymethane)	Volatile		8.24	8.01	HSD
Bis(2-chloroethyl)ether	Volatile		8.24	8.01	HSD
Bis(2-chloroisopropyl) ether	Volatile		8.24	8.01	HSD
Carbon disulfide	Volatile		8.24	8.01	HSD
Carbon tetrachloride	Volatile		8.24	8.01	HSD
Chlordane	Extractable/BN		8.25	8.08	HSD
Chlorinated dibenzo dioxins	Extractable/BN		8.25	8.08	ECD
Chlorinated dibenzo-p-dioxins	Extractable/BN		8280		
Chlorinated biphenyls	Extractable/BN		8.25	8.08	HSD
Chloroacetaldehyde	Volatile		8.24	8.01	HSD
Chlorobenzene	Volatile		8.24	8.01 8.02	HSD PID
Chloroform	Volatile		8.24	8.01	HSD
Chloromethane	Volatile		8.24	8.01	HSD
2-Chlorophenol	Extractable/BN		8.25	8.04	FID, ECD
Chrysene	Extractable/BN	8.10(HPLC)	8.25	8.10	FID
Creosote	Extractable/BN		8.25	8.10	ECD
Cresol(s)	Extractable/A		8.25	8.04	FID, ECD
Cresylic acid(s)	Extractable/A		8.25	8.04	FID, ECD
Dichlorobenzene(s)	Extractable/BN		8.25	8.01 8.02 8.12	HSD PID ECD
Dichloroethane(s)	Volatile		8.24	8.01	HSD
Dichloromethane	Volatile		8.24	8.01	HSD
Dichlorophenoxy-acetic acid	Extractable/A		8.25	8.40	HSD
Dichloropropanol	Extractable/BN		8.25	8.12	ECD
2, 4-Dimethylphenol	Extractable/A		8.25	8.04	FID, ECD
Dinitrobenzene	Extractable/BN		8.25	8.09	FID, ECD
4, 6-Dinitro-o-cresol	Extractable/A		8.25	8.04	FID, ECD
2, 4-Dinitrotoluene	Extractable/BN		8.25	8.09	FID, ECD
Endrin	Extractable/P		8.25	8.08	HSD
Ethyl ether	Volatile		8.24	8.01 8.02	FID FID
Formaldehyde	Volatile		8.24	8.01	FID
Formic acid	Extractable/BN		8.25	8.06	FID
Heptachlor	Extractable/P		8.25	8.06	HSD
Hexachlorobenzene	Extractable/BN		8.25	8.12	ECD
Hexachlorobutadiene	Extractable/BN		8.25	8.12	ECD
Hexachloroethane	Extractable/BN		8.25	8.12	ECD
Hexachlorocyclopentadiene	Extractable/BN		8.25	8.12	ECD
Lindane	Extractable/P		8.25	8.08	HSD
Maleic anhydride	Extractable/BN		8.25	8.06	ECD, FID
Methanol	Volatile		8.24	8.01	FID
Methomyl	Extractable/BN	8.32(HPLC)			
Methyl ethyl ketone	Volatile		8.25	8.01 8.02	FID FID
Methyl isobutly ketone	Volatile		8.25	8.01 8.02	FID FID
Naphthalene	Extractable/BN		8.25	8.10	FID
Napthoquinone	Extractable/BN		8.25	8.06 8.09	ECD, FID FID
Nitrobenzene	Extractable/BN		8.25	8.09	ECD, FID
4-Nitrophenol	Extractable/A		8.24	8.04	ECD, FID
Paraldehyde (trimer of acetaldehyde).	Volatile		8.24	8.01	FID

Compound	Sample handling class/fraction	Non-GC methods	Measurement techniques		
			GC/MS	Conventional	
				GC	Detector
Pentachlorophenol	Extractable/A		8.25	8.04	ECD
Phenol	Extractable/A		8.25	8.04	ECD, FID
Phorate	Extractable/BN			8.22	FPD
Phosphorodithioic acid esters	Extractable/BN			8.06	ECD, FID
				8.09	ECD, FID
				8.22	FPD
Phthalic anhydride	Extractable/BN		8.25	8.06	ECD, FID
				8.09	ECD, FID
2-Picoline	Extractable/BN		8.25	8.06	ECD, FID
				8.09	ECD, FID
Pyridine	Extractable/BN		8.25	8.06	ECD, FID
				8.09	ECD, FID
Tetrachlorobenzene(s)	Extractable/BN		8.25	8.12	ECD
Tetrachloroethane(s)	Volatile		8.24	8.01	HSD
Tetrachloroethene	Volatile		8.24	8.01	HSD
Tetrachlorophenol	Extractable/A		8.24	8.04	ECD
Toluene	Volatile		8.24	8.02	PID
Toluenediamine	Extractable/BN		8.25		
Toluene diisocyanate(s)	Extractable/nonaqueous		8.25	8.06	FID
Toxaphene	Extractable/P		8.25	8.08	HSD
Trichloroethane	Volatile		8.24	8.01	HSD
Trichloroethene(s)	Volatile		8.24	8.01	HSD
Trichlorofluoromethane	Volatile		8.24	8.01	HSD
Trichlorophenol(s)	Extractable/A		8.25	8.04	HSD
2,4,5-TP (Silvex)	Extractable/A		8.25	8.40	HSD
Trichloropropane	Volatile		8.24	8.01	HSD
Vinyl chloride	Volatile		8.24	8.01	HSD
Vinylidene chloride	Volatile		8.24	8.01	HSD
Xylene	Volatile		8.24	8.02	PID

[1]Analyze for phenanthrene and carbazole; if these are present in a ratio between 1.4:1 and 5:1, creosote should be considered present.

ECD = Electron capture detector; FID = Flame ionization detector; FPD = Flame photometric detector; HSD = Halide specific detector; HPLC = High pressure liquid chromotography; NSD = Nitrogen-specific detector; PID = Photoionization detector.

Table 2--Analytical Characteristics of Inorganic Species

Species	Sample handling class	Measurement technique	Method number
Antimony	Digestion	Atomic absortion-furnace/flame	8.50
Arsenic	Hydride	Atomic absorbtion-flame	8.51
Barium	Digestion	Atomic absorbtion-furnace/flame	8.52
Cadmium	Digestion	Atomic absorbtion-furnace/flame	8.53
Chromium	Digestion	Atomic absorbtion-furnace/flame	8.54
Cyanides	Hydrolysis	Atomic absorbtion-spectroscopy	8.55
Lead	Digestion	Atomic absorbtion-furnace/flame	8.56
Mercury	Cold Vapor	Atomic absorbtion	8.57
Nickel	Digestion	Atomic absorbtion-furnace/flame	8.58
Selenium	Hydride digestion	Atomic absorbtion-furnace/flame	8.59
Silver	Digestion	Atomic absorbtion-furnace/flame	8.60

TABLE 3--Sample Preparation/Sample Introduction Techniques

Sample handling class	Physical characteristics of waste[1]		
	Fluid	Paste	Solid
Volatile	Purge and trap. Direct injection.	Purge and trap. Headspace.	Headspace.
Semivolatile and nonvolatile	Direct injection. Shake out.	Shake out.	Shake out. Soxhlet. Sonication.
Inorganic	Direct injection. Digestion. Hydride.	Digestion. Hydride.	Digestion. Hydride.

[1]For purposes of this Table, fluid refers to readily pourable liquids, which may or may not contain suspended particles. Paste-like materials, while fluid in the sense of flowability, can be thought of as being thixotropic or plastic in nature, e.g. paints. Solid materials are those wastes which can be handled without a container (i.e., can be piled up without appreciable sagging).

Procedure and Methods Number(s)

Digestion--See appropriate procedure for element of interest.
Direct injection--8.80.
Headspace--8.82.
Hydride--See appropriate procedure for element of interest.
Purge & Trap--8.83.
Shake out--8.84.
Sonication--8.85.
Soxhlet--8.86.

(Source: Amended at 7 Ill. Reg. 13999, effective October 12, 1983, amended at_____Ill. Reg._____, effective _____.)

