

US EPA ARCHIVE DOCUMENT

ENVIRONMENTAL PROTECTION AGENCY**40 CFR Part 148, 261, 264, 265, 268, and 271****[SWH-FRL-3643-4; EPA/OSW-FR-89-020]****Land Disposal Restrictions for Third Scheduled Wastes****AGENCY:** Environmental Protection Agency (EPA).**ACTION:** Proposed rule.

SUMMARY: Pursuant to RCRA section 3004(g)(5), EPA is proposing to prohibit the land disposal of certain hazardous wastes listed in 40 CFR 268.12 (the third one-third of the schedule of restricted hazardous wastes, hereafter known as the Third Third). Today's action proposes treatment standards and prohibition effective dates for these wastes, as well as for some of the wastes listed in §§ 268.10 and 268.11 (First Third and Second Third), and for two newly listed wastes. The Agency also is proposing prohibition effective dates for these wastes when they are injected into deep underground wells regulated under 40 CFR 148. If these proposed actions are finalized, Third Third wastes can be land disposed after the applicable effective dates if the respective treatment standards are met, or if disposal occurs in units that satisfy the statutory no migration standard.

The Agency is also proposing certain interpretations of general applicability. The most important of these involve: implementation of the dilution prohibition; whether wastes formerly excluded by the Bevill Amendment are to be considered newly identified or listed for purposes of the land disposal restrictions; applicability of California list prohibitions to Third Third wastes that receive national capacity variances; and applicability of the California list prohibitions to newly identified or listed wastes. EPA is also proposing to clarify the scope of paragraphs (c) and (d) of 40 CFR 261.33 (commercial chemicals that are hazardous wastes when discarded) due to the possible lack of clarity that became apparent in the course of establishing treatment standards for these wastes.

DATE: Comments on this proposed rule must be submitted on or before January 8, 1990.

ADDRESSES: The public must send an original and two copies of their comments to EPA RCRA Docket (OS-305), U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460. Place the Docket Number F-89-LD12-FFFFF on your comments. The

EPA RCRA Docket is located in Room 2427, 401 M Street, SW, Washington, DC 20460. The docket is open from 9:00 a.m. to 4:00 p.m., Monday through Friday, except for Federal holidays. The public must make an appointment to review docket materials by calling (202) 475-9327. The public may copy a maximum of 100 pages from any regulatory document at no cost. Additional copies cost \$.20 per page.

FOR FURTHER INFORMATION CONTACT:

For general information contact the RCRA Hotline, Office of Solid Waste, U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460; Telephone: 800-424-9346 (toll-free) or 202-382-3000 locally.

For information on specific aspects of this proposed rule, contact Robert Scarberry or Michaelle Wilson, Office of Solid Waste (OS-333), U.S.

Environmental Protection Agency, 401 M Street SW., Washington, DC 20460, (202) 382-4770. For specific information on BDAT treatment standards, contact Larry Rosengrant, Office of Solid Waste (OS-322), U.S. Environmental Protection Agency, 401 M Street SW., Washington, DC 20460, (202) 382-7917. For specific information on the Underground Injection Control Program and hazardous waste injection wells, contact Bruce Kobelski, Office of Drinking Water (WH-550), U.S. Environmental Protection Agency, 401 M Street SW., Washington, DC 20460, (202) 382-7275. For specific information on capacity determinations or national variances, contact Jo-Ann Bassi, Office of Solid Waste (OS-322), U.S. Environmental Protection Agency, 401 M Street SW., Washington, DC 20460, (202) 475-6673.

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I. Background

A. Summary of the Hazardous and Solid Waste Amendments of 1984 and the Land Disposal Restrictions Framework

1. Statutory Requirements

The Hazardous and Solid Waste Amendments (HSWA), enacted on November 8, 1984, prohibit the land disposal of hazardous wastes. Specifically, the amendments specify dates when particular groups of hazardous wastes are prohibited from land disposal unless ". . . it has been demonstrated to the Administrator, to a reasonable degree of certainty, that there will be no migration of hazardous constituents from the disposal unit or injection zone for as long as the wastes remain hazardous" (RCRA sections 3004 (d)(1), (e)(1), (g)(5); 42 U.S.C. 6924 (d)(1), (e)(1), (g)(5)). Congress established a separate schedule for restricting the disposal by underground injection of solvent and dioxin-containing hazardous wastes, wastes referred to collectively as California list hazardous wastes (RCRA section 3004(f)(2), 42 U.S.C. 6924(f)(2)), and soil and debris resulting from Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) sections 104 and 106 response actions, and RCRA corrective actions when the soil and debris contains listed spent solvent, dioxin, and California list hazardous wastes.

The amendments also require the Agency to set ". . . levels or methods of treatment, if any, which substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents from the waste so that short-term and long-term threats to human health and the environment are minimized" (RCRA section 3004(m)(1), 42 U.S.C. 6924(m)(1)). Wastes that meet treatment standards established by EPA are not prohibited and may be land disposed. In addition, a hazardous waste that does not meet the treatment standard may be land disposed provided the "no migration" demonstration specified in RCRA sections 3004 (d)(1), (e)(1) and (g)(5) is made.

For the purposes of the restrictions, HSWA defines land disposal ". . . to include, but not be limited to, any placement of such hazardous waste in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, salt bed

formation, or underground mine or cave" (RCRA section 3004(k), 42 U.S.C. 6924(k)). HSWA defines land disposal to include underground injection wells; therefore, disposal of hazardous wastes in injection wells is subject to the land disposal restrictions.

The land disposal restrictions are effective when promulgated unless the Administrator grants a national capacity variance from the otherwise-applicable date and establishes a different date (not to exceed two years beyond the statutory deadline) based on "... the earliest date on which adequate alternative treatment, recovery, or disposal capacity which protects human health and the environment will be available" (RCRA section 3004(h)(2), 42 U.S.C. 6924(h)(2)). The Administrator may also grant a case-by-case extension of the effective date for up to one year, renewable once for up to one additional year, when an applicant successfully makes certain demonstrations (RCRA section 3004(h)(3), 42 U.S.C. 6924(h)(3)). A case-by-case extension can be granted whether or not a national capacity variance has been granted.

The statute also allows treatment of hazardous wastes in surface impoundments that meet certain minimum technological requirements (or certain exceptions thereto). Treatment in surface impoundments is permissible provided the treatment residues that do not meet the treatment standard(s) (or applicable statutory prohibition levels) are "... removed for subsequent management within one year of the entry of the waste into the surface impoundment" (RCRA section 3005(j)(11)(B), 42 U.S.C. 6925(j)(11)(B)).

In addition to prohibiting the land disposal of hazardous wastes, Congress prohibited storage of any waste which is prohibited from land disposal unless "... such storage is solely for the purpose of the accumulation of such quantities of hazardous waste as are necessary to facilitate proper recovery, treatment or disposal" (RCRA section 3004(j), 42 U.S.C. 6924(j)).

2. Applicability to Injected Wastes

As noted above, disposal of hazardous wastes in injection wells is subject to the provisions of HSWA. The injection of hazardous wastes is controlled by two statutes, RCRA and the Safe Drinking Water Act (SDWA). The regulations governing injection of these wastes have been codified along with other regulations of the Underground Injection Control (UIC) program under the SDWA in parts 124, 144, 145, 146, 147, and 148 of the Code of Federal Regulations.

3. Solvents and Dioxins

Effective November 8, 1986, HSWA prohibited land disposal (except by deep well injection) of solvent-containing hazardous wastes numbered F001-F005 listed in 40 CFR 261.31 and dioxin-containing hazardous wastes numbered F020-F023 and F026-F028 (RCRA sections 3004 (e)(1), (e)(2), 42 U.S.C. 6924 (e)(1), (e)(2)). On November 7, 1986, EPA promulgated a final rule (51 FR 40572) implementing RCRA section 3004(e). This rule established the general framework for the land disposal restrictions program, and established treatment standards for the F001-F005 solvent wastes and F020-F023 and F026-F028 dioxin-containing wastes.

4. California List Wastes

Effective July 8, 1987, the statute prohibited further land disposal (except by deep well injection) of the following listed or identified wastes (RCRA section 3001) set out in RCRA sections 3004 (d)(1) and (d)(2) (42 U.S.C. 6924 (d)(1), (d)(2)):

(A) Liquid hazardous wastes, including free liquids associated with any solid or sludge, containing free cyanides at concentrations greater than or equal to 1,000 mg/l.

(B) Liquid hazardous wastes, including free liquids associated with any solid or sludge, containing the following metals (or elements) or compounds of these metals (or elements) at concentrations greater than or equal to those specified below: (i) arsenic and/or compounds (as As) 500 mg/ (ii) cadmium and/or compounds (as Cd) 100 mg/l; (iii) chromium (VI and/or compounds (as Cr VI)) 500 mg/l; (iv) lead and/or compounds (as Pb) 500 mg/l; (v) mercury and/or compounds (as Hg) 20 mg/l; (vi) nickel and/or compounds (as Ni) 134 mg/l; (vii) selenium and/or compounds (as Se) 100 mg/l; and (viii) thallium and/or compounds (as Tl) 130 mg/l.

(C) Liquid hazardous waste having a pH less than or equal to two (2.0).

(D) Liquid hazardous wastes containing polychlorinated biphenyls (PCBs) at concentrations greater than or equal to 50 ppm.

(E) Hazardous wastes containing halogenated organic compounds (HOCs) in total concentration greater than or equal to 1,000 mg/kg.

On July 8, 1987, EPA promulgated a final rule (52 FR 25760) implementing RCRA section 3004(d). This rule established treatment standards for California list wastes containing PCBs and certain HOCs, and codified the statutory prohibition on liquid corrosive wastes. The statutory prohibition is in

effect for the California list wastes containing free cyanides, metals, and the California list dilute HOC wastewaters.

5. Disposal of Solvents, Dioxins and California List Wastes in Injection Wells

Section 3004(f) of RCRA required that the Administrator prohibit the disposal of solvents, dioxins and California List wastes in deep wells, effective August 8, 1988, unless such disposal had been determined to be protective of human health and the environment for as long as the wastes remained hazardous, or unless a variance had been granted under RCRA section 3004(h). On July 26, 1988, the Agency established effective dates for the prohibition on injection of solvents and dioxin wastes (53 FR 28118). In another regulation, effective August 6, 1988 and published August 16, 1988 in the Federal Register, the Agency established effective dates for the prohibition on injection of California List wastes (53 FR 30908).

6. Scheduled Wastes

HSWA required the Agency to prepare a schedule by November 8, 1986 for restricting the land disposal of all hazardous wastes, including underground injected wastes, listed or identified as of November 8, 1984 in 40 CFR part 261, excluding solvent- and dioxin-containing wastes and California list wastes covered under the schedule set by Congress. The schedule, based on a ranking of the listed wastes that considers their intrinsic hazard and their volume, ensures that prohibitions and treatment standards are promulgated first for high volume hazardous wastes with high intrinsic hazard before standards are set for low volume wastes with low intrinsic hazard. The statute further requires that these determinations be made by the following deadlines: (A) At least one-third of all listed hazardous wastes by August 8, 1988; (B) at least two-thirds of all listed hazardous wastes by June 8, 1989; and (C) all remaining listed hazardous wastes and all hazardous wastes identified as of November 8, 1984, by one or more of the characteristics defined in 40 CFR part 261 by May 8, 1990.

Furthermore, if EPA failed to set a treatment standard by the statutory deadline for any hazardous waste in the first third or second third of the schedule, the waste was required to be disposed in a landfill or surface impoundment that met the minimum technological requirements specified in RCRA section 3004(o) for new facilities (RCRA section 3004(g)(6)). (NOTE: In the

August 17, 1988 First Third final rule, EPA interpreted the term "such facility" in section 3004(g)(6) to refer to the individual surface impoundment or landfill unit.) In addition, prior to disposal, the generator was required to certify to the Administrator that he had investigated the availability of treatment capacity and had determined that disposal in such landfill or surface impoundment was the only practical alternative to treatment currently available to the generator. This restriction on the use of landfills and surface impoundments applied until EPA set a treatment standard for the waste, or until May 8, 1990, whichever was sooner. These requirements are collectively referred to as the soft hammer provisions. Other forms of land disposal, including underground injection, were not similarly restricted, and could continue to be used for disposal of untreated wastes until EPA promulgated a treatment standard, or until May 8, 1990, whichever was sooner.

If the Agency fails to set a treatment standard for any scheduled hazardous waste by May 8, 1990, the soft hammer provisions are superseded by the hard hammer. These wastes are automatically prohibited from all forms of disposal on May 8, 1990, unless the wastes are the subject of a successful "no migration" demonstration (RCRA section 3004(g)(5), 42 U.S.C. 6924(g)(5)). (Note: RCRA section 3004(h)(2) permits extensions of the effective date such as national capacity extensions or case-by-case extensions beyond the hard hammer date.)

On May 28, 1986, EPA promulgated the schedule for setting treatment standards for the listed and identified hazardous wastes (51 FR 19300). All wastes that are identified as hazardous by characteristic are scheduled in the Third Third, as required by RCRA. This schedule is incorporated in 40 CFR 268.10, 268.11 and 268.12.

For the scheduled wastes, the statute does not provide different deadlines for restriction of wastes that are injected underground versus disposed of in surface land units. The Agency did, however, propose and promulgate First Third regulations for surface disposed and injected wastes on separate dates. The First Third final rule, promulgated on August 8, 1988 and published in the Federal Register on August 17, 1988 (53 FR 31138), set out the conditions under which wastes included in the first one-third of the schedule of restricted hazardous wastes listed in 40 CFR 268.10 may continue to be land disposed (other than by injection). Final

regulations prohibiting deep well injection of certain First Third wastes were published on August 16, 1988 (53 FR 30908) and on June 14, 1989 (54 FR 25416).

The Second Third final rule, promulgated on June 8, 1989 and published in the Federal Register on June 23, 1989, (54 FR 26594) established treatment standards and prohibition effective dates for land disposal and underground injection for certain wastes included in 40 CFR 268.11. In addition, treatment standards and effective dates for certain First Third soft hammer wastes, Third Third wastes and newly listed wastes were promulgated.

Today's notice proposes the conditions under which wastes included in the third one-third of the schedule of restricted hazardous wastes, listed in 40 CFR 268.12, may continue to be land disposed including disposal in underground injection wells. Treatment standards for some restricted hazardous wastes listed in §§ 268.10 and 268.11 (First Third and Second Third wastes) and two newly listed waste (*i.e.*, listed after November 8, 1984) are also proposed.

7. Newly Identified and Listed Wastes

RCRA requires the Agency to make a land disposal prohibition determination for any hazardous waste that is newly identified or listed in 40 CFR part 261 after November 8, 1984 within six months of the date of identification or listing (RCRA section 3004(g)(4), 42 U.S.C. 6924(g)(4)). However, the statute does not provide for an automatic prohibition of the land disposal of such wastes if EPA fails to meet this deadline. Today's notice proposes treatment standards for two newly listed wastes (see section III.A).

B. Regulatory Framework

By way of preface, we note that the following description of existing rules is for the readers' convenience, and is not intended to reopen any of these rules for public comments. The November 7, 1986 final rule (51 FR 40572) established the regulatory framework for implementing the land disposal restrictions program. Some changes to the framework were made in the July 8, 1987, final rule (52 FR 25760) that prohibited the land disposal of California list wastes, as well as in the August 17, 1988 final rule. Some additional changes are also being proposed in today's rule. Regulations specifying how the framework applies to injected wastes were promulgated July 26, 1988 (53 FR 28118). The following discussion summarizes the major provisions of the land disposal restrictions framework.

1. Applicability

The land disposal restrictions apply prospectively to the affected wastes. In other words, hazardous wastes land disposed after the applicable effective dates are subject to the restrictions, but wastes land disposed prior to the effective dates are not required to be removed or exhumed for treatment (51 FR 40577). Similarly, only surface impoundments receiving restricted wastes after the applicable deadline are subject to the restrictions on treatment in surface impoundments contained in 40 CFR 268.4 and RCRA section 3005(j)(11). Also, the storage prohibition applies to wastes placed in storage after the effective dates.

The provisions of the land disposal restrictions apply to wastes produced by generators of greater than 1,000 kilograms of hazardous waste per calendar month, as well as small quantity generators of 100 to 1,000 kilograms of hazardous waste (or greater than 1 kilogram of acute hazardous waste) in a calendar month. However, wastes produced by small quantity generators of less than 100 kilograms of hazardous waste (or less than 1 kilogram of acute hazardous waste) per calendar month are conditionally exempt from RCRA, including the land disposal restrictions (see 40 CFR 268.1).

The land disposal restrictions apply to all facilities subject to RCRA, including both interim status and permitted facilities. The requirements of the land disposal restrictions program supersede 40 CFR 270.4(a), which currently provides that compliance with a RCRA permit constitutes compliance with subtitle C of RCRA. Therefore, even though the requirements may not be specified in the permit conditions, all permitted facilities are subject to the restrictions.

2. Treatment Standards

By each statutory deadline, the Agency must establish the applicable treatment standards under 40 CFR part 268 subpart D for each restricted hazardous waste (RCRA section 3004(m)(1)). After the applicable effective dates, restricted wastes may be land disposed in subtitle C facilities only if they meet the treatment standards. If EPA does not promulgate treatment standards by the statutory deadlines, such wastes are prohibited from land disposal (with the exception of First Third and Second Third scheduled hazardous wastes, which are subject to the soft hammer provisions of

RCRA section 3004(g)(6) until May 8, 1990).

A treatment standard is based on the performance of the best demonstrated available technology (BDAT) to treat the waste (51 FR 40578). EPA may establish treatment standards either as specific technologies or as performance standards based on the performance of BDAT technologies. Compliance with performance standards may be monitored by measuring the concentration level of the hazardous constituents (or in some circumstances, indicator pollutants) in the waste, treatment residual, or in the extract of the waste or treatment residual. When treatment standards are set as performance levels, the regulated community may use any technology not otherwise prohibited (such as impermissible dilution) to treat the waste to meet the treatment standard. Treaters thus are not limited to only those technologies considered in determining the treatment standard. However, when treatment standards are expressed as specific technologies, such technologies must be employed.

3. National Capacity Variances from the Effective Dates

The Agency has the authority to grant national capacity variances from the statutory effective dates, not to exceed two years, if there is insufficient alternative protective treatment, recovery or disposal capacity for the wastes (RCRA section 3004(h)(2)). To make capacity determinations, EPA compares the nationally available alternative treatment, recovery, or protective disposal capacity at permitted and interim status facilities which will be in operation by the effective date with the quantity of restricted waste generated. If there is a significant shortage of such capacity nationwide, EPA will establish an alternative effective date based on the earliest date such capacity will be available. During the period such a capacity variance is in place, if the waste is disposed in a landfill or surface impoundment, such disposal may be made only in a unit meeting the minimum technological requirements of RCRA section 3004(o) (53 FR 31186 and 40 CFR 268.5(h)(2)). It should be noted, however, that if a waste subject to a national capacity variance is treated to meet the applicable treatment standard, it may be disposed in a Subtitle C landfill or surface impoundment regardless of whether the unit meets minimum technological requirements.