6. Appendix G of Part 721, which formerly referenced Appendix VII to 40 CFR 261, is printed out and amended as follows:

Appendix G--Basis for Listing Hazardous Wastes

EPA hazardous waste No.	Hazardous constituents for which listed
F001	Tetrachloroethylene, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, carbon tetrachloride, chlorinated fluorocarbons.
F002	Tetrachloroethylene, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, chlorobenzene, 1,1,2-trichloro-1,2,2-trifluoroethane, ortho-dichlorobenzene, trichlorofluoromethane.
F003	N.A.
F004	Cresols and cresylic acid, nitrobenzene.
F005	Toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine.
F006	Cadmium, hexavalent chromium, nickel, cyanide (complexed).
F007	Cyanide (salts).
F008	Cyanide (salts).
F009	Cyanide (salts).
F010	Cyanide (salts).
F011	Cyanide (salts).
F012	Cyanide (complexed).
F019	Hexavalent chromium, cyanide (complexed).
F020	Tetrachlorodibenzo-p-dioxins
F021	Tetrachlorodibenzo-p-dioxins
F022	Tetrachlorodibenzo-p-dioxins
F023	Tetrachlorodibenzo-p-dioxins
K001	Pentachlorophenol, phenol, 2-chlorophenol, p-chloro-m-cresol, 2,4-dimethylphenyl, 2, 4-dinitrophenol, trichlorophenols, tetrachlorophenols, 2,4-dinitrophenol, cresosote, chrysene, naphthalene, fluoranthene, benzo(b)-fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, benz(a)anthracene, dibenz(a)anthracene, acenaphthalene.
K002	Hexavalent chromium, lead.
K003	Hexavalent chromium, lead.
K004	Hexavalent chromium.
K005	Hexavalent chromium, lead.
K006	Hexavalent chromium.
K007	Cyanide (complexed), hexavalent chromium.
K008	Hexavalent chromium.
K009	Chloroform, formaldehyde, methylene chloride, methyl chloride, paraldehyde, formic acid.
K010	Chloroform, formaldehyde, methylene chloride, methyl chloride, paraldehyde, formic acid, chloroacetaldehyde.
K011	Acrylonitrile, acetonitrile, hydrocyanic acid.
K013	Hydrocyanic acid, acrylonitrile, acetonitrile.
K014	Acetonitrile, acrylamide.
K015	Benzyl chloride, chlorobenzene, toluene, benzotrichloride.
K016	Hexachlorobenzene, hexachlorobutadiene, carbon tetrachloride, hexachloroethane, perchloroethylene.
K017	Epichlorohydrin, chloroethers [bis(chloromethyl) ether and bis (2-chloroethyl) ethers], trichloropropane, dichloropropanols.
K018	1,2-dichloroethane, trichloroethylene, hexachlorobutadiene, hexachlorobenzene.
K019	Ethylene dichloride, 1,1,1-trichloroethane, 1,1,2-trichloroethane, tetrachloro ethanes (1,1,2,2tetrachloroethane and 1,1,1,2-tetrachloroethane), trichloro-ethylene, tetrachloroethylene, carbon tetrachloride, chloroform, vinyl chloride, vinylidene chloride.
K020	Ethylene dichloride, 1,1,1-trichloroethane, 1,1,2-trichloroethane, tetrachloro-ethanes (1,1,2,2-tetrachloroethane and 1,1,1,2-tetrachloroethane), trichloroethylene, tetrachloroethylene, carbon tetrachloride, chloroform, vinyl chloride, vinylidene chloride.
K021	Antimony, carbon tetrachloride, chloroform.
K022	Phenol, tars (polycyclic aromatic hydrocarbons).
K023	Phthalic anhydride, maleic anhydride.
K024	Phthalic anhydride, 1,4-naphthoquinone.
K025	Meta-dinitrobenzene, 2,4-dinitrotoluene.
K026	Paraldehyde, pyridines, 2-picoline.

EPA hazardous waste No.	Hazardous constituents for which listed
K027	Toluene diisocyanate, toluene-2, 4-diamine.
K028	1,1,1-trichloroethane, vinyl chloride.
K029	1,2-dichloroethane, 1,1,1-trichloroethane, vinyl chloride, vinylidene chloride, chloroform.
K030	Hexachlorobenzene, hexachlorobutadiene, hexachloroethane, 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, ethylene dichloride.
K031	Arsenic.
K032	Hexachlorocyclopentadiene.
K033	Hexachlorocyclopentadiene.
K034	Hexachlorocyclopentadiene.
K035	Creosote, chrysene, naphthalene, fluoranthene, benzo(b) fluoranthene, benzo(a)-pyrene, indeno(1,2,3-cd) pyrene, benzo(a)anthracene, dibenzo(a)anthracene, acenaphthalene.
K036	Toluene, phosphorodithioic and phosphorothioic acid esters.
K037	Toluene, phosphorodithioic and phosphorothioic acid esters.
K038	Phorate, formaldehyde, phosphorodithioic and phosphorothioic acid esters.
K039	Phosphorodithioic and phosphorothioic acid esters.
K040	Phorate, formaldehyde, phosphorodithioic and phosphorothioic acid esters.
K041	Toxaphene.
K042	Hexachlorobenzene, ortho-dichlorobenzene.
K043	2,4-dichlorophenol, 2,6-dichlorophenol, 2,4,6-trichlorophenol.
K044	N.A.
K045	N.A.
K046	Lead
K047	N.A.
K048	Hexavalent chromium, lead.
K049	Hexavalent chromium, lead.
K050	Hexavalent chromium.
K051	Hexavalent chromium, lead.
K052	Lead
K060	Cyanide, napthalene, phenolic compounds, arsenic.
K061	Hexavalent chromium, lead, cadmium.
K062	Hexavalent chromium, lead.
K069	Hexavalent chromium, lead, cadmium.
K071	Mercury.
K073	Chloroform, carbon tetrachloride, hexachloroethane, trichloroethane, tetrachloroethylene, dichloroethylene, 1,1,2,2-tetrachloroethane.
K083	Aniline, diphenylamine, nitrobenzene, phenylenediamine.
K084	Arsenic.
K085	Benzene, dichlorobenzenes, trichlorobenzenes, tetrachlorobenzenes, pentachlorobenzene, hexachlorobenzene, benzyl chloride.
K086	Lead, hexavalent chromium.
K087	Phenol, naphthalene.
K093	Phthalic anhydride, maleic anhydride.
K094	Phthalic anhydride.
K095	1,1,2-trichloroethane, 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane.
K096	1,2-dichloroethane, 1,1,1-trichloroethane, 1,1,2-trichloroethane.
K097	Chlordane, heptachlor.
K098	Toxaphene.
K099	2,4-dichlorophenol, 2,4,6-trichlorophenol.
K100	Hexavalent chromium, lead, cadmium.
K101	Arsenic.
K102	Arsenic.
K103	Aniline, nitrobenzene, phenylenediamine.
K104	Aniline, benzene, diphenylamine, nitrobenzene, phenylenediamine.
K105	Benzene, monochlorobenzene, dichlorobenzenes, 2,4,6-trichlorophenol.
K106	Mercury.

N.A.--Waste is hazardous because it fails the test for the characteristic of ignitability, corrosivity, or reactivity.

(Source: Amended at 7 Ill. Reg. 13999, effective October 12, 1983; amended at _____ Ill. Reg. _____, effective _____.)