4. Case-By-Case Extensions of the Effective Dates

The Agency will consider granting up to a one-year extension (renewable only once) of a prohibition effective date on a case-by-case basis. The requirements outlined in 40 CFR 268.5 must be satisfied, including a demonstration that adequate alternative treatment, recovery, or disposal capacity for the petitioner's waste cannot reasonably be made available by the effective date due to circumstances beyond the applicant's control, and that the petitioner has entered into a binding contractual commitment to construct or otherwise provide such capacity. During the period that such a case-by-case extension is in place, the waste may be land disposed only in a unit meeting the minimum technological requirements of RCRA section 3004(o).

5. "No Migration" Exemptions from the Restrictions

EPA has the authority to allow the land disposal of a restricted hazardous waste which does not meet the treatment standard provided that the petitioner demonstrates that there will be no migration of hazardous constituents from the disposal unit or injection zone for as long as the waste remains hazardous (40 CFR 268.6). If a petition is granted, it can remain in effect for no longer than ten years for disposal in interim status land disposal units, and for no longer than the term of the RCRA permit for disposal in permitted units (40 CFR 268.6(h)).

Section 148.20 of 40 CFR (promulgated on July 26, 1988, see 53 FR 28118) outlines in detail the Agency's plan for implementing the "no migration" provisions of RCRA with respect to injected wastes. Briefly, a petitioner is required, through modeling, to demonstrate that there is no migration of hazardous constituents from the injection zone for as long as the waste remains hazardous. This demonstration can be made in one of two ways: the use of flow and transport models to show that injected fluids will not migrate vertically out of the injection zone for a period of 10,000 years; or, use of geochemical modeling to show that the waste is transformed so it will become nonhazardous at the edge of the injection zone. Also, a showing must be made that the well was in compliance with the substantive area of review, corrective action, and mechanical integrity requirements of part 146.

6. Variances from the Treatment Standards

EPA established the variance from the treatment standard to account for those wastes that cannot be treated to meet the applicable treatment standards, even if well-designed and well-operated BDAT treatment systems are used (40 CFR 268.44). This variance is somewhat analogous to the fundamentally different factors variance in the Agency's Clean Water Act effluent limitations guidelines regulation. Among other things, petitions must demonstrate that the waste is significantly different from the wastes evaluated by EPA in establishing the treatment standard, and the waste cannot be treated to the level or by the method specified by the treatment standard, or that such standard or method is inappropriate for the waste (51 FR 40605). This variance procedure can result in the establishment of a new treatability group and corresponding treatment standard that applies to all wastes meeting the criteria of the new waste treatability group. A site-specific variance from the treatment standard may also be granted administratively (without rulemaking), but the variance has no generic applicability to other wastes at other sites (53 FR 31199).

7. Exemption for Treatment in Surface Impoundments

Wastes that would otherwise be prohibited from one or more methods of land disposal may be treated in a surface impoundment that meets certain technological requirements (40 CFR 268.4(a)(3)) as long as treatment residuals that do not meet the applicable treatment standard (or statutory prohibition levels where no treatment standards are established) are removed for subsequent management within one year of entry into the impoundment and are not placed into any other surface impoundment. The owner or operator of such an impoundment must certify to the Regional Administrator that the technical requirements have been met and must also submit a copy of the waste analysis plan that has been modified to provide for testing treatment residuals in accordance with section 268.4 requirements.

8. Storage of Prohibited Wastes

Storage of prohibited wastes is prohibited except where storage is solely for the purpose of accumulating sufficient quantities of wastes to facilitate proper treatment, recovery, or disposal (40 CFR 268.50). A facility that stores a prohibited waste for more than one year bears the burden of proof that such storage is solely for this purpose.

Id. EPA bears the burden of proof if the Agency believes that storage of a restricted waste by a facility for up to one year is not for the purpose of accumulating sufficient quantities to facilitate proper treatment, recovery, or disposal. *Id.*

9. The "Soft Hammer" Provisions

First Third and Second Third wastes for which EPA has not promulgated treatment standards may continue to be disposed in landfill and surface impoundment units until May 8, 1990, or until EPA promulgates treatment standards, whichever is sooner. Such land disposal may occur only if certain demonstrations are made, and provided the landfill or surface impoundment units meet the minimum technology requirements of RCRA section 3004(o) (see 53 FR 31181, August 17, 1988). Other types of land disposal are not similarly restricted. On May 8, 1990, those wastes for which EPA has not established treatment standards are prohibited from land disposal and underground injection (the hard hammer provision). On May 8, 1990, therefore, the soft hammer provisions will no longer be in effect for the First, Second, or Third Third wastes.

II. Summary of Today's Proposed Rule

Today's notice describes the Agency's proposed approach to implementing RCRA Section 3004(g) requirements with respect to certain listed and identified (*i.e.*, characteristic) hazardous wastes included in 40 CFR 268.10-268.12. The Agency is required to promulgate regulations establishing conditions under which the Third Third wastes included in § 268.12 may be land disposed by the statutory deadline of May 8, 1990. Today's notice is the fifth rulemaking promulgated by the Agency in response to Congress' 1984 HSWA mandate.

A. Applicability of Proposed Treatment Standards

Today the Agency is proposing treatment standards and effective dates for all Third Third wastes (*i.e.*, those wastes included in 40 CFR 268.12) (see section III.A.2). The Agency is also proposing treatment standards and effective dates for all First and Second Third soft hammer wastes (currently subject to the requirements of 40 CFR 268.8), and for two newly listed wastes. The treatment standards being proposed today will apply to wastes that are land disposed (including those that are injected into deep wells).

In previous rulemakings, the Agency amended the schedule so that certain First and Second Third wastewater residues, derived-from wastes (*i.e.*,

multi-source leachate), and mixtures of hazardous/radioactive wastes were moved to the Third Third of the schedule (see 53 FR 31214, § 268.12(b), (c), and (d); 54 FR 8264; and 54 FR 26648, § 268.12(b) and (c)). The Agency today is proposing treatment standards for these wastes. In addition, the Agency is proposing treatment standards for two newly listed wastes (*i.e.*, a waste listed after enactment of the Hazardous and Solid Waste Amendments of 1984) that fall into the F002 and F005 waste codes.

In the Second Third rulemaking, the Agency solicited comments, data, and specific suggestions regarding the regulation of lab packs. In today's rule, the Agency is proposing alternative treatment standards expressed as specified technologies for certain lab packs as a separate treatability group.

In the Second Third proposed rule, the Agency also solicited data and comments on the options and approaches that were being considered for establishing BDAT treatment standards for characteristic wastes. In today's rule, the Agency is proposing treatment standards for wastes that exhibit one or more of the characteristics.

B. Applicability of Today's Proposed Rule to Class I-H Hazardous Waste Injection Wells Regulated Under 40 CFR 148

The Agency has, on occasion, proposed and promulgated regulations and effective dates for underground injected hazardous wastes covered under RCRA sections 3004 (f) and (g) separately from regulations addressing wastes disposed in surface facilities. EPA is addressing all methods of land disposal of wastes in today's proposal, including injection wells regulated jointly under the Safe Drinking Water Act (SDWA) and RCRA.

C. Characteristic Wastes

In today's rule, EPA is proposing treatment standards for those wastes which exhibit one or more of the following characteristics: ignitability, corrosivity, reactivity or EP toxicity (40 CFR 261.21-24). EPA today is proposing methods of treatment for some characteristic wastes, and concentration levels for others. For certain characteristic wastes, EPA is proposing to require treatment below the level at which the waste ceases to exhibit the particular characteristic. A detailed discussion of these issues is provided in section III.C.

D. Proposed Treatment Standards for Multi-Source Leachate

On February 27, 1989, the Agency amended the schedule for prohibiting hazardous wastes from land disposal by placing multi-source leachate derived from hazardous waste in the Third Third (see 54 FR 8264). The Agency took this step to study more fully the most appropriate treatment standards for such leachate. The Agency's original approach to multi-source leachate was that the leachate carries the waste codes of all of the listed hazardous wastes from which it is derived and, therefore, is subject to the prohibitions and treatment standards for those wastes. In the event a particular constituent in the leachate is present in more than one prohibited waste, the stricter treatment standard applies (53 FR 31138, August 17, 1988).

Today the Agency is proposing two options for the development of treatment standards for multi-source leachate: (1) Continued application of the treatment standards developed for the underlying wastes from which the leachate is derived; or (2) establishment of one set of wastewater standards and one set of nonwastewater standards which would apply to all multi-source leachate. The Agency is specifically requesting comment on these two options.

A detailed discussion of the proposed options for the development of treatment standards for multi-source leachate is contained in section III.A of today's proposed rule.

E. Mixed (Hazardous/Radioactive) Wastes

EPA is proposing to grant a two-year national capacity variance under section 3004(h)(2) for mixed hazardous/radioactive wastes subject to today's rulemaking. The Agency bases the proposed national variance for these wastes upon a determination that there is inadequate treatment capacity available for these wastes. The Agency is continuing to evaluate the volumes, characteristics, and treatment options for such wastes. A detailed discussion of EPA's approach for mixed wastes subject to today's rulemaking is provided in section III.D of today's proposed rule.

F. Applicability of Today's Proposed Rule to Mineral Processing Wastes

Section 3001(b)(3)(A)(ii) of RCRA excludes from the hazardous waste regulations (pending completion of studies by the Agency) solid wastes from the extraction, beneficiation and processing of ores and minerals. On

September 1, 1989, EPA published a final rule in the Federal Register (54 FR 36592) that narrowed the scope of this temporary exclusion as it applies to mineral processing operations to 25 enumerated wastes that meet the exclusion criteria of "high volume/low hazard," as specified in the September 1 rule. EPA determined that five specific mineral processing wastes clearly remain within the scope of the exclusion, and that 20 additional specified mineral processing wastes remain within the exclusion pending collection of further volume and hazard data. All previously excluded mineral processing wastes, other than these 25 specified wastes, that exhibit one or more of the characteristics of hazardous waste will no longer be excluded from the hazardous waste regulations when the final rule becomes effective. (On September 25, 1989 (see 54 FR 39298-39318), EPA proposed to remove an additional 7 of these wastes from the exclusion based on additional volume and/or hazard data.)

EPA believes that the wastes withdrawn from the exclusion are "newly identified" for the purposes of these provisions. Although technically the wastes are not being identified by a new characteristic, they are being brought into the subtitle C system after the date of enactment of the HSWA on November 8, 1984. The Agency is proposing that these newly identified mineral processing wastes not be subject to the BDAT treatment standards proposed today for characteristic hazardous wastes. A detailed discussion is provided in section III.E.

G. Proposed Alternative Treatment Standards for Lab Packs

The Agency received many comments concerning the applicability of the land disposal restrictions to lab packs in response to previous rulemakings. The Agency maintains that these wastes cannot be exempt from the statutory requirements, since the plain language of the statute includes them, and there is no indication in the legislative history to exclude them from the land disposal restrictions if they contain prohibited wastes. In the Second Third final rule, however, the Agency solicited further comment, data, and specific suggestions to support treatment options for lab packs and modifications to the notification and certification requirements.

The Agency is today proposing alternative treatment standards for lab packs that contain certain organic constituents, and is specifying incineration as the treatment standard

for these wastes. The Agency is also proposing stabilization as an alternative treatment standard for lab packs that contain certain inorganic constituents. The Agency believes that the proposed approach provides some of the administrative relief sought by the commenters, and minimizes the risks posed by land disposal of these small volumes of hazardous waste. Section III.A of today's proposed rule provides a detailed discussion of the alternate requirements for lab packs.

H. Nationwide Variances From the Effective Date

Due to lack of sufficient treatment or recovery capacity, EPA is proposing a national capacity variance for soil and debris contaminated with some of the waste codes covered by today's notice. EPA also is proposing a two-year national capacity variance for certain wastes disposed by deep well underground injection.

Such determinations are based on a comparison of the volumes of wastes requiring treatment to the amount of capacity available for such treatment (see section III.B). Although EPA does not require that BDAT technologies be used to meet the applicable treatment standards, unless otherwise specified, EPA assesses available capacity by evaluating the availability of technologies identified as BDAT.

The Agency is proposing to grant a two-year national capacity variance for the surface-disposed and deep well-injected hazardous wastes, and mixed hazardous/radioactive wastes listed in the following tables:

TABLE 1.—SUMMARY OF PROPOSED 2-YEAR NATIONAL CAPACITY VARIANCE FOR SURFACE-DISPOSED WASTES

Required alternative treatment technology	Waste code	Physical form
Combustion of sludge/solids.	¹ D001	Nonwastewater.
	² Leachate..	Nonwastewater.
Incineration followed by Mercury retorting.	³ D009	Nonwastewater.
	P065.....	Nonwastewater.
Mercury retorting.....	P092.....	Nonwastewater.
	⁴ D009	Nonwastewater.
	K071	Nonwastewater.
	K106	Nonwastewater.
	U151	Nonwastewater.
Thermal recovery....	⁵ D006	Nonwastewater.
	P015.....	Nonwastewater.
	P073.....	Nonwastewater.
	P087.....	Nonwastewater.
Vitrification	D004	Nonwastewater.

TABLE 1.—SUMMARY OF PROPOSED 2-YEAR NATIONAL CAPACITY VARIANCE FOR SURFACE-DISPOSED WASTES—Continued

Required alternative treatment technology	Waste code	Physical form
Wet-air oxidation.....	D010	Nonwastewater.
	K031	Nonwastewater.
	K084	Nonwastewater.
	K101	Nonwastewater.
	K102	Nonwastewater.
	P010	Nonwastewater.
	P011	Nonwastewater.
	P012	Nonwastewater.
	P036	Nonwastewater.
	P038	Nonwastewater.
	P103	Nonwastewater.
	P114	Nonwastewater.
	U136	Nonwastewater.
	U204	Nonwastewater.
	U205	Nonwastewater.
	F019.....	Nonwastewater.

- ¹ D001 (Ignitables).
- ² Multi-source Leachate.
- ³ D009 (Organo-Mercury).
- ⁴ D009 (Inorganic Mercury).
- ⁵ D006 (Cadmium batteries).

TABLE 2.—SUMMARY OF PROPOSED TWO-YEAR NATIONAL CAPACITY VARIANCE FOR UNDERGROUND INJECTED WASTES

Required alternative treatment technology	Waste code	Physical form
Alkaline chlorination.	⁶ D003	Wastewater.
	⁷ D003	Wastewater.
Chemical oxidation followed by chemical precipitation.	D007	Wastewater.
Chromium reduction followed by chemical precipitation.	D009	Nonwastewater.
Mercury retorting.....	D002	Wastewater.
Neutralization.....	⁸ D003	Wastewater.
Treatment of reactives followed by chromium reduction & chemical precipitation.		
Wet-air oxidation.....	K011	Wastewater.
	K013	Wastewater.
	K014	Wastewater.
Wet-air oxidation followed by carbon adsorption.	Leachates ⁹ .	Wastewater.

- ⁶ D003 (Cyanides).
- ⁷ D003 (Sulfides).
- ⁸ D003 (Explosives, Reactives).
- ⁹ Multi-Source Leachate.

I. Best Demonstrated Available Technologies (BDAT)

Today's proposed rule defines waste treatability groups by waste code, and identifies the Best Demonstrated

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Available Technology (BDAT) for each waste code within the treatability group (see section III.A.1). Treatment standards are based on the performance levels achievable by the BDAT identified for each waste code. Any technology not otherwise prohibited (e.g., impermissible dilution) may be used to meet the concentration-based treatment standards. Where treatment standards are expressed as a technology, the waste must be treated using the specified technology prior to land disposal.

J. Determining When Dilution is Permissible

EPA believes that its existing rules regarding impermissible dilution of prohibited wastes require further clarification when applied to situations involving aggregation for centralized treatment of more than one waste. Therefore, the Agency is today amplifying its interpretation of permissible dilution to clarify that, with respect to prohibited wastes containing BDAT constituents at concentrations exceeding the treatment standard, aggregation for centralized treatment of such wastes must result in actual reduction in the toxicity or mobility of at least one BDAT constituent in each prohibited waste that is centrally treated. In many cases, such a reduction must occur for more than one BDAT constituent. In addition, given the site-specific nature of the determination, EPA retains its authority to deviate from this general principle in individual cases where centralized treatment is inadequate. A detailed discussion of this clarification is provided in section III.G of today's proposed rule.

K. Other Impermissible Dilution Issues

EPA today is proposing that: (1) Impermissible dilution of a waste that exhibits the characteristic of toxicity be prohibited; (2) impermissible dilution of listed wastes to achieve a delisting level be prohibited; and (3) impermissible dilution of a waste that exhibits the characteristic of ignitability, corrosivity, or reactivity be prohibited if EPA has established a method of treatment as the treatment standard for the waste. The Agency believes that these types of dilution are incompatible with the language, goals, and legislative history of HSWA, where Congress expressed clear intent that dilution not be used as a substitute for treatment standards promulgated pursuant to RCRA section 3004(m). A detailed discussion of these proposed prohibitions on dilution is provided in section III.H of today's proposed rule.

L. Storage Prohibition

Section 3004(j) provides that storage of prohibited hazardous waste is itself prohibited "... unless such storage is solely for the purpose of the accumulation of such quantities of hazardous waste as are necessary to facilitate proper recovery, treatment or disposal." See § 268.50(a)(2), and 51 FR 1709, January 14, 1986. This language applies only to storage of prohibited wastes in non-land based storage units (e.g., tanks and containers), land-based storage being a type of disposal. The Agency is today soliciting comment on its interpretation that the storage prohibition does not apply where storage precedes legitimate, protective treatment, recovery or disposal. A detailed discussion of this interpretation is provided in section III.I of today's proposed rule.

M. Generator Notification Requirements

The generator notification requirements set forth in 40 CFR 268.7 specify that when the generator has determined, either through testing or his knowledge of the waste, that the waste is restricted and does not meet the applicable treatment standards, the generator must, with each shipment of waste, notify the treatment facility in writing of the appropriate treatment standards. If the generator has determined that the waste he is shipping is restricted, but can be land disposed without further treatment, he must submit to the land disposal facility the same information, as well as a certification stating that the waste meets the applicable treatment standards. In today's rule the Agency is considering changing the interpretation of § 268.7 to allow referencing the treatment standards. In addition, the Agency is proposing to amend § 268.7 to allow a one-time notification and certification for small quantity generator (SQG) shipments subject to tolling agreements. A detailed discussion of these amendments is provided in section III.J of today's notice.