7. Appendix H of Part 721 is amended as follows:

Section 721.Appendix H Hazardous Constituents

acetonitrile (ethanenitrile)
acetophenone (ethanone, 1-phenyl-)
3-(alpha-acetonylbenzyl)-4-hydroxycoumarin and salts
(warfarin)
2-acetylaminofluorene
(acetamide, N-(9H-fluoren-2-yl)-)
acetyl chloride (ethanoyl chloride)
1-acetyl-2-thiourea
(acetamide, N-(aminothioxomethyl)-)
acrolein (2-propenal)
acrylamide (2-propenamide)
acrylonitrile (2-propenenitrile)
aflatoxins
aldrin
(1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-endo,exo-1,4:5,8-dimethanonaphthalene)
allyl alcohol (2-propen-1-ol)
aluminum phosphide
4-aminobiphenyl ([1,1'-biphenyl]-4-amine)
6-amino-1,1a,2,8,8a,8b-hexahydro-8-(hydroxymethyl)-8a-methoxy-5-methylcarbamate azirino[2',3':3,4]pyrrolo[1,2a]indole-4,7-dione, (ester)
(mitomycin C)
(azirino[2',3':3,4]pyrrolo(1,2a)indole-4,7-dione, 6-amino-8-[((aminocarbonyl)oxy)methyl]-1,1a,2,8,8a,8b-hexahydro-8a-methoxy-5-methyl-)
5-(aminomethyl)-3-isoxazolol
(3(2H)-isoxazolone, 5-(aminomethyl)-)
4-aminopyridine (4-pyridinamine)
amitrole (1H-1,2,4-triazol-3-amine)
aniline (benzenamine)
antimony and compounds, N.O.S. (not otherwise specified)
aramite
(sulfurous acid, 2-chloroethyl-, 2-[4-(1,1-dimethylethyl)phenoxy]-1-methylethyl ester)
arsenic and compounds, N.O.S.
arsenic acid (orthoarsenic acid)
arsenic pentoxide (arsenic (V) oxide)
arsenic trioxide (arsenic (III) oxide)
auramine
(benzenamine, 4,4'-carbonimidoylbis[N,N-dimethyl-, monohydrochloride)
azaserine (L-serine, diazoacetate (ester))
barium and compounds, N.O.S.
barium cyanide
benz[c]acridine (3,4-benzacridine)
benz[a]anthracene (1,2-benzanthracene)

benzene (cyclohexatriene)
benzenearsonic acid (arsonic acid, phenyl-)
benzene, dichloromethyl- (benzal chloride)
benzenethiol (thiophenol)
benzidine ([1,1'-biphenyl]-4,4'-diamine)
benzo[b]fluoranthene (2,3-benzofluoranthene)
benzo[j]fluoranthene (7,8-benzofluoranthene)
benzo[a]pyrene (3,4-benzopyrene)
p-benzoquinone (1,4-cyclohexadienedione)
benzotrichloride (benzene, trichloromethyl-)
benzyl chloride (benzene, (chloromethyl)-)
beryllium and compounds, N.O.S.
bis(2-chloroethoxy)methane
(ethane, 1,1'-[methylenebis(oxy)]bis[2-chloro-])
bis(2-chloroethyl) ether
(ethane, 1,1'-oxybis[2-chloro-])
N,N-bis(2-chloroethyl)-2-naphthylamine
(chlornaphazine)
bis(2-chloroisopropyl) ether
(propane, 2,2'-oxybis[2-chloro]-)
bis(chloromethyl) ether
(methane, oxybis[chloro]-)
bis(2-ethylhexyl) phthalate
(1,2-benzenedicarboxylic acid, bis(2-ethylhexyl) ester)
bromoacetone (2-propanone, 1-bromo-)
bromomethane (methyl bromide)
4-bromophenyl phenyl ether
(benzene, 1-bromo-4-phenoxy-)
brucine (strychnidin-10-one, 2,3-dimethoxy-)
2-butanone peroxide (methyl ethyl ketone, peroxide)
butyl benzyl phthalate
(1,2-benzenedicarboxylic acid, butyl phenylmethyl ester)
2-sec-butyl-4,6-dinitrophenol (DNBP)
(phenol, 2,4-dinitro-6-(1-methylpropyl)-)
cadmium and compounds, N.O.S.
calcium chromate (chromic acid, calcium salt)
calcium cyanide
carbon disulfide (carbon bisulfide)
carbon oxyfluoride (carbonyl fluoride)
chloral (acetaldehyde, trichloro-)
chlorambucil
(butanoic acid, 4-[bis(2-chloroethyl)amino1benzene-)
chlordane (alpha and gamma isomers)
(4,7-methanoindan,1,2,4,5,6,7,8,8-octachloro-
3,4,7,7a-tetrahydro-) (alpha and gamma isomers)
chlorinated benzenes, N.O.S.
chlorinated ethane, N.O.S.
chlorinated fluorocarbons, N.O.S.
chlorinated naphthalene, N.O.S.
chlorinated phenol, N.O.S.
chloroacetaldehyde (acetaldehyde, chloro-)

chloroalkyl ethers, N.O.S.
p-chloroaniline (benzeneamine, 4-chloro-)
chlorobenzene (benzene,chloro-)
chlorobenzilate
(benzeneacetic acid, 4-chloro-alpha-(4-chlorophenyl)-alpha-hydroxy-, ethyl ester)
p-chloro-m-cresol
(phenol, 4-chloro-3-methyl-)
1-chloro-2,3-epoxypropane
(oxirane, 2-(chloromethyl)-)
2-chloroethyl vinyl ether
(ethene, (2-chloroethoxy)-)
chloroform (methane, trichloro-)
chloromethane (methyl chloride)
chloromethyl methyl ether (methane, chloromethoxy-)
2-chloronaphthalene (naphthalene, beta-chloro-)
2-chlorophenol (phenol, o-chloro-)
1-(o-chlorophenyl)thiourea (thiourea, (2-chlorophenyl)-)
3-chloropropionitrile (propanenitrile, 3-chloro-)
chromium and compounds, N.O.S.
chrysene (1,2-benzphenanthrene)
citrus red No. 2
(2-naphthol, 1-[(2,5-dimethoxyphenyl)azo]-)
coal tars
copper cyanide
creosote (creosote, wood)
cresols (cresylic acid) (phenol, methyl-)
crotonaldehyde (2-butenal)
cyanides (soluble salts and complexes), N.O.S.
cyanogen (ethanedinitrile)
cyanogen bromide (bromine cyanide)
cyanogen chloride (chlorine cyanide)
cycasin
(beta-D-glucopyranoside, (methyl-ONN-azoxy)methyl-)
2-cyclohexyl-4,6-dinitrophenol
(phenol, 2-cyclohexyl-4,6-dinitro-)
cyclophosphamide
(2H-1,3,2-oxazaphosphorine, [bis(2-chloroethyl)amino]-tetrahydro-, 2-oxide)
daunomycin
(5,12-naphthacenedione, (8S-cis)-8-acetyl-10-[(3-amino-2,3,6-trideoxy)-alpha-L-lyxo-hexopyranosyl)oxy]-7,8,9,10-tetrahydro-6,8,11-trihydroxy-1-methoxy-)
DDD (dichlorodiphenyldichloroethane)
(ethane, 1,1-dichloro-2,2-bis(p-chlorophenyl)-)
DDE (ethylene, 1,1-dichloro-2,2-bis(4-chlorophenyl)-)
DDT (dichlorodiphenyltrichloroethane)
(ethane, 1,1,1-trichloro-2,2-bis(p-chlorophenyl)-)
diallate
(S-(2,3-dichloroallyl)diisopropylthiocarbamate)
dibenz[a,h]acridine (1,2,5,6-dibenzacridine)