N. Waste Analysis Requirements

The Agency today is proposing to incorporate the approach to waste analysis promulgated in the First and Second Third final rules (53 FR 31146 and 54 FR 26594). Where BDAT is a destruction or removal technology, a total waste analysis is required because it is most appropriate for measuring such destruction or removal. The legislative history indicates a strong preference for treatment that destroys hazardous constituents (see, e.g., 130 Cong. Rec., S9179, daily ed. July 25, 1984,

statement of Senator Chaffee), and the only reliable way to verify that destruction has occurred is to measure the total waste. Similarly, where BDAT is identified as an immobilization technology such as stabilization, analysis of a TCLP waste extract is required because it is the most appropriate measure of immobilization. In cases where both technologies are identified as BDAT, both types of waste analysis are required.

In order for the initial generator to determine whether his waste meets the applicable treatment standard as generated, he should analyze the waste extract if a treatment standard is in 40 CFR 268.41, or he should analyze the total waste if the treatment standard is found in § 268.43 (see proposed section 268.35). The generator may also make this determination based on his knowledge of the waste (see § 268.7(a)), provided there is a reasonable basis for doing so (for example, the generator uses so little of a key constituent that it could not be found in the waste at levels exceeding a treatment standard). The Agency has discussed this principle in past rulemakings, and is not reopening it for comment here.

O. Modification to the Framework: Waste Analysis Plans and Treatment/Disposal Facility Testing Requirements

Today, the Agency is soliciting comment on proposed revisions to the treatment and disposal facility testing requirements contained in §§ 264.13(a), 265.13(a), 268.7(b), and 268.7(c). Currently, the comment contained in §§ 264.13(a)(2) and 265.13(a)(2) indicates that the owner/operator of a treatment or disposal facility may rely on the generator of the hazardous waste to supply part or all of the waste analysis information (provided that this information is sufficient for the treatment or disposal facility to meet the regulatory requirements imposed by part 268). This language has been mistakenly construed to preclude requiring the owner or operator of a treatment or disposal facility to conduct a detailed analysis of a representative sample of a waste. The Agency is today seeking comment on the following two approaches that would specify the circumstances under which EPA may require testing:

(1) The generator may supply the waste analysis information only if an EPA-approved waste analysis plan allows the generator to do so. The Agency is clarifying that the owner or operator of the treatment or disposal facility will be required to conduct this testing unless otherwise stated in an

EPA-approved waste analysis plan. The Agency is proposing to amend §§ 268.7(b) and 268.7(c), the waste analysis requirements under the land disposal restrictions, to reflect this change; or

(2) The owner/operator of the treatment or disposal facility is required to test the waste a minimum of once a year. The Regional Administrator may require more frequent testing, through the waste analysis plan, on a site-specific basis.

A detailed discussion of the two approaches is provided in section III.K.

The Agency is also addressing the testing requirements of wastes treated in so-called 90-day tanks (or containers). There is a regulatory gap with respect to treatment of prohibited wastes that is conducted in such tanks or containers regulated under § 262.34. This is because such tanks (or containers) are not subject to a waste analysis plan requirement. Thus, there is presently no regulatory vehicle for determining testing frequency in such circumstances (although the existing testing requirement obviously applies, and continues to apply, to persons conducting treatment of prohibited wastes in section 262.34 tanks and containers).

In order to close this regulatory gap, EPA is proposing today that persons treating prohibited wastes in section 262.34 tanks and containers must prepare a plan justifying the frequency of testing that they choose to adopt. A detailed discussion of the proposed requirements is provided in section III.L of today's proposed rule.

P. Clarification of "P" and "U" Solid Wastes

The Agency is proposing amendments to the existing language of 40 CFR 261.33 to clarify the regulations pertaining to "P" and "U" hazardous wastes. The first amendment involves § 261.33(c), a provision that lists residues from containers and inner liners of containers that have held commercial chemical products listed in § 261.33 (e). This language is partially in error, and the Agency is proposing to correct it. EPA is also proposing a change to clarify when contaminated soil, water, and spill debris contaminated with 40 CFR 261.33 (e) and (f) materials can be solid wastes. A detailed discussion of the Agency's proposed amendments is provided in section III.F of today's preamble.

Q. Applicability of California List Prohibitions After May 8, 1990

With the promulgation of the Third Third final rule, almost all of the

California list prohibitions will be superseded by more specific prohibitions and treatment standards.¹⁰ The only continued applicability of the California list appears to be (1) for liquid hazardous wastes that contain over 50 ppm PCBs; (2) for HOC-containing wastes identified as hazardous by a characteristic property that does not involve HOCs, as, for example, an ignitable waste that also contains greater than 1000 ppm HOCs (but not an EP toxic waste that exhibits the characteristic because it contains one of the six chlorinated organic pesticides covered by the EP toxicity characteristic; and (3) for liquid hazardous wastes that exhibit a characteristic and also contain over 134 mg/l of nickel and/or 130 mg/l of thallium. In section III.M of today's proposal, the Agency is soliciting comment on whether the California list prohibitions should be applicable to newly listed or identified wastes and discusses this option at length.

Also, EPA is restating that the California list prohibitions apply to wastes which receive national capacity variances in later rulemakings. This discussion also appears in section III.M of this preamble.

III. Detailed Discussion of Today's Proposed Rule

A. Development and Identification of Treatment Standards

Today's notice proposes treatment standards for the remaining Third Third scheduled wastes for which treatment standards have not been promulgated. (Land disposal restrictions were promulgated ahead of schedule for 16 wastes originally scheduled in the Third Third: K100 nonwastewaters on August 8, 1988 (53 FR 31174, August 17, 1988), clarified on May 2, 1989 (54 FR 18836); and K005, K007, K023, K093, K094, P013, P021, P099, P109, P121, U069, U087, U088, U102 and U190 wastes on June 8, 1989 (54 FR 26594, June 23, 1989). Details of the development of treatment standards for these wastes can be found in the First Third and Second Third administrative records in the RCRA docket.) Treatment standards are also being proposed for the remaining First Third and Second Third wastes which are currently subject to the "soft hammer" provisions of 40 CFR 268.8.

Development and identification of the proposed treatment standards are presented on a waste code basis in sections III.A.2. through III.A.6. of

¹⁰ See 52 FR 29993 (August 12, 1987) and 52 FR 25773 (July 8, 1987); see also 40 CFR 268.32(h) (HOC prohibition superseded by treatment standard and effective date for a particular HOC).

today's notice. Section III.A.7. presents the development of proposed treatment standards for wastes identified as multi-source leachate and includes a reference table for the BDAT list constituents that correspond to a good portion of the U and P chemicals. This table is a handy reference to the discussion of the development of standards for these U and P chemicals and includes: an alphabetical list of the chemicals proposed for regulation in multi-source leachate, their corresponding U or P code (if applicable), and a reference to sections III.A.2. through III.A.6. that presents background on the development of treatment standards for the corresponding U or P code.

The bulk of the following discussion and that of section III.A.1. has appeared in previous preambles and is being repeated here as an aid to the reader's understanding, not to reopen these issues for comment. (The final paragraph in this section, relating to whether the standards proposed today are below levels that minimize threats to human health and the environment is a new discussion and is open for comment.)

The first step in the development of treatment standards is to divide the wastes to be regulated into groups based on similar physical and chemical properties. These waste treatability groups take into account differences in the applicability and effectiveness of treatment for those particular wastes. The Agency initially decides how wastes should be grouped by examining whether the wastes are generated by similar industries or from similar processes. This is a valid starting point because the waste characteristics that affect treatment performance are expected to be similar for these wastes even though the wastes themselves are somewhat different.

The next step in the development of treatment standards is to identify the Best Demonstrated Available Technology (BDAT) for each treatability group. A treatment technology is considered to be "demonstrated" primarily based on data from full-scale treatment operations that are currently being used to treat the waste (or a similar waste). Once the "demonstrated" technologies have been identified, the Agency determines whether these technologies may be considered "available". To be "available" the technology itself or the services of the technology must be able to be purchased, and the technology must substantially diminish the toxicity of the waste or reduce the likelihood of migration of the waste's hazardous

constituents. EPA notes that it prefers to base BDAT on technologies that further the statutory goals of waste minimization and recycling. In some circumstances EPA may select this type of technology as BDAT over more conventional treatment, provided the disparity in performance of the technologies is not too pronounced, and the technology selected minimizes threats to human health and the environment by substantially diminishing waste toxicity and reducing mobility of toxic constituents.

Treatment data from "demonstrated" "available" technologies are then screened with regard to the design and operation of the equipment, the quality assurance/quality control (QA/QC) analyses of the performance and operating data, and the accuracy and precision of the analytical tests used to assess treatment performance. After this screening, the treatment data are adjusted for each constituent based on the analytical recovery of that constituent from treatment residuals. The Agency has chosen to perform this adjustment in order to account (in part) for analytical interferences associated with the chemical makeup of the treatment residual. Where data for more than one treatment technology exist, the individual performance data for each of the various treatment technologies are then statistically evaluated. The mean concentrations of constituents in the treatment residuals from each technology are compared using an analysis of variance test (referred to as "ANOVA") in order to determine if one technology performed significantly better than the other. (A detailed discussion of the methodology for identification of BDAT and the ANOVA test is provided in the November 7, 1986 final rule (51 FR 40572)). Where data exist for only one technology, the Agency uses best engineering judgement to assess whether that particular technology represents the best applicable technology for that particular waste and whether the data indicate that the treatment system was well-designed and well-operated.

Once BDAT is identified, EPA establishes the treatment standard as maximum constituent-specific concentrations allowed in the waste (or in an extract of the treated waste), as a specific technology (or group of technologies), or as combinations of these. Although the statute provides discretion to establish treatment standards as either levels or methods of treatment, EPA normally attempts to set concentration-based treatment standards whenever possible, because

this allows the use of other technologies or combination of technologies that can achieve the same level of performance (as measured by compliance with these standards). Thus, concentration-based standards provide the regulated community some degree of flexibility in choosing treatment technologies and also allow the investigation and development of new and alternative technologies. In addition, establishing concentration-based standards provides a means of ensuring that the treatment technologies are operated at conditions that the Agency has determined will result in the best demonstrated performance.

(Note: EPA is presently studying its response to the Court's remand order in the land disposal prohibition framework case (*Hazardous Waste Treatment Council v. EPA*, No. 86-1657, D.C. Cir. Sept. 15, 1989). Although the Agency has not formulated its final response, we are finding for purposes of this proposal that, based on present knowledge, none of the treatment standards being proposed appear to be below levels where threats to human health and the environment are minimized. In many cases, the standards being proposed are greater than various standards developed pursuant to less exacting statutory directives. For example, most of the standards for metals are greater than, or in the same order of magnitude, as maximum contaminant levels established pursuant to the Safe Drinking Water Act, which take into account technical feasibility and cost. Other examples include the treatment standards for polyaromatic hydrocarbons in organic and petroleum refining wastes that are orders of magnitude higher than risk-based levels developed for purposes of the Clean Water Act's Water Quality Criteria. For other wastes, the Agency is presently unable to determine with confidence as to when threats would be minimized because of various uncertainties such as the amount of a carcinogen that can pose a risk, behavior of hazardous wastes in a land disposal environment, extrapolation of animal toxicity data to human data. Based on the information the Agency at this time views the technology-based standards proposed today as not being below levels where threats to human health and the environment are minimized.)

1. General Applicability of Treatment Standards and Overview of the Remainder of This Preamble Section

Section III.A.1. of today's preamble discusses certain general issues arising from developing or applying today's proposed treatment standards. In order

to provide a comprehensive general discussion, sections III.A.1.a. through III.A.1.f. restate the Agency's position on certain issues pertinent to the development of today's proposed treatment standards. The Agency is also providing a clarification on how treatment standards compare to Practical Quantitation Limits (PQLs) (see section (III.A.1.e.)), and a clarification on the use of grab and composite samples for purposes of establishing and enforcing treatment standards (see section III.A.1.f.). The Agency is not reopening these issues for public comment, nor is it here presenting a complete discussion of these issues (references to previous *Federal Register* notices and background documents will be provided).

Sections III.A.1.g. and h. provide overviews of general issues and information on the applicability of treatment standards to all characteristic (D001 through D017) wastes and to all U and P wastes, respectively. Section III.A.1.i. presents procedures the public should follow for requesting copies of additional data that the Agency expects to receive during the public comment period, and the reasons that these procedures have been established.

a. Restrictions on the Use of Technologies Identified as BDAT. Compliance with a concentration-based treatment standard requires only that the treatment level be achieved; once achieved, the waste may be land disposed in a subtitle C unit. The waste need not be treated by the BDAT technology; in fact, a concentration-based treatment standard provides maximum flexibility in one's choice of treatment technology because any treatment, including recycling or any combination of treatment technologies, unless prohibited (e.g., impermissible dilution) or unless defined as land disposal (e.g., land treatment), can be used to achieve these standards.

Some treatment standards in today's proposed rule, however, are expressed as a technology rather than as a concentration-based standard. EPA typically establishes a treatment method as the standard when the Agency has no means of calculating valid concentration-based standards that can be used for compliance monitoring. In such cases, that particular technology must be used to treat that particular waste (including any mixture that contains the waste). After the waste is treated using the specified method it may be land disposed, unless EPA has specified otherwise in the rule (see for example, the proposed standard for certain mercury containing wastes), or

(in some situations) if the residue exhibits a hazardous waste characteristic and does not meet BDAT for that characteristic.

In cases where EPA has specified the use of a technology (or technologies) a generator or treater can, however, demonstrate that an alternative technology can achieve the equivalent level of performance as that of the specified treatment method (40 CFR 268.42(b)). This demonstration is anticipated to typically be both waste-specific and site-specific and may be based on: (1) The development of a concentration-based standard that utilizes a surrogate or indicator compound that guarantees effective treatment of the hazardous constituents; (2) the development of a new analytical method for quantifying the hazardous constituents (see discussion of analytical complications in establishing concentration-based standards for U and P wastes in section III.A.1.h.(2) of today's preamble); and (3) other demonstrations of equivalence for an alternative method of treatment based on a statistical comparison of technologies, including a comparison of specific design and operating parameters.

As a result, a new treatment standard based on this demonstration, as well as any analytical methodology used in the demonstration, could then be proposed to be applicable to other wastes determined to be in the same treatability group. It should be noted that promulgating standards expressed as specified methods of treatment does not preclude the Agency from establishing concentration-based standards in the future without receiving specific variance requests from industry, if adequate data and information become available through other means.

In situations where wastes subject to concentration-based standards are mixed with wastes subject to treatment standards expressed as a method, the mixture must be treated by the specified method and must also meet the concentration-based treatment standards for any other prohibited waste contained in the matrix (see generally 53 FR 31146-7, August 17, 1988).

b. Applicability of Treatment Standards to Treatment Residues Identified as "Derived-From" Wastes and to Waste Mixtures. (1) "Derived-From" Wastes. The Agency emphasizes that all residues from treating the original listed F, K, U and/or P wastes are likewise normally considered to be the listed waste by virtue of the "derived-from" rule found in 40 CFR 261.3(c)(2). Consequently, all wastes

generated in the course of treatment are prohibited from land disposal unless they comply with the treatment standard or are otherwise exempted from the prohibition; such as, through a no-migration petition or by a capacity variance.

Treatment operations including those identified as BDAT, typically generate wastewater and nonwastewater residuals that may require further treatment. For example, incineration generates two residues, ash and scrubber waters. In order to comply with the treatment standards, the ash may need to be stabilized in order to immobilize the metal constituents that have concentrated in the ash. In addition, subsequent treatment of the scrubber waters may generate additional inorganic residues that may contain metals that were captured in the scrubber water. Thus, these inorganic residues may also need to be stabilized prior to land disposal, in order to comply with the same treatment standards as the stabilized ash. (Note: The Agency has not tested every possible waste that may result from every subsequent part of the treatment train. However, since the treatment standards proposed today are generally based on treatment of a relatively concentrated form of the waste (i.e., the "original" waste), the Agency believes that residues from subsequent treatment are less difficult to treat.)

The "derived-from" rule does not apply to wastes that are identified as hazardous solely because they exhibit a characteristic of hazardous waste (see 40 CFR 261.3(d)(1)). Once these characteristic wastes are treated in compliance with today's proposed treatment standards (and in accordance with the restrictions on impermissible dilution of prohibited characteristic wastes), any residue (provided that it no longer exhibits the characteristic or a new characteristic) is no longer considered to be a RCRA hazardous waste. This does not necessarily mean, however, that treatment is curbed by the characteristic level. See section III.C. of today's preamble.

The Agency is also investigating "de minimis" levels for certain hazardous constituents in listed wastes below which the waste will no longer be a hazardous waste for purposes of subtitle C regulation. The Agency has yet to propose these "de minimis" levels; thus it has not completed its evaluation of the regulations that would be affected, in particular, the relationship of "de minimis" levels to treatment standards promulgated under the land disposal restrictions.

(2) *Mixtures of Different Hazardous Waste Streams.* Today's proposed treatment standards apply to mixtures of different waste streams. Where a waste mixture has more than one applicable concentration-based treatment standard for a particular constituent, the most stringent standard must be met prior to land disposal (see 40 CFR 268.41(b)). In the event that a waste mixture cannot be treated to meet the most stringent standard, one may petition the Agency for a variance from the treatment standard pursuant to 40 CFR 268.44.

c. Wastewater Versus Nonwastewater Standards. In today's proposed rule the treatment standards (both concentration-based and specified methods) are generally presented as applicable to wastewaters or to nonwastewaters. However, for certain wastes or waste treatability subcategories the Agency is not making a distinction between wastewater and nonwastewaters.

As an example, for some treatability subcategories of D001, D002, and D003 wastes, the definition of these wastes in 40 CFR 261.21, 261.22, and 261.23 establishes only a single treatability group (e.g., the characteristic of corrosivity only applies to "aqueous" wastes (i.e., water) and to "liquids" according to §§ 261.22(a) (1) and (2) respectively. In other cases, making such a distinction would be nonsensical (e.g., D001 ignitable compressed gases). Thus, the Agency is generally proposing to apply only one standard to these treatability subcategories for which the distinction between wastewater and nonwastewater cannot be made. (See discussion of proposed standards for each D001, D002, and D003 treatability subcategory in section III.A.4. of today's preamble.) The Agency believes that this is the most reasonable approach for these characteristic wastes because the difference between wastewater and nonwastewater may be difficult (or impossible) to establish, or is unnecessary to make because the same technology can be logically applied to the entire treatability subgroup.

(1) *Definition of Wastewaters and Nonwastewaters.* Generally, the Agency is adopting in this notice the definition of wastewaters that was used to promulgate treatment standards for the First and Second Third final rules. Wastewaters are defined as those wastes (listed wastes, including wastes generated as a result of the "mixture" and "derived-from" rules) that contain less than 1% total organic carbon (TOC) and less than 1% total suspended solids, except for those wastes identified as

F001, F002, F003, F004, and F005 solvent-water mixtures. (See 53 FR 31145 (August 17, 1988) which adopts this definition for most First Third wastes, and 51 FR 40579 (November 7, 1986) for the definition of F001, F002, F003, F004, and F005 solvent-water mixtures.) Those wastes (listed wastes, including wastes that are hazardous as a result of the "mixture" and "derived-from" rules) that do not meet these criteria are defined as nonwastewaters and thus would contain greater than or equal to 1% TOC, or greater than or equal to 1% total suspended solids. (Note, however, the discussion in III.B. of further subcategorization of nonwastewaters for purposes of national capacity variances based on a lack of solids incineration capacity.)