dibenz[a,j]acridine (1,2,7,8-dibenzacridine)
dibenz[a,h]anthracene (1,2,5,6-dibenzanthracene)
7H-dibenzo[c,g]carbazole (3,4,5,6-dibenzcarbazole)
dibenzo[a,e]pyrene (1,2,4,5-dibenzpyrene)
dibenzo[a,h]pyrene (1,2,5,6-dibenzpyrene)
dibenzo[a,i]pyrene (1,2,7,8-dibenzpyrene)
1,2-dibromo-3-chloropropane
(propane, 1,2-dibromo-3-chloro-)
1,2-dibromoethane (ethylene dibromide)
dibromomethane (methylene bromide)
di-n-butyl phthalate
(1,2-benzenedicarboxylic acid, dibutyl ester)
o-dichlorobenzene (benzene, 1,2-dichloro-)
m-dichlorobenzene (benzene, 1,3-dichloro-)
p-dichlorobenzene (benzene, 1,4-dichloro-)
dichlorobenzene, N.O.S. (benzene, dichloro-, N.O.S.)
3,3'-dichlorobenzidine
([1,1'-biphenyl]-4,4'-diamine, 3,3'-dichloro-)
1,4-dichloro-2-butene (2-butene, 1,4-dichloro-)
dichlorodifluoromethane (methane, dichlorodifluoro-)
1,1-dichloroethane (ethylidine dichloride)
1,2-dichloroethane (ethylene dichloride)
trans-1,2-dichloroethene (1,2-dichloroethylene)
dichloroethylene, N.O.S. (ethene, dichloro-, N.O.S.)
1,1-dichloroethylene (ethene, 1,1-dichloro-)
dichloromethane (methylene chloride)
2,4-dichlorophenol (phenol, 2,4-dichloro-)
2,6-dichlorophenol (phenol, 2,6-dichloro-)
2,4-dichlorophenoxyacetic acid (2,4-D), salts and esters
(acetic acid, 2,4-dichlorophenoxy-, salts and esters)
dichlorophenyl arsine (phenyl dichloroarsine)
dichloropropane, N.O.S. (propane, dichloro-, N.O.S.)
1,2-dichloropropane (propylene dichloride)
dichloropropanol, N.O.S. (propanol, dichloro-, N.O.S.)
dichloropropene, N.O.S. (propene, dichloro-, N.O.S.)
1,3-dichloropropene (1-propene, 1,3-dichloro-)
dieldrin
(1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-
octahydro-endo,exo-1,4:5,8-dimethanonaphthalene)
1,2:3,4-diepoxybutane (2,2'-bioxirane)
diethylarsine (arsine, diethyl-)
N,N'-diethylhydrazine (hydrazine, 1,2-diethyl-)
O,O-diethyl S-methyl ester of phosphorodithioic acid
(phosphorodithioic acid, O,O-diethyl S-methyl ester)
O,O-diethylphosphoric acid, O-p-nitrophenyl ester
(phosphoric acid, diethyl p-nitrophenyl ester)
diethyl phthalate
(1,2-benzenedicarboxylic acid, diethyl ester)
O,O-diethyl O-2-pyrazinyl phosphorothioate
(phosphorothioic acid, O,O-diethyl O-pyrazinyl ester)
diethylstilbestrol
(4,4'-stilbenediol, alpha,alpha-diethyl,
bis(dihydrogen phosphate, (E)-)

dihydrosafrole
(benzene, 1,2-methylenedioxy-4-propyl-)
3,4-dihydroxy-alpha-(methylamino)methyl benzyl alcohol
(1,2-benzenediol, 4-[1-hydroxy-2-(methylamino)ethyl]-)
diisopropylfluorophosphate (DFP)
(phosphorofluoridic acid, bis(1-methylethyl) ester)
dimethoate
(phosphorodithioic acid, O,O-dimethyl
S-[2-(methylamino)-2-oxoethyl] ester)
3,3'-dimethoxybenzidine
([1,1'-biphenyl]-4,4'-diamine, 3,3'-dimethoxy-)
p-dimethylaminoazobenzene
(benzenamine, N,N-dimethyl-4-(phenylazo)-)
7,12-dimethylbenz[a]anthracene
(1,2-benzanthracene, 7,12-dimethyl-)
3,3'-dimethylbenzidine
([1,1'-biphenyl]-4,4'-diamine, 3,3'-dimethyl-)
dimethylcarbamoyl chloride
(carbamaoyl chloride, dimethyl-)
1,1-dimethylhydrazine (hydrazine, 1,1-dimethyl-)
1,2-dimethylhydrazine (hydrazine, 1,2-dimethyl-)
3,3-dimethyl-1-(methylthio)-2-butanone,
O-[(methylamino)carbonyl]oxime
(thiofanox)
alpha,alpha-dimethylphenethylamine
(ethanamine, 1,1-dimethyl-2-phenyl-)
2,4-dimethylphenol (phenol, 2,4-dimethyl-)
dimethyl phthalate
(1,2-benzenedicarboxylic acid, dimethyl ester)
dimethylsulfate
(sulfuric acid, dimethyl ester)
dinitrobenzene, N.O.S. (benzene, dinitro-, N.O.S.)
4,6-dinitro-o-cresol and salts
(phenol, 2,4-dinitro-6-methyl-, and salts)
2,4-dinitrophenol (phenol, 2,4-dinitro-)
2,4-dinitrotoluene (benzene, 1-methyl-2,4-dinitro-)
2,6-dinitrotoluene (benzene, 1-methyl-2,6-dinitro-)
di-n-octyl phthalate
(1,2-benzenedicarboxylic acid, dioctyl ester)
1,4-dioxane (1,4-diethylene oxide)
diphenylamine (benzenamine, N-phenyl-)
1,2-diphenylhydrazine (hydrazine, 1,2-diphenyl-)
di-n-propylnitrosamine (N-nitroso-di-n-propylamine)
disulfoton
(O,O-diethyl S-[2-(ethylthio)ethyl] phosphorodithioate
2,4-dithiobiuret (thioimidodicarbonic diamide)
endosulfan
(5-norbornene, 2,3-dimethanol, 1,4,5,6,7,7-hexachloro-,
cyclic sulfite)
endrin and metabolites
(1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-
octahydro-endo,endo-1,4:5,8-dimethanonaphthalene,
and metabolites)

ethyl carbamate
(urethan) (carbamic acid, ethyl ester)
ethyl cyanide (propanenitrile)
ethylenebisdithiocarbamic acid, salts and esters
(1,2-ethanediylbiscarbamodithioic acid, salts and esters)
ethyleneimine (aziridine)
ethylene oxide (oxirane)
ethylenethiourea (2-imidazolidinethione)
ethyl methacrylate (2-propenoic acid, 2-methyl-, ethyl ester)
ethyl methanesulfonate (methanesulfonic acid, ethyl ester)
fluoranthene (benzo[j,k]fluorene)
fluorine
2-fluoroacetamide (acetamide, 2-fluoro-)
fluoroacetic acid, sodium salt
(acetic acid, fluoro-, sodium salt)
formaldehyde (methylene oxide)
formic acid (methanoic acid)
glycidylaldehyde (1-propanal, 2,3-epoxy-)
halomethane, N.O.S
heptachlor
(4,7-methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-)
heptachlor epoxide (alpha, beta and gamma isomers)
(4,7-methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-2,3-epoxy-3a,4,7,7-tetrahydro-, alpha, beta and gamma isomers)
hexachlorobenzene (benzene, hexachloro-)
hexachlorobutadiene (1,3-butadiene, hexachloro-)
hexachlorocyclohexane (all isomers)
(lindane and isomers)
hexachlorocyclopentadiene
(cyclopentadiene, hexachloro-)
hexachloroethane (ethane, hexachloro-)
1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4:5,8-endo,endo-dimethanonaphthalene
(hexachlorohexahydro-endo,endo-dimethanonaphthalene)
hexachlorophene
(2,2'-methylenebis(3,4,6-trichlorophenol))
hexachloropropene (propene, hexachloro-)
hexaethyl tetraphosphate
(tetraphosphoric acid, hexaethyl ester)
hydrazine (diamine)
hydrocyanic acid (hydrogen cyanide)
hydrofluoric acid (hydrogen fluoride)
hydrogen sulfide
hydroxydimethylarsine oxide (cacodylic acid)
indeno(1,2,3-cd)pyrene
(1,10-(1,2-phenylene)pyrene)
iodomethane (methyl iodide)
iron dextran (ferric dextran)
isocyanic acid, methyl ester (methyl isocyanate)
isobutyl alcohol (1-propanol, 2-methyl-)

isosafrole (benzene, 1,2-methylenedioxy-4-allyl-)
kepone
(decachlorooctahydro-1,3,4-metheno-2H-
cyclobuta[cd]pentalen-2-one)
lasiocarpine
(2-butenoic acid, 2-methyl-, 7-[(2,3-dihydroxy-
2-(1-methoxyethyl)-3-methyl-1-oxobutoxy)methyl]-
2,3,5,7a-tetrahydro-1H-pyrrolizin-1-yl ester)
lead and compounds, N.O.S.
lead acetate (acetic acid, lead salt)
lead phosphate (phosphoric acid, lead salt)
lead subacetate (lead, bis(acetato-O)tetrahydroxytri-)
maleic anhydride (2,5-furandione)
maleic hydrazide (1,2-dihydro-3,6-pyridazinedione)
malononitrile (propanedinitrile)
melphalan
(alanine, 3-[p-bis(2-chloroethyl)amino]phenyl-, L-)
mercury fulminate (fulminic acid, mercury salt)
mercury and compounds, N.O.S.
methacrylonitrile (2-propenenitrile, 2-methyl-)
methanethiol (thiomethanol)
methapyrilene
(pyridine, 2-[(2-dimethylamino)ethyl]-2-thenylamino-)
metholmyl
(acetimidic acid, N-[(methylcarbamoyl)oxy]thio-,
methyl ester)
methoxychlor
(ethane, 1,1,1-trichloro-2,2'-bis(p-methoxyphenyl)-)
2-methylaziridine (1,2-propylenimine)
3-methylcholanthrene
(benz[j]aceanthrylene, 1,2-dihydro-3-methyl-)
methylchlorocarbonate
(carbanochloridic acid, methyl ester)
4,4'-methylenebis(2-chloroaniline)
(4,4'-methylenebis(2-chlorobenzenamine))
methyl ethyl ketone (MEK) (2-butanone)
methyl hydrazine (hydrazine, methyl-)
2-methyllactonitrile (propanenitrile, 2-hydroxy-2-methyl-)
methyl methacrylate (2-propenoic acid, 2-methyl-, methyl ester)
methyl methanesulfonate (methanesulfonic acid, methyl ester)
2-methyl-2-(methylthio)propionaldehyde-O-
(methylcarbonyl) oxime
(propanal, 2-methyl-2-(methylthio)-,
O-[(methylamino)carbonyl]oxime)
N-methyl-N'-nitro-N-nitrosoguanidine
(guanidine, N-nitroso-N-methyl-N'-nitro-)
methyl parathion
(O,O-dimethyl O-(4-nitrophenyl) phosphorothioate)
methylthiouracil
(4-1H-pyrimidinone, 2.3-dihydro-6-methyl-2-thioxo-)
mustard gas (sulfide, bis(2-chloroethyl)-)

naphthalene
1,4-naphthoquinone (1,4-naphthalenedione)
1-naphthylamine (alpha-naphthylamine)
2-naphthylamine (beta-naphthylamine)
1-naphthyl-2-thiourea (thiourea, 1-naphthalenyl-)
nickel and compounds, N.O.S.
nickel carbonyl (nickel tetracarbonyl)
nickel cyanide (nickel (II) cyanide)
nicotine and salts
(pyridine, (S)-3-(1-methyl-2-pyrrolidinyl)-, and salts)
nitric oxide (nitrogen (II) oxide)
p-nitroaniline (benzenamine, 4-nitro-)
nitrobenzene (benzene, nitro-)
nitrogen dioxide (nitrogen (IV) oxide)
nitrogen mustard and hydrochloride salt
(ethanamine, 2-chloro-, N-(2-chloroethyl)-N-methyl-, and hydrochloride salt)
nitrogen mustard Noxide and hydrochloride salt
(ethanamine, 2-chloro-, N-(2-chloroethyl)-N-methyl-, N-oxide, and hydrochloride salt)
nitroglycerin (1,2,3-propanetriol, trinitrate)
4-nitrophenol (phenol, 4-nitro-)
4-nitroquinoline-1-oxide (quinoline, 4-nitro-1-oxide-)
nitrosamine, N.O.S.
N-nitrosodi-n-butylamine (1-butanamine, N-butyl-N-nitroso-)
N-nitrosodiethanolamine (ethanol, 2,2'-(nitrosoimino)bis-)
N-nitrosodiethylamine (ethanamine, N-ethyl-N-nitroso-)
N-nitrosodimethylamine (dimethylnitrosamine)
N-nitroso-N-ethylurea (carbamide, N-ethyl-N-nitroso-)
N-nitrosomethylethylamine (ethanamine, N-methyl-N-nitroso-)
N-nitroso-N-methylurea (carbamide, N-methyl-N-nitroso-)
N-nitroso-N-methylurethane
(carbamic acid, methylnitroso-, ethyl ester)
N-nitrosomethylvinylamine
(ethenamine, N-methyl-N-nitroso-)
N-nitrosomorpholine (morpholine, N-nitroso-)
N-nitrosonornicotine (nornicotine, N-nitroso-)
N-nitrosopiperidine (pyridine, hexahydro-, N-nitroso-)
N-nitrosopyrrolidine (pyrrole, tetrahydro-, N-nitroso-)
N-nitrososarcosine (sarcosine, N-nitroso-)
5-nitro-o-toluidine (benzenamine, 2-methyl-5-nitro-)
octamethylpyrophosphoramide (diphosphoramide, octamethyl-)
osmium tetroxide (osmium (VIII) oxide)
7-oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
(endothal)
paraldehyde
(1,3,5-trioxane, 2,4,6-trimethyl-)
parathion
(phosphorothioic acid, O,O-diethyl O-(p-nitrophenyl) ester)
pentachlorobenzene (benzene, pentachloro-)
pentachloroethane (ethane, pentachloro-)

pentachloronitrobenzene (PCNB)
(benzene, pentachloronitro-)
pentachlorophenol (phenol, pentachloro-)
phenacetin (acetamide, N-(4-ethoxyphenyl)-)
phenol (benzene, hydroxy-)
phenylenediamine (benzenediamine)
phenylmercury acetate (mercury, acetatophenyl-)
N-phenylthiourea (thiourea, phenyl-)
phosgene (carbonyl chloride)
phosphine (hydrogen phosphide)
phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl] ester
(phorate)
phosphorothioic acid, O,O-dimethyl
O-[p-((dimethylamino)sulfonyl)phenyl] ester
(famphur)
phthalic acid esters, N.O.S.
(benzene, 1,2-dicarboxylic acid, esters, N.O.S.)
phthalic anhydride
(1,2-benzenedicarboxylic acid anhydride)
2-picoline (pyridine, 2-methyl-)
polychlorinated biphenyl, N.O.S.
potassium cyanide
potassium silver cyanide
(argentate(1-), dicyano-, potassium)
pronamide
(3,5-dichloro-N-(1,1-dimethyl-2-propynyl)benzamide)
1,3-propane sultone
(1,2-oxathiolane 2,2-dioxide)
n-propylamine (1-propanamine)
propylthiouracil
(2,3-dihydro-6-propyl-2-thioxo-4(1H)-pyrimidinone)
2-propyn-1-ol (propargyl alcohol)
pyridine
reserpine
(yohimban-16-carboxylic acid, 11,17-dimethoxy-
18-[(3,4,5-trimethoxybenzoyl)oxy]-, methyl ester)
resorcinol (1,3-benzenediol)
saccharin and salts
(1,2-benzoisothiazolin-3-one, 1,1-dioxide, and salts)
safrole (benzene, 1,2-methylenedioxy-4-allyl-)
selenious acid (selenium dioxide)
selenium and compounds, N.O.S.
selenium sulfide (sulfur selenide)
selenourea (carbamimidoselenoic acid)
silver and compounds, N.O.S.
silver cyanide
sodium cyanide
streptozotocin
(D-glucopyranose, 2-deoxy-2-(3-methyl-3-nitrosoureido)-)
strontium sulfide
strychnine and salts (strychnidin-10-one, and salts)
1,2,4,5-tetrachlorobenzene (benzene, 1,2,4,5-tetrachloro-)