(2) *Impermissible Switching of Applicable Wastewater and Nonwastewater Standards.* It is not permissible to dilute or partially treat a waste in order to switch the applicability of a nonwastewater standard to a wastewater standard, or vice versa (see 52 FR 21012 (June 4, 1987); but see 52 FR 25767 (July 8, 1987) noting special circumstances when California list wastes are involved). The Agency has established this principle because technologies applicable to nonwastewaters are not generally applicable to wastewaters, or require special designs (in the cases of incineration) in order to simultaneously handle wastewaters. Furthermore, treatment residues meeting the definition of nonwastewaters must comply with all applicable nonwastewater treatment standards; likewise, residual wastewaters must comply with all applicable wastewater treatment standards.

The Agency recognizes, however, that certain technologies are specifically designed to separate wastewaters from nonwastewaters. Such technologies may or may not be considered partial treatment under this principle, as discussed in the following paragraphs.

Dewatering technologies such as filtration and centrifugation are typically designed to remove suspended solid materials (TSS) from aqueous wastes. (Note: For the purposes of applying BDAT treatment standards, the Agency does not consider carbon adsorption a dewatering technology even though it may act as a filter for suspended material.) When these technologies are applied to a nonwastewater that contains greater than 1% TSS but less than 1% TOC, the resultant liquid residue will probably meet the definition of a wastewater (i.e., it will probably contain less than 1% TSS and less than

1% TOC). The Agency does not consider this impermissible switching of applicable treatment standards.

When the suspended material is organic and the overall untreated waste contains greater than 1% TOC, these dewatering technologies are also not precluded from use. The resultant residuals (i.e., the removed solids and the liquids) must comply with the applicable wastewater or nonwastewater treatment standards depending on their TOC and TSS content. If the liquid residues from these dewatering technologies meet the definition of wastewaters, the Agency does not consider this impermissible switching of applicable standards.

The importance of the TOC level in determining impermissible switching of applicable wastewater or nonwastewater treatment standard is apparent in the scenario of treatment of a waste containing less than 1% TSS and slightly more than 1% TOC (such as 2 or 3% TOC), and thereby being a nonwastewater by definition. If EPA has established concentration-based treatment standards for the corresponding wastewater form of this waste, it would be permissible to use carbon adsorption to treat this nonwastewater, so long as these concentration-based treatment standards for the wastewaters are ultimately achieved (i.e., if the residual wastewater contains hazardous constituents at levels above the concentration-based wastewater treatment standards, additional treatment with other technologies is necessary prior to land disposal.) However, if EPA has established a wastewater treatment standard expressed as "Carbon Adsorption as a Method of Treatment" for this waste code, the nonwastewater described above must comply with the standard for the nonwastewater form, despite the fact that the TOC content is only slightly greater than 1%. This is not just a mechanical application of the requirement that treatment must be conducted by the specified method, with the treatability group determined at the point of generation. EPA established "Carbon Adsorption as a Method of Treatment" standard for certain wastewaters based on the assumption that wastewaters typically contain TOC levels much less than 1%, so that removal of the organic constituents from these wastewaters was anticipated to be effective. If the nonwastewater previously described is subjected to carbon adsorption as a method of treatment, there would be no means of assuring optimum removal of the

hazardous constituents. Thus, in such a situation, the use of carbon adsorption for this nonwastewater, is not permitted as a means of complying with BDAT. The Agency considers this an impermissible switching of applicable treatability groups and treatment standards.

(3) *Application of Wastewater/Nonwastewater Standards To Residues Generated From Use of a Specified Method.* When EPA specifies a treatment method as the treatment standard, residues resulting from the required treatment method are no longer prohibited from land disposal unless EPA should otherwise specify. Commenters during previous rulemakings suggested that EPA specifically clarify the applicability of the treatment standards expressed as a required method for certain residues generated from the use of the specified methods.

In the Second Third final rule (see generally 54 FR 26625, 26630, June 23, 1989), the Agency presented specific guidelines on this. This summary is repeated here for the reader's convenience. Where EPA has established "Incineration as a Method of Treatment" as a treatment standard for nonwastewaters and/or wastewaters, or where EPA has established "Carbon Adsorption as a Method of Treatment" for wastewaters, the following statements concerning residuals from treatment trains incorporating these technologies are true: (1) Scrubber waters from incinerators in compliance with the substantive provisions of 40 CFR 264 subpart O or 265 subpart O are considered to meet the treatment standard and can be land disposed; (2) the scrubber waters from incinerators in compliance with the substantive provisions of 40 CFR 264 subpart O or part 265 subpart O are not required to undergo "Carbon Adsorption as a Method of Treatment" when this specified wastewater treatment method also has been established; (3) incinerator ashes and residues from the subsequent treatment of scrubber waters from incinerators in compliance with the substantive provisions of 40 CFR 264 subpart O or 265 subpart O are considered to meet the required "Incineration" treatment standard, and can be land disposed; (4) incinerator equipment (such as fire brick) derived from sections of the incinerator that have been directly subjected to the high temperatures of the incinerator that was operated in compliance with the substantive provisions of 40 CFR 264, subpart O or 265 subpart O, or are downstream from the high temperature

zones, are considered to meet the treatment standards for these wastes and can be land disposed; (5) wastewater effluent and any subsequent nonwastewater treatment residues from carbon adsorption units treating wastewater forms of these wastes (i.e., wastes from downstream from the carbon column) are considered to meet the specified treatment standard and can be land disposed; and (6) where EPA specifies carbon adsorption as the treatment method for wastewaters, spent carbon, as well as any other nonwastewater residues from the wastewater treatment preceding carbon adsorption, are *not* considered to meet the treatment standard; such spent carbon and nonwastewater residues must be treated by the specified nonwastewater method prior to land disposal.

d. Transfer of Treatment Standards. Rather than testing the performance of BDAT on every waste, for certain wastes the Agency examines similarities in waste stream characteristics and constituents in order to transfer treatment standards from a tested waste to a similar untested waste. EPA believes that transferring treatment performance data for untested wastes is technically valid, particularly when the untested wastes are generated from similar industries or similar processing steps. EPA also believes that transferring treatment performance data for tested constituents in one waste to untested constituents in another similar waste is technically valid, particularly when the constituents and wastes have similar chemical and physical properties.

To determine whether wastes generated by different processes can be treated to the same performance levels, EPA reviews data on waste characteristics to identify parameters that are expected to affect treatment selection. When this analysis suggests that an untested waste can be treated with the same technology as a tested waste, the Agency examines a more comprehensive list of constituents that represent the most important waste characteristics that will affect treatment performance.

The complete methodology for transferring treatment standards, however, depends upon the waste itself and often differs from treatability group to treatability group. For a detailed discussion of the transfer methodology for the wastes presented in today's notice, refer to the background documents for each waste or treatability group and the background documents

for the wastes from which the treatment standards were transferred.

EPA notes further that in the case of transfers of standards based on performance of incineration, EPA is most often transferring standards that were based on the ability of the incinerator to achieve destruction of organics to detection limits as measured in the ash and scrubber water. This is supported by data from approximately fourteen different test burns of a variety of different RCRA hazardous wastes. These wastes contained varying concentrations of many BDAT list organics. While not all of the organics on the BDAT list were present in the untreated wastes, the residues were analyzed for them and thus detection limits were calculated for a variety of incinerator residues. In developing concentration-based treatment standards for U and P wastes, the Agency considered all of these detection limits and determined which were the most representative of U and P wastes. In order to account for the anticipated variability in waste characteristics of untreated U and P wastes, the Agency typically selected the highest detection limits for the constituent that corresponded to the chemical represented by the U or P code. Thus, the Agency believes the resultant treatment standards should be achievable on a routine basis for the majority of U and P wastes.

However, in developing concentration-based treatment standards for specific F and K wastes containing organics, the Agency considered all of these data and determined which particular waste was the most representative of that particular F or K waste (based on the availability of waste characterization data for the untreated F or K waste). As a result, the Agency often transferred treatment standards that were significantly lower than those developed for the U and P wastes. The Agency believes that these lower treatment standards are achievable for these F and K wastes based on the achievability of detection limits in the waste matrix from which the standard was transferred.

e. Analytical Requirements and Relationship of PQLs to BDAT—(1) Waste Analysis Requirements. In today's proposed rule, BDAT has been identified as a destruction technology for organic constituents and cyanides in many wastes. For these wastes the best measure of treatment performance is one that reflects the extent to which these organics and cyanides have been destroyed. This approach is likewise consistent with the Congressional

preference to destroy hazardous wastes where possible. See, e.g., 130 Cong. Rec. S 9179 (July 25, 1984) (statement of Sen. Chaffee) (wastes with high organic content should be incinerated). This approach is also consistent with the strong Congressional goal of eliminating uncertainty from land disposal of hazardous waste, see, e.g., RCRA section 3004(d)(1), because it ensures removal of hazardous constituents from the land disposal environment. Therefore, the corresponding treatment standards for these constituents are based on an analysis of total constituent concentrations in a representative sample of the treated waste. [NOTE: The land disposal restrictions for solvent waste codes F001–F005 (51 FR 40572) require analysis of waste extracts obtained from the Toxicity Characteristic Leaching Procedure (TCLP) as a measure of performance. At the time that the treatment standards for F001–F005 were promulgated, useful data were not available on total constituent concentrations in treated residuals and, as a result, the TCLP was considered to be the best available measure of performance.]

In cases where treatment standards for metals in nonwastewaters are based on stabilization, the use of the TCLP is typically required as the measure of the performance of the treatment technology. Where treatment standards for nonwastewaters are based on multiple treatment processes due to mixtures of organics and metals, or where recovery of metals is the basis of the treatment standards, analysis of total constituent concentrations and analysis of the TCLP extract (or EP extract depending upon the standard) must be performed prior to land disposal.

(2) The BDAT List. The Agency has established a list of chemicals, primarily derived from the constituents in 40 CFR 261 Appendix VII and Appendix VIII, that are evaluated for regulation as BDAT constituents (i.e., concentration-based treatment standards) when they are present in a listed waste. The rationale for selection of the particular constituents to be regulated can be found in the background document for each waste or waste treatability group. The Agency believes that it is not limited to regulating only those constituents for which a waste is listed (40 CFR 261 Appendix VII). Appendix VII sets forth only the constituents that were the basis for the listing and is not an exhaustive list of hazardous constituents in each waste. Additional support for taking this approach is found in RCRA section 3001(f), which specifies

that EPA must consider additional hazardous constituents other than those for which the waste was listed when evaluating delisting petitions. Section 3001(f) thus acknowledges that Appendix VII is only a partial list of the hazardous constituents that can be present in a listed waste.

(3) *Relationship of Treatment Standards to PQLs.* The regulated community has asked a number of questions about the relationship of treatment standards to the practical quantitation limits (PQLs) for a number of constituents. It is important, therefore, to clarify the definition of PQLs, their intended use, and their relationship to treatment standards.

In proposed revisions to the September 1986 edition of Test Methods for Evaluating Solid Wastes (also known as and herein referred to as SW-846), the Agency defines PQLs as " * * * the lowest level of quantitation that the Agency believes a competent laboratory can be expected to reliably achieve." The intended use of PQLs is mentioned in Method 8250 of SW-846 (the analytical method for the determination of semivolatile organics in wastes by gas chromatography/mass spectrometry). This discussion states: "Sample PQLs are highly matrix-dependent. The PQLs listed herein are provided for guidance and may not always be achievable" (SW-846, September, 1986, Table 2, p. 8250-5). The discussion further defines PQLs as the method detection limit in reagent water (from Table 1, pp. 8250-2, 8250-3, and 8250-4) multiplied by a matrix dependent factor that was estimated for four matrices (Table 2, p. 8250-5).

As is evident from the above citations, the PQLs are directly related to the amount of interferences that are present in the different waste matrices, and the PQLs listed in SW-846 are not always achievable for constituents as measured in untreated wastes. However, the Agency points out that most treatment processes, particularly destructive technologies such as incineration, destroy not only the hazardous constituents of the waste but also other organics that typically interfere with the analysis for constituents in untreated wastes as well. Thus, PQLs typically are significantly lower for treatment residuals such as incinerator ash than for untreated wastes. Such differences in PQLs for untreated versus treated wastes are demonstrated by the data for almost every incineration test burn performed by the Agency in developing BDAT treatment standards (see appropriate background documents for each waste treatability group).

Potential users of PQLs should keep in mind that the PQLs in SW-846 were established to provide guidance for the analysis of waste samples by acting as minimum performance criteria for analytical laboratories. The PQLs do not necessarily represent the lowest limits of analytical performance achievable for any given waste.

The PQLs in SW-846 were intended to be broadly applied to groups of wastes. As a result, matrix dependent correction factors were not developed for any particular waste code, and do not specifically apply to any particular treatment residuals (i.e., only correction factors for matrices identified as ground water, low-level soil, high-level soil, and non-water miscible waste were specified in Method 8250 of SW-846). Furthermore, the Agency is currently modifying and expanding the matrix correction factors, as well as modifying the detection limits from which the PQLs are derived.

The PQLs listed in SW-846 for some constituents are less stringent than some of the treatment standards. This apparent anomaly results primarily from the fact that the PQLs in SW-846 were not based on the same waste matrices (i.e., treatment residues) that were tested in developing the treatment standards. The treatment standards for a given waste code are based on analysis of the treatment residuals of the waste (or in some cases, a similar waste from which the treatment standards are transferred). Consequently, the resulting treatment standards appropriately reflect the level of analytical performance achievable for that waste. Thus, the PQLs in SW-846 are generally not used directly in developing the part 268 treatment standards.

The question has been raised whether constraints posed by the limits of applicable analytical methods allow treatment standards to be met reliably on a routine basis. The Agency points out that the laboratories used to develop the treatment standards are reliable and must maintain compliance with EPA's Quality Assurance/Quality Control requirements on a routine basis. The background documents for all wastes for which incineration has been established as BDAT provide additional support that treatment standards are above the limits of detection for regulated constituents on a routine basis. These documents provide data that indicate that the laboratories consistently obtain low detection limits for the regulated constituents in the wastes.

In cases where a facility believes that waste-specific treatment standards

cannot be met because their laboratory is unable to achieve PQLs below the treatment standards on specific treatment residuals, the facility may submit a petition for a variance from the treatment standards for that particular waste code (EPA construes 40 CFR 268.44 as encompassing such petitions). The facility must demonstrate that the analyses are in compliance with all other BDAT QA/QC provisions (as outlined in the BDAT Generic Quality Assurance Project Plan (EPA/530-SW-87-011, March 1987). Moreover, the petitioner must also demonstrate that the treatment process is a well-designed and well-operated BDAT process.

(Note: The Agency may use analytical methods that are not specifically identified in SW-846 for setting treatment standards, provided that the methods comply with all appropriate detection limits, spike/surrogate recoveries, and other quality assurance criteria. Thus, a facility may also develop a petition in a similar manner.)

f. Treatment Standards Based on Single Facility Data, Grab Samples Versus Composite Samples, and Waste Analysis Plans—(1) Single Facility Data. As discussed in the August 17, 1988 final rule for First Third wastes, the Agency believes that the use of a small number of data sets from a single treatment facility can be representative of the treatment achieved by the particular treatment system. This is particularly true when no other treatment data are available, or when data exist but there is no verification that the treatment process from which the data were obtained was well-designed or well-operated. It is not possible for the Agency to sample every facility generating the waste or every treatment system treating the waste. For the purposes of determining treatment standards, the Agency has established a methodology for selecting particular facilities and treatment systems that it considers to be well-designed and well-operated. The Agency also selects wastes that are representative of those most difficult to treat.

The Agency recognizes that there is variability inherent in every treatment system, as well as variability in the characteristics of the wastes. The Agency accounts for these by multiplying the mean of the constituent concentrations by a correction factor known as the variability factor. This factor is derived through a quantitative procedure that determines the statistical 99th percentile for the treatment standard. This establishes a treatment standard that should be achievable 99 percent of the time by a well-designed,

well-operated system. The Agency further adjusts the treatment standard to account for variabilities due to analytical recovery. In addition, all analyses of hazardous constituents are performed in accordance with an established QA/QC plan as outlined in the BDAT Generic Quality Assurance Project Plan. The Agency is confident that this methodology will result in treatment standards that accurately represent the performance of a particular treatment system.

Standards based on incineration are always established above the limit of detection rather than at the detection limit. This is because the Agency prefers to account for the variability inherent in the treatment system and in the analysis of the recovery data. Therefore, following EPA's methodology for establishing treatment standards, the data (the average detection limit) are adjusted through use of the variability factor (typically 2.8) and a correction for recovery of a spiked analyte (or surrogate). The resulting treatment standards for the organic constituents are above the detection limits. The standards are thus actually greater than the achievable levels (which are at or below the detection limits) and should be easily met by a well-designed, well-operated incineration system.

(2) *Grab versus Composite Samples.* Where performance data exist based on both the analysis of composite samples and the analysis of grab samples, the Agency establishes the treatment standards based on the analysis of grab samples. Grab samples normally reflect maximum process variability, and thus would reasonably characterize the ranges of treatment system performance.

In cases where only composite data exist, the Agency considers the QA/QC of the data, the inherent efficiency of the process design, and the level of performance achieved. The Agency may then choose to use this composite data to develop the treatment standard. Where these data are used to establish the treatment standard, the treatment standard is identified as based on analysis of a composite sample. Enforcement of that standard thus would also be based on composite samples.

(3) *Waste Analysis Plans.* The waste analysis plan shall provide the basis for monitoring a disposal facility's compliance with promulgated treatment standards. This plan must be adequate to assure compliance with part 268. The disposal facility is, however, ultimately responsible if it disposes a waste that does not meet a treatment standard. Therefore, a disposal facility may violate the land disposal restrictions

while at the same time complying with the provisions of its waste analysis plan. Put another way, a waste analysis plan may be written to authorize types of sampling and monitoring different from those used to develop the treatment standard(s). In such an instance, the disposal facility must demonstrate that the waste analysis plan (and the specific deviating feature) is adequate to assure compliance with part 268 (see 40 CFR 264.13). This might require, for example, a demonstration of statistical equivalence between a composite sampling protocol and one based on grab sampling, or a demonstration of why monitoring for a subset of pollutants would assure compliance of those not monitored.