tetrachlorodibenzo-p-dioxins
2,3,7,8-tetrachlorodibenzo-p-dioxin
(TCDD)
(dibenzo-p-dioxin, 2,3,7,8-tetrachloro-)
tetrachloroethane, N.O.S.
(ethane, tetrachloro-, N.O.S.)
1,1,1,2-tetrachloroethane (ethane, 1,1,1,2-tetrachloro-)
1,1,2,2-tetrachloroethane (ethane, 1,1,2,2-tetrachloro-)
tetrachloroethene (perchloroethylene)
tetrachloromethane (carbon tetrachloride)
2,3,4,6-tetrachlorophenol (phenol, 2,3,4,6-tetrachloro-)
tetraethyldithiopyrophosphate
(dithiopyrophosphoric acid, tetraethyl ester)
tetraethyl lead (plumbane, tetraethyl-)
tetraethylpyrophosphate (pyrophosphoric acid, tetraethyl ester)
tetranitromethane (methane, tetranitro-)
thallium and compounds, N.O.S.
thallic oxide (thallium (III) oxide)
thallium (I) acetate (acetic acid, thallium (I) salt)
thallium (I) carbonate (carbonic acid, dithallium (I) salt)
thallium (I) chloride
thallium (I) nitrate (nitric acid, thallium (I) salt)
thallium selenite
thallium (I) sulfate (sulfuric acid, thallium (I) salt)
thioacetamide (ethanethioamide)
thiosemicarbazide (hydrazinecarbothioamide)
thiourea (carbamide, thio-)
thiuram (bis(dimethylthiocarbamoyl) disulfide)
toluene (benzene, methyl-)
toluenediamine (2,4-diaminotoluene)
toluene diisocyanates, N.O.S.
o-toluidine hydrochloride
(benzeneamine, 2-methyl-, hydrochloride)
toxaphene (camphene, octachloro-)
tribromomethane (bromoform)
1,2,4-trichlorobenzene (benzene, 1,2,4-trichloro-)
1,1,1-trichloroethane (methyl chloroform)
1,1,2-trichloroethane (ethane, 1,1,2-trichloro-)
trichloroethene (trichloroethylene)
trichloromethanethiol (methanethiol, trichloro-)
trichloromonofluoromethane (methane, trichlorofluoro-)
2,4,5-trichlorophenol (phenol, 2,4,5-trichloro-)
2,4,6-trichlorophenol (phenol, 2,4,6-trichloro-)
2,4,5-trichlorophenoxyacetic acid (2,4,5-T)
(acetic acid, 2,4,5-trichlorophenoxy-)
2,4,5-trichlorophenoxypropionic acid (2,4,5-TP) (silvex)
(propionic acid, 2-(2,4,5-trichlorophenoxy)-)
trichloropropane, N.O.S.
(propane, trichloro-, N.O.S.)
1,2,3-trichloropropane
(propane, 1,2,3-trichloro-)

O,O,O-triethyl phosphorothioate
(phosphorothioic acid, O,O,O-triethyl ester)
sym-trinitrobenzene
(benzene, 1,3,5-trinitro-)
tris(1-aziridinyl) phosphine sulfide
(phosphine sulfide, tris(1-aziridinyl)-)
tris(2,3-dibromopropyl) phosphate
(1-propanol, 2,3-dibromo-, phosphate)
trypan blue
(2,7-naphthalenedisulfonic acid, 3,3'-[(3,3'-dimethyl(1,1'-biphenyl)-4,4'-diyl)bis(azo)]bis(5-amino-4-hydroxy-, tetrasodium salt)
undecamethylenediamine, N,N'-bis(2-chlorobenzyl)-, dihydrochloride
(N,N'-undecamethylenebis(2-chlorobenzylamine), dihydrochloride)
uracil mustard
(uracil, 5-[bis(2-chloroethyl)amino]-)
vanadic acid, ammonium salt (ammonium vanadate)
vanadium pentoxide (vanadium (V) oxide)
vinyl chloride (ethene, chloro-)
zinc cyanide
zinc phosphide

(Source: Amended at 7 Ill. Reg. 13999, effective October 12, 1983; amended at_____Ill. Reg._____, effective_____.)

8. Appendix I of Part 721 is added as follows:

Appendix I--Method of Analysis for Chlorinated dibenzo-p-dioxins and dibenzofurans[1][2][3][4]

Method 8280

1. Scope and Application

1.1 This method covers the determination of chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans in chemical wastes including still bottoms, filter aids, sludges, spent carbon, and reactor residues, and in soils.

---

[1]This method is appropriate for the analysis of tetra-, penta-, and hexachlorinated dibenzo-p-dioxins and -dibenzofurans.

[2]Analytical protocol for determination of TCDDs in phenolic chemical wastes and soil samples obtained from the proximity of chemical dumps. T. O. Tiernan and M. Taylor, Brehm Laboratory, Wright State University, Dayton, OH 45435. (Footnote continued on following page.)

1.2 The sensitivity of this method is dependent upon the level of interferences.

1.3 This method is recommended for use only by analysts experienced with residue analysis and skilled in mass spectral analytical techniques.

1.4 Because of the extreme toxicity of these compounds, the analyst must take necessary precautions to prevent exposure to himself, or to others, of materials known or believed to contain CDDs or CDFs.

2. Summary of the Method

2.1 This method is an analytical extraction cleanup procedure, and capillary column gas chromatography-low resolution mass spectrometry method, using capillary column GC/MS conditions and internal standard techniques, which allow for the measurement of PCDDs and PCDFs in the extract.

2.2 If interferences are encountered, the method provides selected general purpose cleanup procedures to aid the analyst in their elimination.

3. Interferences

3.1 Solvent, reagents, glassware, and other sample processing hardware may yield discrete artifacts and/or elevated baselines causing misinterpretation of gas chromatograms. All of these materials must be demon-

---

(Footnote continued from previous page.)

[3]Analytical protocol for determination of chlorinated dibenzo-p-dioxins and chlorinated debenzofurans in river water. T. O. Tiernan and M. Taylor, Brehm Laboratory, Wright State University, Dayton, OH 45435.

[4]In general, the techniques that should be used to handle these materials are those which are followed for radioactive or infectious laboratory materials. Assistance in evaluating laboratory practices may be obtained from industrial hygienists and persons specializing in safe laboratory practice. Typical infectious waste incinerators are probably not satisfactory devices for disposal of materials highly contaminated with CDDs or CDFs. A laboratory planning to use these compounds should prepare a disposal plan to be reviewed and approved by EPA's Dioxin Task Force (Contact Conrad Kleveno, WH-548A, U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460).

strated to be free from interferences under the conditions of the analysis by running method blanks. Specific selection of reagents and purification of solvents by distillation in all-glass systems may be required.

3.2 Interferences co-extracted from the samples will vary considerably from source to source, depending upon the diversity of the industry being sampled. PCDD is often associated with other interfering chlorinated compounds such as PCB's which may be at concentrations several orders of magnitude higher than that of PCDD. While general cleanup techniques are provided as part of this method, unique samples may require additonal cleanup approaches to achieve the sensitivity stated in Table 1.

3.3 The other isomers of tetrachlorodibenzo-p-dioxin may interfere with the measurement of 2, 3, 7, 8-TCDD. Capillary column gas chromatograph is required to resolve those isomers that yield virtually identical mass fragmentation patterns.

4. Apparatus and Materials

4.1 Sampling equipment for discrete or composite sampling.

4.1.1 Grab sample bottle--amber glass, 1-liter or 1-quart volume. French or Boston Round design is recommended. The container must be washed and solvent rinsed before use to minimize interferences.

4.1.2 Bottle caps--threaded to screw on to the sample bottles. Caps must be lined with Teflon. Solvent washed foil, used with the shiny side towards the sample, may be substituted for the Teflon if sample is not corrosive.

4.1.3 Compositing equipment--automatic or manual compositing system. No tygon or rubber tubing may be used, and the system must incorporate glass sample containers for the collection of a minimum of 250 ml. Sample containers must be kept refrigerated after sampling.

4.2 Water bath--heated, with concentric ring cover, capable of temperature control (± 2° C). The bath should be used in a hood.

4.3 Gas chromatograph/mass spectrometer data system.

4.3.1 Gas chromatograph: An analytical system with a temperature-programmable gas chromatograph and all required accessories including syringes, analytical columns, and gases.

4.3.2 Column: SP-2250 coated on a 30 m long x 0.25 mm I.D. glass column (Supelco No. 2-3714 or equivalent). Glass capillary column conditions: Helium carrier gas at 30 cm/sec linear velocity run splitless. Column temperature is 210° C.

4.3.3 Mass spectrometer: Capable of scanning from 35 to 450 amu every 1 sec or less, utilizing 70 volts (nominal) electron energy in the electron impact ionization mode and producing a mass spectrum which meets all the criteria in Table 2 when 50 ng of decafluorotriphenyl-phosphine (DFTPP) is injected through the GC inlet. The system must also be capable of selected ion monitoring (SIM) for at least 4 ions simultaneously, with a cycle time of 1 sec or less. Minimum integration time for SIM is 100 ms. Selected ion monitoring is verified by injecting .015 ng of TCDD Cl^{37} to give a minimum signal to noise ratio of 5 to 1 at mass 320.

4.3.4 GC/MS interface: Any GC-to-MS interfact that gives acceptable calibration points at 50 ng per injection for each compound of interest and achieves acceptable tuning performance criteria (see Sections 6.1-6.3) may be used. GC-to-MS interfaces constructed of all glass or glass-lined materials are recommended. Glass can be deactivated by silanizing with dichlorodimethylsilane. The interface must be capable of transporting at least 10 ng of the components of interest from the GC to the MS.

4.3.5 Data system: A computer system must be interfaced to the mass spectrometer. The system must allow the continuous acquisition and storage on machine-readable media of all mass spectra obtained throughout the duration of the chromatographic program. The computer must have software that can search any GC/MS data file for irons of a specific mass and that can plot such ion abundances versus time or scan number. This type of plot is defined as an Extracted Ion Current Profile (EICP). Software must also be able to integrate the abundance, in any EICP, between specified time or scan number limits.

4.4 Pipettes-Disposable, Pasteur, 150 mm long x 5 mm ID (Fisher Scientific Co., No. 13-678-6A or equivalent).

4.5 Flint glass bottle (Teflon-lined screw cap).

4.6 Reacti-vital (silanized) (Pierce Chemical Co.).

5. Reagents

5.1 Potassium hydroxide-(ACS), 2 percent in distilled water.

5.2 Sulfuric acid-(ACS), concentrated.

5.3 Methylene chloride, hexane, benzene, petroleum ether, methanol, tetradecane-pesticide quality or equivalent.

5.4 Stock standards in a glovebox, prepare stock standard solutions of TCDD and ^{37}Cl-TCDD (molecular weight 328). The stock solutions are stored in a glove-box, and checked frequently for signs of degradation or evaporation, especially just prior to the preparation of working standards.

5.5 Alumina-basic, Woelm; 80/200 mesh. Before use activate overnight at 600°C, cool to room temperature in a dessicator.

5.6 Prepurified nitrogen gas.

6.0 Calibration

6.1 Before using any cleanup procedure, the analyst must process a series of calibration standards through the procedure to validate elution patterns and the absence of interferences from reagents.

6.2 Prepare GC/MS calibration standards for the internal standard technique that will allow for measurement of relative response factors of at least three TCDD/^{37}Cl-TCDD and TCDF/^{37}Cl-TCDF ratios.[5] The ^{37}Cl-TCDD/F concentration in the standard should be fixed and selected to yield a reproducible response at the most sensitive setting of the mass spectrometer.

---

[5] ^{37}Cl-labelled TCDD and TCDF are available from K.O.R. Isotopes, Cambridge, MA. Proper standardization requires the use of a specific labelled isomer for each congener to be determined. However, the only labelled isomers readily available are ^{37}Cl-2, 3, 7, 8-TCDD and ^{37}Cl-2, 3, 7, 8-TCDF. This method therefore uses these isomers as surrogates for the CDDs and CDFs. When labelled CDDs and CDFs are available, their use will be required.

6.3 Assemble the necessary GC/MS apparatus and establish operating parameters equivalent to those indicated in Section 11.1 of this method. Calibrate the GC/MS system according to Eichelberger, et al. (1975) by the use of decafluorotriphenyl phosphine (DFTPP). By injecting calibration standards, establish the response factors for CDDs vs. ^{37}Cl-TCDF. The detection limit provided in Table 1 should be verified by injecting .015 ng of ^{37}Cl-TCDD which should give a minimum signal to noise ratio of 5 to 1 at mass 320.

7. Quality Control

7.1 Before processing any samples, the analyst should demonstrate through the analysis of a distilled water method blank, that all glassware and reagents are interference-free. Each time a set of samples is extracted or there is a change in reagents, a method blank should be processed as a safeguard against laboratory contamination.

7.2 Standard quality assurance practices must be used with this method. Field replicates must be collected to validate the precision of the sampling technique. Laboratory replicates must be analyzed to validate the precision of the analysis. Fortified samples must be analyzed to establish the accuracy of the analysis.

8. Sample Collection, Preservation, and Handling

8.1 Grab and composite samples must be collected in glass containers. Conventional sampling practices should be followed, except that the bottle must not be prewashed with sample before collection. Composite samples should be collected in glass containers in accordance with the requirements of the RCRA program. Sampling equipment must be free of tygon and other potential sources of contamination.

8.2 The samples must be iced or refrigated from the time of collection until extraction. Chemical preservatives should not be used in the field unless more than 24 hours will elapse before delivery to the laboratory. If an aqueous sample is taken and the sample will not be extracted within 49 hours of collection, the sample should be adjusted to a pH range of 6.0-8.0 with sodium hydroxide or sulfuric acid.

8.3 All samples must be extracted within 7 days and completely analyzed within 30 days of collection.

). Extraction and Cleanup Procedures

9.1 Use an aliquot of 1-10 g sample of the chemical waste or soil to be analyzed. Soils should be dried using a stream of prepurified nitrogen and pulverized in a ball-mill or similar device. Transfer the sample to a tared 125 ml Flint glass bottle (Teflon-lined screw cap) and determine the weight of the sample. Add an appropriate quantity of ^{37}Cl-labelled 2, 3, 7, 8-TCDD (adjust the quantity according to the required minimum detectable concentration), which is employed as an internal standard.

9.2 Extraction

9.2.1 Extract chemical waste samples by adding 10 ml methanol, 40 ml petroleum ether, 50 ml doubly distilled water, and then shaking the mixture for 2 minutes. Tars should be completely dissolved in any of the recommended neat solvents. Activated carbon samples must be extracted with benzene using method 3540 in SW-846 (Test Methods for Evaluating Solid Waste--Physical/Chemical Methods, available from G.P.O. Stock #055-002-81001-2). Quantitatively transfer the organic extract or dissolved sample to a clean 250 ml flint glass bottle (Teflon lined screw cap), add 50 ml doubly distilled water and shake for 2 minutes. Discard the aqueous layer and proceed with Step 9.3.

9.2.2 Extract soil samples by adding 40 ml of petroleum ether to the samples, and then shaking for 20 minutes. Quantitatively trasfer the organic extract to a clean 250 ml flint glass bottle (Teflon-lined screw cap), add 50 ml doubly distilled water and shake for 2 minutes. Discard the aqueous layer and proceed with Step 9.3.

9.3 Wash the organic layer with 50 ml of 20% aqueous potassium hydroxide by shaking for 10 minutes and then remove and discard the aqueous layer.

9.4 Wash the organic layer with 50 ml of doubly distilled water by shaking for 2 minutes and discard the aqueous layer.

9.5 Cautiously add 50 ml concentrated sulfuric acid and shake for 10 minutes. Allow the mixture to stand until layers separate (approximately 10 minutes), and remove and discard the acid layer. Repeat acid washing until no color is visible in the acid layer.

9.6 Add 50 ml of doubly distilled water to the organic extract and shake for 2 minutes. Remove and discard the aqueous layer and dry the organic layer by adding 10g of anhydrous sodium sulfate.

9.7 Concentrate the extract to incipient dryness by heating in a 50° C water bath and simultaneously flowing a stream of prepurified nitrogen over the extract. Quantitatively transfer the reside to an alumina microcolumn fabricated as follows:

9.7.1 Cut off the top section of a 10 ml disposable Pyrex pipette at the 4.0 ml mark and insert a plug of silanized glass wool into the tip of the lower portion of the pipette.

9.7.2 Add 2.8g of Woelm basic alumina (previously activated at 600° C overnight and then cooled to room temperature in a desiccator just prior to use).