In any case, enforcement of the land disposal restrictions is based on grab samples (except as described in the previous section) and analysis of all constituents regulated by the applicable treatment standards, not on the facility's waste analysis plan.

g. General Issues on Developing Treatment Standards for Characteristic Wastes. This section of today's preamble presents a discussion of general issues on establishing treatment standards for all characteristic wastes. EPA initially took the position that wastes that are hazardous exclusively by virtue of exhibiting a characteristic are not subject to the RCRA section 3004(g)(C) "hard hammer" (See 51 FR 1607 n.4., January 14, 1986). EPA no longer takes this position, and is now reading RCRA section 3004(g)(6)(C) to encompass all wastes for which EPA has an obligation to establish treatment standards for under paragraph (g)(5), which includes identified characteristic wastes. The legislative history also indicates that Congress intended EPA to include identified characteristic wastes (i.e., those identified as of the effective date of HSWA) by the statutory deadline (H.R. Conf. Rep. No. 1133, 98th Cong., 2d Sess. 88 (1984)). In any case, since EPA intends to promulgate treatment standards for these wastes, the issue has no practical significance.

The criteria for identifying a waste as a characteristic hazardous waste are defined in 40 CFR 261.21 through 261.24. These criteria identify five major groups of characteristic wastes: Ignitable (D001), Corrosive (D002), Reactive (D003), EP Toxic Metals (D004-D011), and EP Toxic Pesticides (D012-D017). There are several criteria within each of these major groups that define the particular characteristic. EPA used these individual criteria as the basis for identifying treatability groups (subcategories) within each major characteristic group.

There are a number of options for developing treatment standards for any characteristic waste code or subcategory. One option is to propose concentration-based standards when the Agency has data to support such an action. A second option is to propose a treatment standard expressed as a required method. A third option is to simply establish the characteristic level as the treatment standard. A fourth option is to establish a method of treatment along with a required performance level. (See preamble section III.C. for further discussion of EPA's authority to establish treatment standards for characteristic wastes.)

Section III.A.4. of today's preamble presents the proposed treatment standards for: ignitable (D001), corrosive (D002), and reactive (D003) characteristic wastes; their treatability subcategories; and related U and P reactive wastes. Proposed treatment standards for EP Toxic Metals (D004-D011) are presented in section III.A.5. along with proposed treatment standards for some K, U and P wastes that contain these metals. Proposed treatment standards for EP Toxic Pesticides (D012-D017) are presented in section III.A.2.c. along with treatment standards for related K, U, and P halogenated pesticides.

For many of the wastes that are hazardous only because they exhibit one of the characteristics in 40 CFR 261.3(c)(1) and (d)(1), the use of some BDAT technologies will result in a residue that no longer exhibits any of the characteristics. In some cases, however, the use of a BDAT treatment technology to remove one characteristic will result in a residue which has a different characteristic, and thus requires further treatment (e.g., incineration of an ignitable D001 waste may generate an ash that exhibits the characteristic of EP Toxicity for metals (D004-D011)). Furthermore, if the characteristic waste or its treatment residue is mixed with a listed hazardous waste, the entire mixture is considered to be the listed hazardous waste due to the derived-from rule, even if treated to remove all characteristics.

The Agency is today proposing that characteristic wastes and residues from treatment of characteristic wastes must be treated to meet all characteristic treatment standards prior to land disposal. When the treatment standard for one characteristic is expressed as a required method of treatment, the method must be used *and* the treatment standard for any additional characteristic in the residue must be met. See preamble section III.A.4.a. for a

further discussion of this concept as it applies to ignitable, reactive, and corrosive characteristic wastes.

For purposes of complying with today's proposed treatment standards, dilution of characteristic wastes in order to remove the characteristic (in lieu of meeting the treatment standard) is not allowed. Dilution does not destroy the chemical constituents causing the characteristic; it is merely a physical process that provides temporary removal of the characteristic which can be reversed if the physical conditions are changed. The Agency understands, however, that dilution is sometimes necessary in order to facilitate treatment (e.g., in order to lower the BTU value of a D001 waste with a very high BTU value). This type of dilution to effect treatment is not prohibited as long as it is not used as treatment or to avoid compliance with treatment standards, or in the case of California list wastes, prohibition levels. (See preamble sections III.C. and III.D. for further discussion of issues relating to dilution.)

h. General Issues Pertaining to All Remaining U and P Wastes. Today's proposed rule addresses several issues pertinent to the development of concentration-based treatment standards for U and P wastes as defined in 40 CFR 261.33 (e) and (f). These include issues such as deficiencies in waste characterization, analytical complications, sporadic generation patterns, infrequent land disposal, potential necessity for dissolution prior to treatment, and difficulties in evaluation of recycling potential. EPA is also proposing two clarifying corrections to the existing scope of section 261.33: one change to correct an unintended gap in paragraph (c), and the other to clarify that contaminated soils and other spill residues are not automatically excluded from being solid wastes if recycled.

The Agency believes that concentration-based treatment standards can be developed for many of the U and P wastes based on existing data. EPA has grouped all of the U and P wastes into various treatability groups based on similarities in elemental composition (e.g., carbon, halogens and metals) and the presence of key functional groups (e.g., phenolics, esters, and amines) within the structure of the individual chemical represented by the U or P waste code. The Agency has also accounted for physical and chemical factors that are known to affect the selection of treatment alternatives and to affect the performance of the treatment, such as volatility and solubility, when developing these treatability groups. The use of the

chemical (e.g., pesticides and pharmaceuticals) was also important in establishing these groups. Emphasizing the use of these chemicals allows the Agency to identify issues specific on these groups of chemicals, to target potential sources of data, and to solicit comments and data from specific industries and public interest groups.

(1) Waste Characterization of U and P Wastes. EPA has designated a specific U or P waste code number referring to the specific chemical constituent associated with that code. EPA's listing sorts these wastes into two general hazard categories. Those wastes identified as P wastes are defined as "acute hazardous" wastes and those wastes identified as U wastes are defined as "toxic" wastes. The Agency has determined that these distinctions generally have no significant bearing on treatability of the particular chemical or waste, and thus did not consider these distinctions between U and P wastes in developing the treatability groups identified in this section.

The U and P wastes are defined as out-of-date commercial products, chemical intermediates, off-specification (off-spec) products, container liners (or residues), or spill residues. (See 40 CFR 261.33.) These wastes can also exist as wastewater or nonwastewater treatment residues based on the derived-from or mixture rules. In addition, U and P wastes are often contained in lab packs as complex mixtures of discarded concentrated chemicals, contaminated laboratory samples, old analytical laboratory standards, and contaminated equipment.

The composition of these wastes can vary significantly. Some U and P wastes may not contain the same constituents or concentration of the specific U or P chemical that was present in the waste from which concentration-based standards may be proposed to be transferred. However, given the statutory time constraints that exist, the Agency cannot possibly test every single U and P chemical. The Agency believes that the transfer of data and development of concentration-based standards is the best alternative for these U and P wastes, and is therefore proposing such standards whenever possible.

(2) Analytical Complications. The Agency has determined that for many U and P wastes, as well as for some K wastes, there are several complications that arise in terms of how reliably the primary hazardous constituents can be quantified. These complications appear to preclude the establishment of

concentration-based treatment standards. As a direct result of these complications, the Agency is compelled to establish a method (or methods) of treatment as a treatment standard rather than concentration-based constituent specific standards.

For any particular U or P chemical, there are four major reasons that these quantification complications exist: (1) there are no methods that are currently verified for the quantification of the constituent of interest in treatment residuals; (2) calibration standards (i.e., standard solutions of known purity for validating compliance with QA/QC procedures) of that chemical are not currently available on the commercial market; (3) the chemical may be unstable in water, or react with water; and (4) the chemical may not be listed as a single chemical entity (e.g., P030 is listed as "soluble cyanide salts, not otherwise specified"). Chemical specific complications are presented in the appropriate section of today's preamble that discusses the specific treatability group where the U or P chemical has been classified. Implications of these complications on the general procedures for establishment of concentration-based standards are outlined in greater detail below.

(a) Availability of a Verified Analytical Method. The September, 1986, edition of Test Methods for Evaluating Solid Wastes (also known as SW-846), does not include analytical methods that are currently verified for the quantification of some U and P chemicals in treatment residuals. This does not imply that an existing analytical method cannot be used to quantify that particular chemical, but rather, it indicates that the Agency has not verified the quantification of that U or P chemical in the specific treatment residuals of interest. However, in the absence of this verification and where the Agency has sufficient belief that a particular analytical method can analyze a particular chemical, the Agency is not precluded from establishing a concentration-based treatment standard for that U or P chemical. In fact, the Agency anticipates that for many U and P chemicals, analytical methods will be verified as appropriate for complex matrices such as treatment residuals. EPA is currently working to validate analytical methods for a growing number of chemicals in a variety of matrices. It is anticipated that treatment data obtained during the development of BDAT for specific waste codes will also assist in the validation of these methods.

For many U and P chemicals, the Agency has determined that only High Performance Liquid Chromatography (HPLC) analytical methods can be used to measure their concentration. Although HPLC techniques have been used to quantify certain chemicals in relatively clean aqueous matrices, the Agency has not completely verified that HPLC is appropriate for analysis of either untreated wastes or treatment residuals. There is only one HPLC method that is currently listed in SW-846 as applicable to analysis of solid wastes, with very limited applicability. However, the Agency is in the process of validating other HPLC methods, including multiple-column HPLC systems and HPLC units coupled with mass spectroscopy. Until this method validation work is completed, the Agency does not believe that it should establish concentration-based treatment standards for these particular U and P chemicals. Further, the Agency currently lacks data on treatment of hazardous wastes based on HPLC analyses.

The Agency also recognizes the existence of methods other than those specifically identified in SW-846, that can successfully quantify some U and P compounds in complex matrices, and for the purposes of today's proposed rule solicits information about them. In particular, the commenter should supply all available QA/QC information and the data must represent analysis of treated residuals from the use of technologies that are equivalent to that examined or specified in today's preamble as BDAT for that particular chemical. Commenters should specify that the submitted data are applicable to a particular waste code.

(b) Commercial Availability of Calibration Standards. Solutions of known purity and concentration of a chemical or mix of chemicals are often referred to as calibration standards. These are used by analytical laboratories to verify the accuracy and precision (QA/QC) of a particular analysis for a particular chemical or group of chemicals. The continued availability of these standards from commercial chemical suppliers is important in maintaining proper QA/QC of quantitative analysis for the chemical constituents in treatment residuals. For the purposes of routine compliance with treatment standards, the Agency believes that an analytical laboratory must be able to readily and consistently purchase these calibration standards.

EPA determined which compounds are commercially available by asking five major suppliers whether they had the chemicals in stock and whether they

were available for shipping to prospective buyers. Only those chemicals thus found to be "commercially available" were included on the list of those for which EPA will set concentration-based standards and require analytical quantification. However, EPA realizes that some analytical reagents may exist for these chemicals, outside the commercial inventories of the major supply houses contacted. Nevertheless, unless a compound is consistently in stock at major suppliers, the Agency believes that the difficulties in obtaining these standards and in verification of their purity are sufficient cause to not establish concentration-based treatment standards for these U and P chemicals. This does not, however, preclude the Agency from promulgating a concentration-based standard at a later date.

While the use of calibration standards is an integral component of all analyses, the Agency's SW-846 methods do not typically require that a calibration standard be available for every compound being analyzed. Surrogate compounds are often used as calibration standards in many analytical methods. The Agency could establish concentration-based treatment standards for a surrogate compound in the waste or for some other waste characteristic that could act as an indicator of effective treatment (i.e., an indicator parameter), provided that a correlation of the concentration of the surrogate or indicator parameter to the concentration of the constituent of interest can be established. In general, the lack of waste characterization data and the variability in waste composition for U and P wastes interferes with the establishment of surrogate or indicator parameters for many U and P wastes.

This does not preclude the Agency from the use of surrogates or indicator parameters in establishing concentration-based treatment standards. Where deemed appropriate, the Agency has specifically identified these surrogates or indicators on a waste code specific basis in today's proposed rule. In fact, in the Land Disposal Restrictions for Second Third Wastes (54 FR 26614, June 23, 1989), treatment standards for total and amenable cyanides have already been promulgated for several U and P waste codes that are listed as specific cyanide salts. In general, commenters to the proposed rule for these wastes supported the use of these indicator parameters.

In cases where these U and P chemicals are no longer produced or

used in this country, and are not reasonably expected to be detected in environmental or waste samples, the Agency may choose to not establish concentration-based treatment standards for particular constituents. In most cases, EPA does not wish to encourage a market for high-purity samples of these compounds, as might happen if it required that these compounds be analyzed, thus creating a demand for quantification reagent samples.

(c) Stability in Water. Some U and P compounds dissociate, decompose or otherwise significantly change their identity when exposed to water. EPA chooses not to set concentration-based BDAT standards for these compounds, because there is generally a high probability of the presence of water in many treatment residuals and particularly in wastes classified as wastewaters. Thus, while analytical methods may exist for some of these "unstable" chemicals when measured in nonaqueous matrices and even in aqueous samples (depending on their "half-life" of instability), accurate quantification of their concentration in treatment residuals where there is a reasonable expectation that water may be present would be severely hampered. For many of these chemicals, a high level of coordination of sampling and analytical personnel would be required in order to assure a consistency in holding times and thus highly variable analytical results might be expected.

In developing the list of chemicals to be analyzed for purposes of compliance with groundwater monitoring requirements of 40 CFR 264 (i.e., the chemicals listed in Appendix IX), EPA faced the same problem of identifying those chemicals that are "unstable" in water and therefore not amenable to these groundwater monitoring requirements. Consequently, EPA designates as "unstable" those U and P chemicals that were particularly excluded from Appendix IX for this reason. EPA is confident that it is correct in relieving the regulated community from the burden of undertaking analysis of hazardous waste treatment residuals for those U and P compounds excluded from Appendix IX because of their instability in water.

(d) Multiple or Ambiguous Identity. For several U and P waste codes, the specific listing for that waste code does not identify only one particular chemical for which the listing applies (e.g., P075 is listed as "Nicotine and salts" and P051 is listed as "Endrin and metabolites"). For purposes of compliance with the

treatment standards, the Agency has determined which chemicals should be analyzed (if any).

In cases where the U or P listing did not specify particular isomers and there are a limited number of isomers, treatment standards are typically reported as applicable to all isomers, are isomer specific, or are applicable to the sum of the isomers depending upon whether the identity of isomers can be distinguished.

When the exact identity of the chemical for which the U or P waste code is listed is ambiguous, or where the listing specifies "and salts" or "and metabolites", the Agency typically chooses to set a technology rather than a concentration-based standard in order to preclude analysis for a particular chemical that may not have even been present originally. The Agency also may choose to establish an indicator compound for these wastes (or the primary listed compound) that would assure treatment of any additional chemical that may fall into the broad listing (See earlier discussion of P030 in this section of today's preamble).

(3) *Current Generation and Land Disposal Practices.* Data indicate that there are relatively few generators of many of the U and P wastes. Information from the 1986 TSDR survey also suggests that the majority of these U and P wastes are not typically land disposed. The Agency considered proposing a treatment standard of "No Land Disposal Based on No Generation" for many of these wastes. However, the sporadic nature of generation suggests that these wastes may be generated at any time and thus may require land disposal of treatment residues.

While establishing a treatment standard of "No Land Disposal Based on No Generation" allows generators to petition for a variance from the treatment standard (40 CFR 268.44), the Agency prefers to establish concentration-based standards or methods of treatment whenever a transfer of standards can be reasonably performed. However, for some U and P wastes that have a very low probability of generation, the "No Land Disposal Based on No Generation" alternative may be feasible. This alternative may be particularly attractive for a few U and P wastes for which the Agency cannot identify sufficient data to show that treatment technologies are demonstrated or even applicable.

(4) *Dissolution for Treatment.* Some of the discarded or off-spec U and P chemicals, when existing as concentrated chemicals or mixtures, may be dissolved in a suitable solvent or water prior to treatment. Because this

is a form of dilution, the question arises whether it is a form of permissible dilution. Two such instances occur as follows: 1) concentrated organic liquids and solids are sometimes dissolved in appropriate organic solvents (or waste solvents) and then incinerated in a liquid injection system; and 2) concentrated inorganic chemicals and metal salts are sometimes dissolved in water or acidic media, chemically oxidized (or reduced), and precipitated as an insoluble salt. In all of these cases, this type of management is permissible because it renders the chemical suitable for treatment by the designated BDAT technology.

Where organic U and P wastes are generated in small amounts, however, incineration in a rotary kiln may be preferred over dissolution in order to reduce the risk from mixing and handling. However in other cases, dissolving the organic U and P chemicals in solvents may actually be desirable in order to reduce the maximum emission rate of halides or oxides of phosphorus, nitrogen, or sulfur that may occur from incinerating excessive amounts of the concentrated forms of these U or P chemicals. Thus, EPA does not wish to preclude dissolution for purposes of effective treatment.

(5) *Recycling Potential.* The Agency believes that it may be feasible to legitimately recycle some organic U and P wastes. For example, a true "off-spec" product could potentially undergo further on-site processing rather than land disposal, be sold as a low grade chemical product in the market, or be exchanged as a raw material to other industry participating in a hazardous waste exchange program. Indeed, these materials may not be solid wastes if legitimately recycled (see 40 CFR 261.33).

However, other forms of organic U and P wastes may require further treatment prior to recycling (e.g., organics that tend to polymerize or solidify may need to be stabilized prior to reuse). In addition, other organic U and P wastes may not be amenable to recycling for a variety of reasons. The major reason being that quite often other chemicals such as residual catalysts, unreacted reagent chemicals, by-products, or process contaminants are present in the waste that preclude their reuse. Because of the variety in possible contaminants per organic U and P waste, the Agency cannot identify specific waste characteristics per waste code that would allow the Agency to establish direct reuse as a treatment standard for the majority of U and P organic chemicals. The Agency solicits

data and information to identify those wastes (or subcategories based on certain waste characteristics), that are amenable to direct reuse and recycling.

EPA does not intend to preclude the legitimate recycling of any of these wastes. EPA notes, however, that soil and other residues from spilling these commercial chemicals would ordinarily not be recyclable. Indeed, the spilling onto the land is itself a type of disposal. Thus, EPA is proposing as part of today's rule a clarifying change whereby such soils and other spill residues would be solid wastes unless they are recycled a short time after the spill event (see section II.P. above and III.F. below).

(6) *Analysis of Existing and Newly Developed Treatment Data.* Overall, there are over 300 organic chemicals represented by the U and P waste codes. Existing treatment data for wastewater and nonwastewater forms of specific U and P wastes are somewhat limited. The treatability data that does exist is primarily for the corresponding U or P constituents as they are present in other wastes (such as the K wastes tested by the Agency). Therefore, in the development of today's proposed treatment standards, EPA examined all of the available BDAT data for the corresponding U and P constituents in approximately fourteen different incineration test burns of RCRA hazardous wastes. In addition, the Agency examined available data on the treatment of wastewaters.

The majority of all of these data appear to be for the U and P treatability subcategories identified as halogenated aliphatics, aromatics, polynuclear aromatic hydrocarbons, and oxygenated hydrocarbons. This seems logical in that for wastewaters most of the available data are for those constituents that are also designated as priority pollutants under regulation by the Agency's Office of Water, and that for nonwastewaters most of the available data are for organic chemicals that are typically used as solvents or pesticides. More information on the development of treatment standards for these wastes can be found in the background document for each treatability group in the RCRA docket.

(a) *Treatment Data for U and P Nonwastewaters.* For the purpose of this rulemaking, the Agency examined the relative availability, expense, and ease of generating new incineration data for nonwastewater forms of the organic U and P waste codes. EPA decided to select for testing a limited number of compounds representative of the various classifications inherent to the structure of these chemicals. These new data

were used in conjunction with previous data to develop treatment standards that were then transferred to the remaining untested wastes. The compounds that were tested were carefully selected as representative of the treatability of each group of waste codes, based on similarities in chemical structure (i.e., presence of key functional groups, elemental composition (including chlorine, sulfur, and nitrogen), number of carbon atoms, arrangement and number of aromatic and nonaromatic rings, isomer and homologue series, and degree of chlorination).

These new performance data on the treatment of the representative compounds were obtained utilizing a rotary kiln incinerator and performed by EPA in June, 1989. The feed included three specific RCRA hazardous wastes that contained constituents in the halogenated pesticide and chlorobenzene treatability group, in concentrations of up to 8%. The hazardous wastes from this treatability group that were burned include: Heptachlor process waste (which contained Chlordane, Heptachlor, hexachlorobutadiene and hexachlorocyclopentadiene), D014 (EP Toxic for Methoxychlor), and D016 (EP Toxic for 2,4-D).

In addition to the three hazardous wastes, the feed contained fifteen commercial chemical products representing other various U and P waste codes. These commercial chemical products were used because the Agency was unable to obtain any wastes specifically identified as U or P wastes in the period of time required to perform the test.

The burn was designed such that the physical forms, concentrations, and soil content of the feed would represent a range of wastes likely to exist. The treatability test consisted of two 6-hour burns consisting of 11 liquids and 7 solids. Clean fill (i.e., dirt) was added to produce ash that is necessary in order to analyze for treated concentrations (or detection limits), and to simulate a waste spilled on soil. Four sample sets of ash and scrubber water were analyzed for BDAT list constituents. (More information on the test burn can be found in the Onsite Engineering Report of the Third Incineration Treatability Test, July, 1989.)

The Agency is proposing to use much of these data to transfer concentration-based standards from these compounds to the various U, P, K, and D waste codes where other data are unavailable or of questionable value. These data will also supplement existing data that have

been judged to represent BDAT for other wastes.

(b) *Treatment Data for U and P Wastewaters.* Similar to the aforementioned test burn for nonwastewaters, the Agency is conducting wastewater treatment tests for selected U and P chemicals using wet air oxidation, powdered activated carbon treatment (PACT), and carbon adsorption. Since much of the currently available wastewater treatment data is from the treatment of relatively low concentrations of U and P constituents in industrial wastewaters, these studies have been particularly designed to examine the applicability of these technologies to wastewaters containing relatively high concentrations of U and P constituents. The data developed in these studies have been placed in the administrative record for inspection and comment.

For many of the U and P waste codes in today's rule, concentration-based standards for the wastewater forms have been developed based on concentrations of the constituents measured in incinerator scrubber waters. In general, when the Agency has appropriate wastewater treatment data from well-designed and well-operated wastewater treatment units, it prefers to use these data rather than use scrubber water concentrations to develop wastewater treatment standards. This does not, however, preclude the Agency from establishing treatment standards for other wastes based on constituent concentrations in incinerator scrubber waters and given the time constraints imposed by the statutory deadline, the Agency believes that the use of scrubber water data for the development of wastewater standards is a viable alternative to developing no standard. Treatment standards for these wastewaters based on incinerator scrubber water may also be appropriate when one considers that incineration typically provides significant destruction (even for wastewaters) and that some of these wastewaters may actually contain *high concentrations* (near 1% TOC) of organics. Furthermore, commenters to the Second Third proposed rule, indicated that they were indeed incinerating many wastewaters and that they did not want to be precluded from doing so where EPA had proposed only carbon adsorption as a method of treatment for wastewater forms of certain U and P organophosphorus pesticides.

The Agency has recently gathered and analyzed wastewater treatment data from various sources including: (1) the Office of Water's Industrial Technology

Division (ITD) and National Pollution Discharge Elimination System (NPDES) data (specifically from the Organic Chemicals, Plastics, and Synthetic Fibers (OCPSF) data base); (2) the Hazardous Waste Engineering Research Laboratory (HWERL) database; (3) the Office of Solid Waste's BDAT data (from previous land disposal restrictions rules); and (4) additional wastewater treatment data were gathered from literature articles on wet air oxidation and PACT. As expected, these data include the treatment of wastewaters that are not specifically listed as D, F, K, U, or P wastewaters, but do contain varying concentrations of many of the corresponding constituents. While these data were not available in time to incorporate into the discussion of individual treatability groups in sections III.A.2. through III.A.7. of today's notice, or into the background document for each treatability group, these data are being placed in the administrative record for today's notice and the Agency has been able to develop alternative standards for wastewaters based on these data.

These alternative wastewater treatment standards are presented in section III.A.7. of today's notice as treatment standards for wastewater forms of multi-source leachate. While these standards are presented on a constituent basis, they correspond to the respective waste code. (For example, the alternative standard for "U220 (toluene)" wastewaters based on these new data is presented simply as a standard for "toluene" for wastewater forms of multi-source leachate in section III.A.7.; the standard for U220 (toluene) presented in section III.A.3.b. is the standard based on analysis of scrubber water.) Thus, the Agency is proposing these standards as alternative standards for all U and P wastewaters for which concentration-based standards based on incinerator scrubber waters have been proposed in sections III.A.2. and III.A.3. of today's preamble and for some wastewater forms of EP Toxic metals. Further information on these alternative standards based on these data can be found in the "BDAT Background Document for Wastewaters Containing BDAT List Constituents" in the administrative record for today's notice.

Much of these new data for wastewaters include analysis of composite samples rather than grab samples. Thus, the Agency has developed many of the alternative concentration-based treatment standards based on an analysis of composite samples rather than grab samples. Where data from analysis of

composite samples were used as the basis of the treatment standard, the Agency so indicates in the appropriate table of treatment standards.

The Chemical Manufacturing Association (CMA) has calculated suggested wastewater treatment standards for many constituents based on data contained in the OCPSF database, and has submitted these suggested limits to the Agency for review. However, standards based solely on these data may not be representative of the treatability of all wastewaters, in particular wastewater forms of U, P, and D wastes containing high concentrations of the respective chemicals. As an example, the standard suggested by CMA for chloroform in wastewaters is lower than that promulgated by the Agency specifically for K009 and K010 wastewaters. The Agency has not completed its review of CMA's suggested standards; however, it has placed this information in the administrative record for today's notice.

(7) *Methods of Treatment as U and P Wastewater Standards.* Based on analytical complications previously discussed in section III.A.1.h.(2.), the Agency is proposing certain methods of treatment as the treatment standard for many U and P wastewaters and nonwastewaters. Generally, for U and P nonwastewaters this process is relatively easy because incineration processes are relatively indiscriminate in the destruction of organics due to the high temperatures, efficient mixing, and consistent residence times. However, in the case of wastewater treatment technologies, there are more chemical specific factors that are involved such as: water solubility, instability, molecular size, volatility, elemental composition, and polarity of the specific chemical that is to be treated. Other waste characteristics will also affect the efficiency of treatment such as: total organic carbon, oil and greases, total dissolved solids, total suspended solids, pH, and alkalinity/acidity.

For these reasons, the Agency has grouped the organic U and P waste codes into treatability groups (as presented in sections III.A.2. and III.A.3.) that are designed to reflect similarities in wastewater and nonwastewater treatment besides similarities in structure or elemental composition. However, in some cases these similarities may not reflect similarities in treatability for all wastewater treatment technologies. As a result, the Agency has typically proposed more than one method of treatment as the treatment standard for

these U and P wastewater treatability groups.

In all cases, the Agency believes that incineration, while not always practical for wastewaters, will provide an efficient destruction of these organic U and P constituents in wastewaters. While the Agency does not want to identify incineration as the primary BDAT treatment technology for these wastewaters, it also does not want to preclude its use. In addition, the Agency does not want to process needless variances for a technology that is recognized to be effective. Therefore, in all cases, "Incineration as a Method of Treatment" is proposed as one of the alternative treatment standards for wastewater forms of these organic U and P wastes.

The wastewater treatment technology that most closely resembles incineration is wet air oxidation. It is specifically designed to destroy organics in wastewaters and efficiently oxidizes organics in aqueous media by operating at relatively high temperatures and high pressures. Furthermore, wet air oxidation is typically performed on wastewaters that contain relatively high concentrations of organics (i.e., those that are at or near the 1% TOC cut-off for wastewaters). For wastewaters that contain significantly lower concentrations of organics, chemical oxidation and biodegradation can typically provide the necessary destruction of organics to levels that can then be adsorbed onto activated carbon (as a polishing step). Since these technologies are known to provide effective treatment for constituents that can be analyzed, the Agency is therefore proposing multiple treatment technologies for most of the organic U and P constituents that require specified methods of treatment. None of these technologies have been specifically identified as better than the others due to the current lack of data for these constituents that are difficult to analyze, or for any other surrogate/indicator parameters. However, the Agency is currently investigating the potential use of surrogates/indicators that could be used to ensure complete destruction and to determine which technology performs best for these U and P constituents in wastewaters. The Agency is soliciting comment on the selection of surrogates (such as COD, BOD, TOC, and etc.) that could be established per waste or technology, and any data that may aid in the comparison of these technologies for these wastes. The Agency reminds commenters that these particularly difficult to analyze U and P wastewaters are generated at relatively few facilities,

and that surrogates that can be used to measure performance for these constituents may be best addressed in an individual facility's waste analysis plan.

For quite a few of the organic and some inorganic U and P wastes that require specified methods of treatment, concentration-based treatment standards have not been proposed because the compounds are relatively unstable in water. This instability implies that they should easily be destroyed with any chemical oxidant (and most probably at ambient temperature and air pressure). In a similar manner, biodegradation can be expected to result in oxidation of certain U and P organics. Again, due to the instability of these organic compounds in water, the Agency believes that biodegradation can provide effective removal of some of these organics from wastewaters.

(8) *Regulated Constituents.* The regulated constituents for the D, U, and P wastes generally are those specific constituents for which the D, U, or P waste is listed (as specified in 40 CFR 261.33 (e) and (f)). The regulated constituents for the F and K wastes were determined based on waste characterization, the constituents for which the F and K waste was listed, and compounds shown or expected to be present in the waste. Other than the D wastes, metals are typically regulated only for selected U, P, F, and K wastes in these treatability groups when they are expected to be present. More detail on the selection of regulated constituents can be found in the background documents for each treatability subcategory. The proposed regulated constituents for these wastes and the proposed treatment standards are presented in the tables at the end of each section.

i. Procedures for Requesting Additional Data on Specific Treatment Standards

The Agency is today proposing treatment standards according to a relatively rapid schedule. This schedule is statutorily imposed and requires that treatment standards must be developed for all remaining RCRA waste codes by May 8, 1990. If treatment standards are not developed by this so-called "hard hammer" date, the wastes are automatically prohibited from land disposal by statute.

Every effort has been made to develop treatment standards for all of these remaining waste codes in this proposed rule. In certain cases, however, EPA expects to receive additional data during the public comment period

pertaining to the proposed treatment standard. This additional data may be used to refine the proposed treatment standard. In order to give other interested parties the opportunity to comment on any data submitted during the public comment period, EPA will make these data available upon specific request.

In instances where EPA expects additional data to be submitted during the public comment period, the Agency identifies this potential in the appropriate section of the preamble. Commenters should attempt to identify all areas where additional data can be submitted without the Agency specifically requesting it. Commenters should view this proposal as their opportunity to provide the additional data required to develop these standards. Data submissions should be in compliance with all appropriate BDAT data requirements and should include all appropriate QA/QC information. The Agency also points out that treatment data must include analyses of treatment residuals and that operational evidence must be provided indicating that the treatment system was both well-designed and well-operated. Submission of such data does not guarantee that BDAT will be developed based on the submitted data. (EPA notes that commenters could have been legitimately aware of the need to generate such data since November, 1984. EPA thus will look with disfavor on comments protesting the lack of time to develop such data.)

Data submitted during the comment period must be properly noticed and available to the public. All new data must be submitted within 30 days of this notice in order for the Agency to give subsequent notice of these new data following the procedures outlined in this section. Data received after 30 days will be placed in the administrative docket for the final rule, but may not be considered in development of the final standards. Given the time constraints for this rule, data that are submitted as confidential business information limits the Agency's ability to incorporate into these treatment standards.

Commenters wishing to receive a copy of any additional data, should specifically request it in writing and submit it to the RCRA docket, identifying the request according to the specific preamble section numbers and title of interest (i.e., "III.A.5.g.—Arsenic Stabilization Data"). This request for additional data may be included as part of your comments on the overall proposed rule, or it may be made separately. The request for additional

data (as well as all comments on the overall proposed rule) must be submitted to the RCRA docket during the 45-day public comment period—the Agency prefers that these requests be submitted early in the comment period, i.e., within 30 days of the notice, in order to expedite this subsequent notice of data as it arrives.

The Agency intends to send copies of additional data only to persons specifically requesting it, following the aforementioned procedures. It will be extremely burdensome for the Agency to process requests for data that are nonspecific (e.g., requests for all data submissions). The Agency also points out that all new data will be submitted to the RCRA docket for public viewing as rapidly as possible. The Agency will allow 21 days from the date the additional data are mailed to those requesting it for review and submittal of any written response. Subsequent comments on the additional data must be sent to the RCRA docket and be clearly identified as "Response to Additional Data Pertaining to * * * [preamble section numbers and specific treatment standard title]."

2. Proposed Treatment Standards for Halogenated Organic Wastes

a. Introduction. Many of the chemicals represented by the U and P wastes and many of the major constituents present in several D, F, and K wastes fall under a general category of chemicals known as halogenated organics. For the purposes of assessing BDAT, the Agency has determined that within this general category, there are six major subcategories of wastes based primarily on similarities in the structure of these halogenated organic chemicals. These subcategories are also based partially on the industrial use and waste generation patterns of the wastes. These major subcategories include: chlorinated aliphatics, halogenated pesticides, chlorobenzenes, halogenated phenolics, brominated organics, and miscellaneous halogenated organics.

(1) Relationship to the California List Rule for HOCs. The Agency promulgated treatment standards for certain California list wastes on July 8, 1987 (52 FR 25760). Treatment standards were promulgated for certain halogenated organic compounds (HOCs) when present in hazardous wastes at a total HOC concentration of greater than 1,000 parts per million (ppm), as well as for liquid RCRA hazardous wastes containing greater than 50 ppm of polychlorinated biphenyls (PCBs). Although PCBs are also halogenated organics, this stricter limit for PCBs was mandated by HSWA.

There is a regulatory overlap between treatment standards for California list HOCs and treatment standards for halogenated organics proposed in today's rule. The Agency has stated in previous rulemakings (see 52 FR 25773; 53 FR 31187) that, in cases when there is a regulatory overlap, the more waste-specific treatment standard and effective date applies. This principle is set out in the rules in section 268.32(h). The concentration-based treatment standards being proposed today, when promulgated, will therefore supercede the California list treatment standards because they are more specific treatment standards. However, if there is a national capacity variance based on the new standards, the old standards will continue to apply during the period of the variance. (See further discussion of this final point in section III.M. below.)

(2) Specifying Incineration for Halogenated Nonwastewaters. As generated, the majority of the wastes listed in this section of the preamble are likely to contain greater than 1,000 ppm of HOCs, and thus land disposal of these wastes is most likely already restricted by the California list prohibition for HOCs. This prohibition further establishes that BDAT for these HOCs is Incineration as a Method of Treatment, with Fuel Substitution as a Method of Treatment (burning in a boiler or industrial furnace) allowed as an alternative. The Agency assumed that there was sufficient fuel content in many of the wastes that would fall under the broad definition of HOC wastes.

In the proposal for the Second Third wastes (54 FR 1056, (January 11, 1989)), the Agency presented advance notice that it was considering the transfer of performance data to the majority of the remaining waste codes that contain halogenated organics from the incineration of various other halogenated wastes (such as K019 and F024). In doing so, the Agency indicated that incineration was the appropriate treatment technology and would probably be determined to be BDAT for these halogenated organic wastes. (The Agency in fact, specifically indicated each waste code that was considered a halogenated organic.) No comments were received indicating that any other technology should be considered BDAT for the majority of these halogenated organic wastes.

Due to the high concentrations of specific, identified halogenated organics known or anticipated to be present in these U and P off-spec chemicals; the relatively high toxicity of some of the

pesticides and miscellaneous halogenated organics; the anticipated low fuel value of these U and P wastes; and the need for control of HCl emissions from the destruction of halogenated organics, the Agency does not believe that fuel substitution is a viable alternative for the majority of specific U and P waste codes identified in this section.

In today's rule, the Agency is proposing that incineration represents BDAT for all of the halogenated organics presented in this section. Where the Agency is proposing "Incineration as a Method of Treatment" as the treatment standard for a particular halogenated organic waste code, it has not included fuel substitution as an alternative. However, where the Agency has proposed concentration-based standards, thermal destruction in fuel substitution units is not precluded.

(3) *Additional Wastewater Treatment Data.* Additional wastewater treatment data primarily from the Agency's Office of Water have been recently analyzed for incorporation into the treatment standards for many of the U and P wastes in this section. These data include the treatment of wastewaters that are not specifically listed as U or P wastewaters, but do contain many of the corresponding U, P, and metal constituents. While these data were not available in time to incorporate into this discussion or into the background document for these wastes, these data are being placed in the administrative record for today's notice. Therefore, the Agency is not precluded from using these data in promulgating the standards for these wastes. Further information on these data can be found in section III.A.1.h.(6.).

Alternative standards based on these data are presented in section III.A.7. of today's notice for wastewater forms of multisource leachate. These standards are presented on a constituent basis and correspond to the respective U or P wastewater. Thus, the Agency is proposing these standards as alternative standards for all U and P wastewaters for which concentration-based standards based on incinerator scrubber waters have been proposed in the following sections.

(4) *Specifying Technologies for Halogenated Wastewaters.* Based on analytical complications previously discussed in section III.A.1.h.(2.), the Agency is also proposing certain methods of treatment as the treatment standards for many U and P wastewaters. In the following sections (III.A.2.b. through f.) of the preamble the Agency identifies twenty five specific

halogenated organic U and P wastes for which the Agency is proposing three treatment technologies as alternative BDAT treatment standards: (1) Wet air oxidation followed by carbon adsorption; (2) Chemical oxidation followed by carbon adsorption; or (3) Incineration of wastewaters. Since these technologies are known to provide effective treatment for the halogenated organic constituents within each treatability group (as identified in III.A.2.) that can be analyzed, the Agency is therefore proposing these multiple treatment technologies for all of the twenty five U and P halogenated organics that require specified methods of treatment.