9.8 Elute the microcolumn with 10 ml of 3% methylene chloride-in-hexane followed by 15 ml of 20% methylene chloride-in-hexane and discard these effluents. Elute the column with 15 ml of 50% methylene chloride-in-hexane and concentrate this effluent (55° C water bath, stream of prepurified nitogren) to about 0.3-0.5 ml.

9.9 Quantitatively transfer the residue (using methylene chloride to rinse the container) to a silanized Reacti-Vial (Pierce Chemical Co.). Evaporate, using a stream of prepurified nitrogen, almost to dryness, rinse the walls of the vessel with approximately 0.5 ml methylene chloride, evaporate just to dryness, and tightly cap the vial. Store the vial at 5°C until analysis, at which time the sample is reconstituted by the addition of tridecane.

9.10 Approximately 1 hour before GC-MS (HRGC-LRMS) analysis, dilute the residue in the micro-reaction vessel with an appropriate quantity of tridecane. Gently swirl the tridecane on the lower portion of the vessel to ensure dissolution of the CDDs and CDFs. Analyze a sample by GC/EC to provide insight into the complexity of the problem, and to determine the manner in which the mass spectrometer should be used. Inject an appropriate aliquot of the sample into the GC-MS instrument, using a syringe.

9.11 If, upon preliminary GC-MS analysis, the sample appears to contain interfering substances which obscure the analyses for CDDs and CDFs, high performance liquid chromatographic (HPLC) cleanup of the extract is accomplished, prior to further GC-MS analysis.

10. HPLC Cleanup Procedure

10.1 Place approximately 2 ml of hexane in a 50 ml flint glass sample bottle fitted with a Teflon-lined cap.

10.2 At the appropriate retention time, position sample bottle to collect the required fraction.
10.3 Add 2 ml of 5% (w/v) sodium carbonate to the sample fraction collected and shake for one minute.

10.4 Quantitatively remove the hexane layer (top layer) and transfer to a micro-reaction vessel.

10.5 Concentrate the fraction to dryness and retain for further analysis.

11. GC/MS Analysis

11.1 The Following column conditions are recommended: Glass capillary column conditions: SP-2250 coated on a 30 cm long x 0.25 mm I.D. glass column (Supelco No. 2-3714, or equivalent) with helium carrier gas at 30 cm/sec linear velocity, run splitless. Column Temperature is 210°C. Under these conditions the retention time for TCDDs is about 9.5 minutes. Calibrate the system daily with, a minimum, three injections of standard mixtures.

11.2 Calculate response factors for standards relative to ^{37}Cl-TCDD/F (see Section 12).

11.3 Analyze samples with selected ion monitoring of at least two ions from Table 3. Proof of the presence of CDD or CDF exists if the following conditions are met:

11.3.1 The retention time of the peak in the sample must match that in the standard, within the performance specifications of the analytical system.

11.3.2 The ratio of ions must agree within 10% with that of the standard.

11.3.3 The retention time of the peak maximum for the ions of interest must exactly match that of the peak.

11.4 Quantitate the CDD and CDF peaks from the response relative to the ^{37}Cl-TCDD/F internal standards. Recovery of the internal standard should be greater than 50 percent.

11.5 If a response is obtained for the appropriate set of ions, but is outside the expected ratio, a co-eluting impurity may be suspected. In this case, another set of

ions characteristic of the CDD/CDF molecules should be analyzed. For TCDD a good choice of ions is m/e 257 and m/e 259. For TCDF a good choice of ions is m/e 241 and 243. These ions are useful in characterizing the molecular structure of TCDD or TCDF. For analysis of TCDD good analytical technique would require using all four ions, m/e 257, 320, 322, 328, to verify detection and signal to noise ratio of 5 to 1. Suspected impurities such as DDE, DDD, or PCB residues can be confirmed by checking for their major fragments. These materials can be removed by the cleanup columns. Failure to meet criteria should be explained in the report or the sample reanalyzed.

11.6 If broad background interference restricts the sensitivity of the GC/MS analysis, the analyst should employ cleanup procedures and reanalyze by GC/MS.

11.7 In those circumstances where these procedures do not yield definitive conclusion, the use of high resolution mass spectrometry is suggested.

12. Calculations

12.1 Determine the concentration of individual compounds according to the formula:

$$\text{Concentration, ug/gm} = \frac{A \times A_s}{G \times A_{is} \times R_f}$$

Where:
A = ug of internal standard added to the sample.[6]
G = gm of sample extracted.
A_s = area of characteristic ion of the compound being quantified.
A_{is} = area of characteristic ion of the internal standard.
R_f = response factor
Response factors are calculated using data obtained from the analysis of standards according to the formula:

$$R_f = \frac{A_s \times C_{is}}{A_{is} \times C_s}$$

---

[6]The proper amount of standard to be used is determined from the calibration curve (See Section 6.0).

Where:
C_{is} = Concentration of the internal standard
C_s = concentration of the standard compound

12.2 Report results in micrograms per gram without correction for recovery data. When duplicate and spiked samples are analyzed, all data obtained should be reported.

12.3 Accuracy and Precision. No data are available at this time.

TABLE 1--Gas Chromatography of TCDD

Column	Retention time (min.)	Detection limit (ug/kg)[1]
Glass Capillary	9.5	0.003

[1]Detection limit for liquid samples is 0.003 ug/l. This is calculated from the minimum detectable GC response being equal to five times the GC background noise assuming a 1 ml effective final volume of the 1 liter sample extract and a GC injection of 5 microliters. Detection levels apply to both electron capture and GC/MS detection. For further details see 44 FR 69526 (December 3, 1979).

TABLE 2--DFTPP key Ions and Ion Abundance Criteria[1]

Mass	Ion abundance criteria
51	30 to 60 percent of mass 198.
68	Less than 2 percent of mass 69.
70	Do.
127	40 to 60 percent of mass 198.
197	Less than 1 percent of mass 198.
198	Base peak, 100 percent relative abundance.
199	5 to 9 percent of mass 198.
275	10 to 30 percent of mass 198.
365	Greater than 1 percent of mass 198.
441	Present but less than mass 443.
442	Greater than 40 percent of mass 198.
443	17 to 23 percent of mass 442.

[1]J. W. Eichelberger, L. E. Harris, and W. L. Budde 1975. Reference compound to calibrate ion abundance measurement in gas chromatography-mass spectrometry. Analytical Chemistry 47:995.

TABLE 3--List of Accurate Masses Monitored Using GC Selected-Ion Monitoring, Low Resolution, Mass Spectrometry For Simultaneous Determination of Tetra-, Penta-, and Hexachlorinated Dibenzo-p-Dioxins and Dibenzofurans

Class of Chlorinated dibenzodioxin or dibenzofuran	Number of chlorine Substituents (x)	Monitored M/z for dibenzofurans $C_{12}H_{x}OCl_{x}$	Monitored M/z for dibenzodioxins $C_{12}H_{x}O_{2}Cl_{x}$	Approximate theoretical-ratio expected on Basis of isotopic abundance
Tetra	4	[1]319.897	[1]303.902	0.74
		321.894	321.899	1.00
		[2]327.885		
		[3]256.933		.21
		[3]258.930		.20
Penta	5	[1]353.858	[1]337.863	.57
		355.855	339.860	1.00
Hexa	6	389.816	373.821	1.00
		391.813	375.818	.87

[1]Molecular ion peak.

[2]Cl_4--labelled standard peaks.

[3]Ions which can be monitored in TCDD analyses for confirmation purposes.

(Comment: A Notice of Proposed Rulemaking which includes Method 8280 was published by U.S. EPA in the Federal Register at 48 FR 14514 (April 4, 1983).)

(Source: Amended at _____ Ill. Reg. _____, effective _____.)

IT IS SO ORDERED.

I, Dorothy M. Gunn, Clerk of the Illinois Pollution Control Board, hereby certify that the above Opinion and Order was adopted on the 21st day of November, 1984 by a vote of 5-0.

Dorothy M. Gunn

Dorothy M. Gunn, Clerk
Illinois Pollution Control Board