Biodegradation has not been specified as an alternative technology for halogenated organics, because they are generally thought of as more difficult to biodegrade than nonhalogenated organic due to the overall higher toxicity of the halogenateds compared to their nonhalogenated counterparts. However, the Agency solicits comment and data that would indicate that the twenty five specific U and P halogenated organics are similar to the biodegradability of other halogenated organics and/or other nonhalogenated organics, and thereby, potentially serving as surrogates or indicators of efficient destruction. While biodegradation is not specifically specified as BDAT, it is not precluded from use as part of a treatment train, provided that it is not elsewhere prohibited as land disposal.

Carbon adsorption has been specified as part of the treatment train because these particular twenty five halogenated U and P organics are believed to be adsorbable when present in low concentrations, as might be expected in an effluent from either wet air or chemical oxidation.

The Agency further recognizes that while difficulties can arise in specifying only one treatment method for these wastewaters (as outlined in greater detail in section III.A.1.h.(7.)), the Agency must develop a treatment standard for these wastes to avoid the hard hammer and at the same time, somehow justify that these technologies provide significant treatment. None of these technologies have been specifically identified as better than the others by the Agency because of the lack of data for these specific twenty five halogenated organic constituents (due to the identified analytical complications) or for any surrogate parameters.

b. Halogenated Aliphatics. This subcategory of halogenated organics consists of six K wastes from the production of various halogenated

organics and nineteen U wastes. The individual waste codes are provided at the beginning of each subheading in this section. EPA grouped these waste codes together because the primary constituents for which the wastes were listed are halogenated aliphatic compounds. These compounds are all open chain, alkane or alkene hydrocarbons consisting of up to six carbons, with varying numbers of hydrogen atoms replaced by chlorine. The Agency is proposing to transfer standards for the organic constituents in these wastes based in part on this structural similarity. Thus, for purposes of BDAT, the Agency has grouped all of these wastes into one general treatability group identified as halogenated aliphatics.

(1) *K017 and K073 Wastes.*

K017—Heavy ends (still bottoms) from the purification column in the production of epichlorohydrin.

K073—Chlorinated hydrocarbon waste from the purification step of the diaphragm cell process using graphite anodes in chlorine production.

Treatment standards for K017 and K073 wastes were originally scheduled to be promulgated as part of the First Third rulemaking (i.e., they were to be promulgated by August 8, 1988). The Agency did not promulgate standards for K017 or K073 by August 8, 1988, and as a result, land disposal of these wastes are currently subject to the "soft hammer" provisions of 40 CFR 268.8.

Concentration-based treatment standards for all wastewater and nonwastewater forms of K017 are proposed today based on the transfer of performance data from incineration of nonwastewater forms of F024 (wastes from the production of chlorinated aliphatics such as distillation residues, heavy ends, tars, and reactor clean-out wastes). Treatment standards for F024 were promulgated with the Second Third wastes on June 8, 1989 (54 FR 26594 (June 23, 1989)).

Concentration-based treatment standards for all wastewater and nonwastewater forms of K073 are proposed today based on the transfer of performance data from incineration of nonwastewater forms of K019 (heavy ends from the distillation of ethylene dichloride in ethylene dichloride production). Treatment standards for K019 were promulgated with the First Third wastes on August 8, 1988.

The transfer of standards is dependent upon the constituents present in each waste and the corresponding concentrations and waste characteristics of K019 and F024. The Agency compared these data to

determine which of the constituents in each waste most resembled the anticipated treatability of the constituents in K017 and K073. Details of the transfers can be found in the Background Document for K017 and K073 Wastes in the RCRA docket.

The Agency reminds commenters that there are very few (if any) of these wastes that are currently being generated as originally listed and that in practice, the standards will probably only be necessary for residues from previous disposal. The Agency believes that these residues should be similar or less difficult to treat than the original waste as generated.

(2) *K021 Waste.*

K021—Aqueous spent antimony catalyst from fluoromethane production.

Treatment standards for K021 wastes were originally scheduled to be promulgated as part of the First Third rulemaking (i.e., K021 wastes were to be promulgated by August 8, 1988). A treatment standard of "No Land Disposal Based on No Generation" for K021 nonwastewaters was promulgated on August 8, 1988. This standard, however, was subsequently revised on May 2, 1989 (54 FR 18836) to be applicable only to "Nonwastewater forms of these wastes generated by the process described in the listing description and disposed after August 17, 1988, and not generated in the course of treating wastewater forms of these wastes [Based on No Generation]." The Agency did not promulgate standards for the wastewater forms of K021 by August 8, 1988, and as a result, land disposal of K021 wastewaters is currently subject to the "soft hammer" provisions of 40 CFR 268.8.

In the proposal for the Second Third wastes (54 FR at 1100 (January 11, 1989)), EPA stated its intention to develop concentration-based treatment standards for all forms of K021 prior to May 8, 1990, and has therefore decided to propose to revoke the promulgated treatment standard of "No Land Disposal Based on No Generation" for K021 nonwastewaters. This is because there is a reasonable chance that these nonwastewaters may be generated.

Concentration-based treatment standards for organics in wastewater and nonwastewater forms of K021 are proposed today based on the transfer of performance data from incineration of nonwastewater forms of K019 (heavy ends from the distillation of ethylene dichloride in ethylene dichloride production). Treatment standards for K019 nonwastewaters were promulgated with the First Third wastes on August 8, 1988. Concentration-based treatment

standards for antimony in nonwastewater forms of K021 are proposed today based on the transfer of performance data from the stabilization of ash from the incineration of nonwastewater forms of K048 (dissolved air flotation (DAF) float from the petroleum refining industry) and K051 (API separator sludge from the petroleum refining industry) wastes.

Because the concentration of antimony in the untreated incinerator ash was relatively low compared to concentrations of antimony that might be expected in a K021 waste or clean-up residue, the Agency is simultaneously proposing a concentration-based standard for antimony nonwastewaters of 5.6 ppm, based on the performance of vitrification of arsenic wastes (see section III.A.5.(a.) of today's notice describing the development of this arsenic standard for D004 wastes). The Agency believes that this transfer of treatment performance data may be appropriate due to the chemical similarity between arsenic and antimony. The Agency, however is seeking comment of which standard is more appropriate for K021 waste.

The treatment standard for antimony in K021 wastewaters is based on concentrations found in the scrubber water from the incineration of K048 and K051. However, additional data are available for the treatment of antimony in wastewaters and as a result the Agency is simultaneously proposing a concentration-based standard for antimony wastewaters of 1.9 ppm, based on the performance of lime precipitation, sedimentation, and filtration (see previous discussion on these additional data in III.A.2.a.(3.) above). Details on the transfers can be found in the Background Document for K021 wastes in the RCRA docket.

(3) *K028, K029, K095 and K096 Wastes.*

K028—Spent catalyst from the hydrochlorinator reactor in the production of 1,1,1-trichloroethane.

K029—Waste from the product steam stripper in the production of 1,1,1-trichloroethane.

K095—Distillation bottoms from the production of 1,1,1-trichloroethane.

K096—Heavy ends from the heavy ends column from the production of 1,1,1-trichloroethane.

Treatment standards for K028, K029, K095, and K096 wastes were originally scheduled to be promulgated as part of the Second Third rule. Treatment standards were only promulgated, however, for the wastewater forms of K028 and the nonwastewater forms of K028, K029, K095 and K096. Since the Agency did not promulgate standards for the wastewater forms of K029, K095,

and K096 by their statutory deadline, land disposal of these wastewaters are currently subject to the "soft hammer" provisions in 40 CFR 268.8.

Initially, the Agency stated that there was no need to develop wastewater standards for K029, K095, and K096 because it was unlikely that they were being generated due to the recycling and generation practices for these three wastes. However, comments were received that indicated that the likelihood for their generation was reasonably good. While the Agency agreed with the commenters, concentration-based treatment standards were not promulgated because none had been proposed.

In today's rule, the Agency is proposing concentration-based standards for organics in K029, K095 and K096 wastewaters based on the transfer of performance data from rotary kiln incineration of K019 (heavy ends from the distillation of ethylene dichloride in ethylene dichloride production) nonwastewaters. These treatment standards for organics have been developed similar to those promulgated for K028 wastewaters. The Agency is however, proposing to revoke the reserved status for metal standards in K029, K095 and K096 wastewaters. The Agency has determined that based on waste characterization data on the corresponding nonwastewaters, it is believed that these three wastes are essentially all organic and would not be expected to contain any BDAT list metal constituents.

The Agency stated that it intended to develop standards for metals in nonwastewater forms of K028 and propose them with the Third wastes prior to promulgation by May 8, 1990. The Agency reserved standards based on TCLP analyses for chromium and nickel in the promulgated standards for K028 nonwastewaters. While EPA proposed standards based on stabilization of K048 and K051 incinerator ash for K028 nonwastewaters as part of the Second Third proposed rule, the Agency did not promulgate these standards as proposed because new data on the stabilization of F024 incinerator ash were developed. However these data were received too late to be promulgated in the final rule for Second Third wastes (54 FR 26617). The Agency believes that these new data for stabilized F024 ash more closely resemble what would be expected for stabilized K028 ash. Thus, treatment standards for metal constituents in K028 nonwastewaters are proposed today based on the transfer of TCLP data from stabilization of F024 wastes. These

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treatment standards for metals are simultaneously being proposed for F024 nonwastewaters in today's rule. The Agency will consider all comments on the standards for F024 as they also relate to K028 nonwastewaters.

(3) U Wastes for Which EPA is Proposing Concentration-Based Standards.

- U044—Chloroform
- U074—1,4-Dichloro-2-butene
- U076—1,1-Dichloroethane
- U077—1,2-Dichloroethane
- U078—1,1-Dichloroethylene
- U079—1,2-Dichloroethylene
- U080—Methylene chloride
- U083—1,2-Dichloropropane
- U084—1,3-Dichloropropane
- U131—Hexachloroethane
- U184—Pentachloroethane
- U208—1,1,1,2-Tetrachloroethane
- U209—1,1,2,2-Tetrachloroethane
- U210—Tetrachloroethylene
- U211—Carbon tetrachloride
- U226—1,1,1-Trichloroethane
- U227—1,1,2-Trichloroethane
- U228—Trichloroethylene
- U243—Hexachloropropene

In developing the treatment standards for these nineteen halogenated aliphatic U wastes, the Agency reviewed treatability and detection limit data from several different incineration test burns conducted by EPA for various F and K wastes. These data represented a myriad of different hazardous wastes that were generated and treated at several different incineration facilities.

The Agency determined that there was substantial treatment data for many of these halogenated aliphatics from the incineration of K019 and F024. Data from the test burns of both F024 and K019 wastes included detection limit information on the majority of the halogenated aliphatic chemicals which correspond to these U wastes. The waste characterization data for the untreated wastes showed concentrations of these halogenated aliphatic constituents ranging from very low levels in some wastes, to high levels in others. In general, the majority of the measured values for halogenated aliphatics in the incinerator residues were approximately at the detection limit for all of the constituents analyzed.

In the incinerator ash, the measured values or detection limits ranged from <0.005 mg/kg to <10 mg/kg. In the scrubber water, the measured values or detection limits ranged from <0.005 ppm to <0.05 ppm.

The Agency also reviewed new performance data for carbon tetrachloride, methylene chloride, 1,1,1-trichloroethane, tetrachloroethane and hexachloroethane obtained from a rotary kiln incinerator test burn EPA

performed in June, 1989. These five chemicals were specifically selected for this test burn as representatives of all of the U wastes in the halogenated aliphatic treatability group. See details of this test burn previously discussed in section III.A.1.h.(6.) of today's preamble. The Agency believes that these new data coupled with the previously mentioned data provide a sufficient range of concentration of halogenated aliphatic chemicals in untreated wastes to be considered representative of all halogenated aliphatic U wastes.

The Agency has reviewed both characterization and performance data for each of the halogenated aliphatics present in treated and untreated F024 wastes, K019 wastes, and wastes from the June, 1989, EPA incineration test burn, and has determined that the transfer of performance data primarily from the incineration of K019 nonwastewaters is appropriate for the development of the concentration-based treatment standards for all halogenated aliphatic waste codes proposed in today's rule. Details on the development of treatment standards can be found in the Background Document for Halogenated Aliphatics in the RCRA docket.

U074, U079 and U084 wastes are listed as 1,4-dichloro-2-butene, 1,2-dichloroethylene and 1,3-dichloropropane, respectively. Due to the position of the chlorines on these alkenes, all of the chemicals have stereoisomers identified as "cis-" and "trans-". For U074 and U084 wastes both the "cis-" and the "trans-" isomers can be quantified using verified SW-846 methods. Therefore, concentration-based treatment standards are being proposed for both isomers of the two compounds. While 40 CFR 261.33(f) lists U079 wastes as 1,2-dichloroethylene, the chemical abstracts identification number that is listed for this compound (156-60-5) is specific for trans-1,2-dichloroethylene. Since the trans-isomer is also specified in 40 CFR 261 Appendix VIII, the Agency is thus proposing concentration-based treatment standards only for trans-1,2-dichloroethylene for U079 wastes.

The treatment standards for wastewater forms of the U wastes presented in the tables following this section, have been calculated based primarily on the detection limits of these constituents in scrubber waters from incineration of K019 nonwastewaters. However, additional data are available for the treatment of these constituents in wastewaters and alternative standards based on these data are presented in section III.A.7. of today's notice for

wastewater forms of multi-source leachate. (See previous discussions on these data and alternative standards in section III.A.1.h.(6.) and III.A.2.a.(3.).)

BDAT TREATMENT STANDARDS FOR K017

[Nonwastewaters]

Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
1,2-Dichloropropane.....	0.014
1,2,3-Trichloropropane.....	0.014
Bis(2-chloroethyl)ether.....	1.8

BDAT TREATMENT STANDARDS FOR K019

[Wastewaters]

Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
1,2-Dichloropropane.....	0.014
1,2,3-Trichloropropane.....	0.014
Bis(2-chloroethyl)ether.....	0.037

BDAT TREATMENT STANDARDS FOR K021

[Nonwastewaters]

[Revised from no land disposal]

Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
Chloroform.....	6.2
Carbon tetrachloride.....	6.2
	EP(mg/l)
Antimony.....	0.23

BDAT TREATMENT STANDARDS FOR K021

[Wastewaters]

Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
Chloroform.....	0.008
Carbon tetrachloride.....	0.008
Antimony.....	0.60

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BDAT TREATMENT STANDARDS FOR K028

[Nonwastewaters]¹

Regulated constituent	Maximum for any single grab sample, TCLP (mg/l)
Chromium (total).....	0.073
Lead.....	0.021
Nickel.....	0.088

¹ These standards do not replace the standards for the organics in K028 nonwastewaters that were promulgated with the Second Third wastes.

BDAT TREATMENT STANDARDS FOR K029

[Wastewaters]

Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
Chloroform.....	0.007
1,2-Dichloroethane.....	0.007
1,1-Dichloroethylene.....	0.033
1,1,1-Trichloroethane.....	0.007
Vinyl chloride.....	0.033

BDAT TREATMENT STANDARDS FOR K073

[Wastewaters]

Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
Carbon tetrachloride.....	6.2
Chloroform.....	6.2
Hexachloroethane.....	28
Tetrachloroethane.....	6.2
1,1,1-Trichloroethane.....	6.2

BDAT TREATMENT STANDARDS FOR K073

[Wastewaters]

Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
Carbon tetrachloride.....	0.008
Chloroform.....	0.008
Hexachloroethane.....	0.033
Tetrachloroethane.....	0.008
1,1,1-Trichloroethane.....	0.008

BDAT TREATMENT STANDARDS FOR K095

[Wastewaters]

Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
1,1,1,2-Tetrachloroethane.....	0.007
1,1,2,2-Tetrachloroethane.....	0.007
Tetrachloroethane.....	0.007
1,1,2-Trichloroethane.....	0.007
Trichloroethane.....	0.007
Hexachloroethane.....	0.033
Pentachloroethane.....	0.007

BDAT TREATMENT STANDARDS FOR K096

[Wastewaters]

Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
1,1,1,2-Tetrachloroethane.....	0.007
1,1,2,2-Tetrachloroethane.....	0.007
Tetrachloroethane.....	0.007
1,1,2-Trichloroethane.....	0.007
Trichloroethane.....	0.007
1,3-Dichlorobenzene.....	0.008
Pentachloroethane.....	0.007
1,2,4-Trichlorobenzene.....	0.023

BDAT TREATMENT STANDARDS FOR U044, U074, U076, U077, U078, U079, U080, U083, U084, U131, U184, U208, U209, U210, U211, U226, U227, U228, AND U243

[Nonwastewaters]

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
U044	Chloroform.....	6.2
U074	trans-1,4-Dichloro-2-butene...	30
U074	cis-1,4-Dichloro-2-butene.....	30
U076	1,1-Dichloroethane.....	6.2
U077	1,2-Dichloroethane.....	6.2
U078	1,1-Dichloroethylene.....	6.2
U079	trans-1,2-Dichloroethylene.....	6.2
U080	Methylene chloride.....	31
U083	1,2-Dichloropropane.....	15
U084	cis-1,3-Dichloropropene.....	15
U084	trans-1,3-Dichloropropene.....	15
U131	Hexachloroethane.....	30
U184	Pentachloroethane.....	31
U208	1,1,1,2-Tetrachloroethane.....	6.2
U209	1,1,2,2-Tetrachloroethane.....	6.2
U210	Tetrachloroethylene.....	6.2
U211	Carbon tetrachloride.....	6.2
U226	1,1,1-Trichloroethane.....	6.2
U227	1,1,2-Trichloroethane.....	6.2
U228	Trichloroethylene.....	5.6
U243	Hexachloropropene.....	37

BDAT TREATMENT STANDARDS FOR U044, U074, U076, U077, U078, U079, U080, U083, U084, U131, U184, U208, U209, U210, U211, U226, U227, U228, and U243

[Wastewaters]¹

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
U044	Chloroform.....	0.007
U074	trans-1,4-Dichloro-2-butene...	0.034
U074	cis-1,4-Dichloro-2-butene.....	0.034
U076	1,1-Dichloroethane.....	0.007
U077	1,2-Dichloroethane.....	0.007
U078	1,1-Dichloroethylene.....	0.007
U079	trans-1,2-Dichloroethylene.....	0.007
U080	Methylene chloride.....	0.037
U083	1,2-Dichloropropane.....	0.067
U084	cis-1,3-Dichloropropene.....	0.067
U084	trans-1,3-Dichloropropene.....	0.067
U131	Hexachloroethane.....	0.034
U184	Pentachloroethane.....	0.037
U208	1,1,1,2-Tetrachloroethane.....	0.007
U209	1,1,2,2-Tetrachloroethane.....	0.007
U210	Tetrachloroethylene.....	0.007
U211	Carbon tetrachloride.....	0.007
U226	1,1,1-Trichloroethane.....	0.007
U227	1,1,2-Trichloroethane.....	0.007
U228	Trichloroethylene.....	0.007
U243	Hexachloropropene.....	0.047

¹ Note: Alternative standards for these U and P wastewaters are also proposed and are presented in section III.A.7. as standards for the corresponding chemical in wastewater forms of Multi-source Leachate. See background on these alternative standards in section III.A.1.h.(6.) (b).

c. Halogenated Pesticides and Chlorobenzenes. This subcategory of halogenated organics consists of six characteristic D wastes, nine K wastes from the production of various halogenated pesticides and chlorobenzenes, and twenty six U and P wastes. EPA grouped these waste codes together because the primary constituents for which the wastes were listed are halogenated organic compounds that are (or have been) primarily used as pesticides. While other halogenated organics have been (or could be) used as pesticides, the Agency has grouped these particular halogenated organics together due to their similarities in their common use as pesticides, their ability to be analyzed, and similarities in structure. Thus, for purposes of BDAT, the Agency has grouped all of these wastes into one general treatability group identified as "halogenated pesticides and chlorobenzenes".

This subcategory has been further divided into five subcategories based primarily on similarities in chemical structure for the purposes of transferring treatability data. These subcategories include: 1) Chlorinated Norbornane and Norbornene Derivatives; 2)

Chlorobenzenes; 3) Chlorophenoxy-carboxylic Acids and Derivatives; 4) Chlorinated Diphenyls; and 5) Lindane and Hexachlorobutadiene. The individual waste codes within each subcategory are provided at the beginning of each subheading in section III.A.2.c.(3.) of today's preamble.

(1) *Availability of Treatment Data for These Wastes.* The Agency has determined that only a limited amount of treatability data on halogenated pesticides and chlorobenzenes exist. In section III.A.1.h.(6.) of today's preamble, the Agency presented information on an extensive June, 1989 test burn for multiple chemical wastes including several halogenated pesticides. The data obtained from this test burn were used in conjunction with other existing incineration data to develop proposed treatment standards for the pesticides tested. The Agency is also proposing to transfer these performance data to the remaining untested pesticide wastes.

The feed wastes for this test burn included three RCRA hazardous wastes that contained constituents in the halogenated pesticide and chlorobenzene treatability group present in concentrations of up to 8% by weight. These three wastes included: (1) a Heptachlor process waste which contained Chlordane, Heptachlor, hexachlorobutadiene and hexachlorocyclopentadiene; (2) a D014 (EP Toxic for Methoxychlor) waste; and (3) a D016 (EP Toxic for 2,4-D) waste. Specific details and additional information on the test burn can be found in the Onsite Engineering Report of the Third Third Incineration Treatability Test, July, 1989.

The Agency is proposing to transfer concentration-based standards from these compounds as well as from the other existing data to the remaining D, U, P, and K halogenated pesticide and chlorobenzene waste codes. More information on the development and transfer of treatment standards for these wastes can be found in the background document for these wastes in the RCRA docket.

(2) *Treatment Standards for Wastewaters.* The treatment standards for wastewater forms of the U wastes presented in the tables following this section, have been calculated based primarily on the detection limits of these constituents in scrubber waters from incineration of nonwastewaters containing halogenated pesticides. However, additional data are available for the treatment of these constituents in wastewaters and alternative standards based on these data are presented in section III.A.7. of today's notice for

wastewater forms of multi-source leachate. (See previous discussions on these data and alternative standards in section III.A.1.h.(6.) and III.A.2.a.(3.)).

(3) *Regulation of EP Toxic Halogenated Pesticides* The new data from EPA's June, 1989 testing of rotary kiln incineration on multiple wastes, including D014 and D016 wastes, (see section III.A.1.h.(6.)) indicate that all of the halogenated pesticides that were present in the feed can be incinerated to detection limits (as measured using analysis of total constituent concentrations in both the ash and scrubber water). As a result, concentration-based standards that are near the detection limits in their respective media (i.e., wastewaters and nonwastewaters) are being proposed today for all of the halogenated pesticides in the respective U, P, and K wastes of this treatability group. The Agency believes that the wastes tested represent the most difficult to treat wastes.

The Agency is proposing two options for treatment standards for EP Toxic halogenated pesticides wastes (D012, D013, D014, D015, D016 and D017). Based on the aforementioned data, the Agency is proposing one option of concentration-based treatment standards based on the ability of incineration to destroy these pesticides to detection limits. (Note: These proposed standards are based on the analysis of total constituents rather than analysis of EP or TCLP leachates.) The Agency believes that this provides a consistency in approach with the proposed treatment standards for the corresponding U, P and K wastes.

Because these data indicate that these D pesticides can be incinerated to detection limits, the Agency further believes that compliance with this standard can be demonstrated by performing a total constituent analysis of the ash samples for these pesticides rather than performing the more expensive and more time-consuming extraction procedure for these pesticides. One can then assume that the total concentration of the pesticide measured in the incinerator ash corrected for the appropriate dilution factor (which is part of the extraction procedure protocol) provides a reasonable surrogate for actual measurement of the concentration in an extract provided that the total concentration is expected to be near the detection limit.

As discussed in detail in section III.C. of today's preamble, the Agency has determined that it may have the authority to establish treatment standards below the characteristic level

for these wastes. The Agency is also proposing a second option of limiting the treatment standard for D012, D013, D014, D015, D016 and D017 wastes to their respective characteristic levels. The Agency believes that the total constituent standards proposed in option one are preferable in that it assures the public that these chemicals are being destroyed to the best levels that are achievable. This comports with the statutory policy of reducing the uncertainties inherent in hazardous waste land disposal, as well as specific Congressional directives to destroy hazardous organic constituents, see, e.g., 130 Cong. Rec. S9179 (July 25, 1984) (statement of Sen. Chaffee), and results in minimization of threats to human health and the environment. EPA also finds it anomalous that standards for the same pesticides will be lower than the characteristic level when the pesticides are disposed in their U or P form, but cannot be so limited when the pesticides are discarded in the EP toxic form. This result does not appear to further any statutory policy. The Agency specifically solicits comments on these two options, and on the policy support for choosing a level based on the characteristic level.

The Agency points out to the commenters that there are not very many of these wastes being generated and that although the treatment standards are based on incineration for these wastes, the use of other technologies is permitted to achieve these concentration-based standards. In addition, the Agency refers commenters to section III.A.1.g. of today's preamble for a more complete discussion of other general issues pertaining to all characteristic wastes, including these D pesticides.

(4) *Discussion of Individual Treatability Groups—(a) Chlorinated Norbornane and Norbornene Derivatives.*

- D012—EP Toxic for Endrin.
- D015—EP Toxic for Toxaphene.
- K032—Wastewater treatment sludge from the production of Chlordane.
- K033—Wastewater treatment scrubber water from the chlorination of cyclopentadiene in the production of Chlordane.
- K034—Filter solids from filtration of hexachlorocyclopentadiene in the production of Chlordane.
- K041—Wastewater treatment sludge from the production of Toxaphene.
- K097—Vacuum stripper discharge from the Chlordane chlorinator in the production of Chlordane.
- K098—Untreated process wastewater from the production of Toxaphene.

P004—Aldrin
 P037—Dieldrin
 P050—Endosulfan
 P051—Endrin and metabolites
 P059—Heptachlor
 P060—Isodrin
 P123—Toxaphene
 U036—Chlordane
 U130—Hexachlorocyclopentadiene
 U142—Kepone

The Agency has grouped these eighteen waste codes together because they all contain or represent halogenated pesticides that have the structural classification known as chlorinated norbornane and norbornene derivatives. This classification basically consists of compounds having multicyclic, fused-ring, hydrocarbon structures (one of which being a six-membered ring) that have varying numbers of hydrogen atoms replaced by chlorine, methyl groups or other simple functional groups. Hexachlorocyclopentadiene and Kepone, the compounds for which U130 and U142 were listed, are exceptions to the norbornene classification since they do not have a six-membered ring in their structure. However, their structures are somewhat similar to the norbornane and norbornene derivatives, and thus, are included in this subcategory of halogenated pesticides.

The Agency has data on incineration of Heptachlor, Chlordane, and hexachlorocyclopentadiene that were used in developing the standards for this subgroup of halogenated pesticides. The new data from EPA's June 1989 testing of rotary kiln incineration indicate that Heptachlor, Chlordane and hexachlorocyclopentadiene can be incinerated to detection limits (as measured in both the ash and scrubber water). As a result, concentration-based standards based on these detection limits (using analysis of total constituent concentrations) are being proposed today for P059, U036, and U130 wastes. Standards for P004, P037, P050, P051, P060, P123 and U142 are being proposed based on detection limits for the corresponding constituents from fourteen incineration treatment tests.

In a similar manner, concentration-based standards have been developed for the major hazardous constituents anticipated to be present in K032, K033, K034, K041, K097, and K098 wastes. The organic constituents selected for regulation in these K wastes are specified in the treatment standards at the end of this section. Details on the selection of constituents and the transfer of performance data for these wastes are provided in the background document for these halogenated pesticide wastes.

As discussed earlier in this section, the Agency is today proposing two sets of concentration-based standards for D012 and D015 characteristic wastes. One set of standards is based on the characteristic levels and the other set of standards were developed from incineration treatment data.

Endosulfan, the compound for which P050 was listed as a hazardous waste, commonly exists as a mixture of two isomers (i.e., Endosulfan I and Endosulfan II). Both can be analyzed by SW-846 Method 8080 for organochlorine pesticides. In fact, analytical laboratories typically report analysis for each. Accordingly, the concentration-based standards for P050 are proposed for Endosulfan I and II. In addition, Endosulfan can be converted to Endosulfan sulfate in environmental samples. The Agency anticipates that Endosulfan sulfate, which is also on the Priority Pollutant List used by the Agency's Office of Water, will be typically found in the presence of Endosulfan.

In a similar manner, Heptachlor (P059) can be commonly converted to Heptachlor epoxide in certain environmental conditions. Again analytical laboratories typically report results for Heptachlor and for Heptachlor epoxide (which is also on the Priority Pollutant List). Accordingly, concentration-based standards for P059 are today proposed for Heptachlor and Heptachlor epoxide.

P051 is specifically listed in 40 CFR 261.33(e) as "Endrin and metabolites". The most common metabolite of Endrin is the Priority Pollutant, Endrin aldehyde. Concentration-based standards for P051 are thus proposed for Endrin and Endrin aldehyde.

(b) *Chlorobenzenes.*

K042—Heavy ends or distillation residues from the distillation of tetrachlorobenzene in the production of 2,4,5-T.

K085—Distillation of fractionation column bottoms from the production of chlorobenzenes.

K105—Separated aqueous stream from the reactor product washing step in the production of chlorobenzenes.

U037—Chlorobenzene

U070—1,2-Dichlorobenzene

U071—1,3-Dichlorobenzene

U072—1,4-Dichlorobenzene

U127—Hexachlorobenzene

U183—Pentachlorobenzene

U185—Pentachloronitrobenzene

U207—1,2,4,5-Tetrachlorobenzene

The Agency has grouped these three K wastes and eight U wastes together because they all contain or are represented by halogenated organics

that have the structural classification known as chlorobenzenes. These chemicals consist of one benzene ring with increasing chlorine substitution and their associated isomers.

The Agency has data on the incineration of all of the chlorobenzenes with the exception of 1,3-dichlorobenzene. More information on these data can be found in the background document for these wastes. These data were used to develop standards for all of the chlorobenzene wastes in this treatability group. Treatment standards for 1,3-dichlorobenzene were developed from examination of detection limit data for this constituent from the fourteen incineration treatment tests.

The data indicate that these chemicals can be incinerated to at or near detection limits for these chemicals, which generally range in the treatment residuals from <0.005 ppm to <10 ppm in the ash and from <0.002 mg/l to <0.013 mg/l in the scrubber water. As a result, EPA is proposing concentration-based standards based on these detection limits (using analysis of total constituent concentrations) for the organic constituents in these waste codes. These incineration data are also the only available treatment data for these wastes. More information on the development of these standards can be found in the background document for these wastes in the RCRA Docket.

For K085 wastes the Agency determined that the untreated wastes often contained various concentrations of PCBs. As indicated in the proposed rule for Second Third wastes, there were some indications that some K085 wastes may contain greater than 50 ppm of PCBs. However, the Agency could not verify that these levels were always exceeded. Nevertheless, the Agency has decided to propose concentration-based treatment standards for PCBs for both wastewater and nonwastewater forms of K085. These standards are listed for seven of the common mixtures of PCBs known originally by the brand name of Aroclor (i.e., the proposed standards are listed for Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1280). If K085 Wastes exceed 50 ppm PCBs, they must be incinerated in a TSCA permitted facility (several of the commercial facilities that are permitted for RCRA wastes are also permitted for PCB contaminated wastes under TSCA).

(c) *Chlorophenoxy-carboxylic Acids and Derivatives.*

D016—EP Toxic for 2,4-D

D017—EP Toxic for 2,4,5-TP (Silvex)

U240—2,4-D, salts and esters

These three waste codes have been grouped together because they contain 2,4-dichlorophenoxyacetic acid (commonly referred to as 2,4-D), 2,4,5-trichlorophenoxypropionic acid (commonly referred to as 2,4,5-TP), or salts and esters of 2,4-D. All of these chemicals are classified as chlorophenoxy carboxylic acids or esters. The functional groups common to these compounds are an aromatic ring, a carbon-oxygen ester linkage, and several chlorine atoms (two or three) on the aromatic ring.

The Agency has data on the incineration of 2,4-D that were used in developing the standards for D016 and U240. The data indicate that 2,4-D can be incinerated to detection limits in the ash and in the scrubber water (based on analysis of total constituent concentrations). Detection limit data for 2,4,5-TP in fourteen incineration tests were used in developing treatment standards for D017. The Agency is proposing concentration-based standards for these wastes based on their respective detection limits.

According to 40 CFR 261.33(f), wastes identified as U240 are listed for the presence of 2,4-D or its various salts and/or esters. Because 2,4-D salts and esters are not analyzed as 2,4-D, the Agency is today proposing "Incineration as a Method of Treatment" for 2,4-D salts and esters identified as U240 nonwastewaters. For the wastewater forms of 2,4-D salts and esters, EPA is proposing a treatment standard of "Wet Air Oxidation or Chemical Oxidation, Followed by Carbon Adsorption; or Incineration as Methods of Treatment". (See discussion on selecting these technologies as BDAT for halogenated organics in section III.A.2.a.(4.) above.) These wastewater technologies are appropriate for these constituents and have been demonstrated and/or promulgated for similar U and P waste codes. The use of other technologies is not precluded prior to or following the use of these specified technologies provided the other technologies do not allow land disposal (i.e., land treatment). For U240 wastes expected to be simply 2,4-D, the Agency is also proposing concentration-based standards based on the analysis for only 2,4-D. Thus, where a facility can reasonably assume that only 2,4-D is being handled, only the concentration-based treatment standard for 2,4-D would be applied. However, should one expect that salts or esters could be formed during storage, treatment, or disposal, the U240 wastes would have to be treated according to the standard methodology for salts and esters.

As discussed earlier in this section, the Agency is today proposing two sets of concentration-based standards for D016 and D017 characteristic wastes. One set of standards is based on the characteristic levels and the other set of standards were developed from incineration treatment data.

Accuracy data for these compounds from the test burn data indicate a highly variable recovery of spiked ash samples. This, coupled with the fact that U240 is listed as 2,4-D, salts and esters, has led the Agency to simultaneously propose an alternative treatment standard of "Incineration as a Method of Treatment" for all three of these wastes. The Agency is specifically soliciting comment and data on the routine achievability of these standards for chlorophenoxy carboxylic acids and esters. In particular, the Agency is requesting QA/QC data as well as detection limit data (as measured in ash samples from the incineration of these or similar wastes) for not only 2,4-D and 2,4,5-TP, but also the salts and esters of 2,4-D.

(d) Chlorinated Diphenyls.

D014—EP Toxic for Methoxychlor
U038—Chlorobenzilate
U060—DDD
U061—DDT
U132—Hexachlorophene
U247—Methoxychlor

These six waste codes have been grouped together because they all contain halogenated pesticides classified as chlorinated diphenyl compounds. Diphenyls are compounds consisting of two benzene rings attached to a single, common carbon atom. (Diphenyls are not to be confused with biphenyls which have the structure of two benzene rings attached directly to each other.) The chlorinated diphenyls represented by these waste codes have varying degrees of chlorine substitution on the benzene rings and on the carbon in the middle.

The Agency has data on the incineration of Methoxychlor that were used in developing the standards for D014 and U247. The data indicate that Methoxychlor can be incinerated to detection limits in the ash and in the scrubber water. Standards for the remaining waste codes in this treatability group were developed using detection limit data from fourteen incineration treatment tests. As a result, concentration-based standards based on these detection limits (using analysis of total constituent concentrations) are being proposed today for U038, U060, U061, U132, and U247 wastes. As with the other characteristic pesticide D wastes, the standard for D014

(Methoxychlor) is being proposed as two sets of concentration-based standards. One set of standards is based on the characteristic levels and the other set of standards were developed from incineration treatment data.

DDD and DDT, the compounds for which U060 and U061 were respectively listed, can both exist as one of two isomers (i.e., o,p'-DDD and p,p'-DDD; o,p'-DDT and p,p'-DDT respectively). All of these isomers can be analyzed by SW-846 Method 8080 for organochlorine pesticides. Analytical results for DDD and DDT are often reported separately for each isomer. However, the predominant isomer for both is the p,p'-isomer. Because of this, the Agency is proposing that the concentration-based standards for U060 and U061 are based on the analysis for both isomers. In addition, DDD and DDE are common breakdown products of DDT. Accordingly, the Agency is today proposing to regulate the two isomers of DDD, DDE and DDT in U061 wastes. However, the Agency is soliciting comment on the need to regulate these waste codes for all isomers of the constituents and their breakdown products, and is not precluded from promulgating the standards for only the p,p'-isomers.

(e) Lindane and Hexachlorobutadiene.

D013—EP Toxic for Lindane
U128—Hexachlorobutadiene
U129—Lindane

Lindane (U129) is the gamma-isomer of a class of compounds known as hexachlorocyclohexanes (a cyclic six membered hydrocarbon ring with a chlorine substituted on each carbon) and is often referred to as "gamma-BHC" (Note: BHC is an abbreviation for benzene hexachloride—which is a misnomer because benzene is not part of the structure). Hexachlorobutadiene (U128) has been placed in this subcategory because it has the same number of chlorine atoms (six) and has a hydrocarbon structure consisting of four carbon atoms linked by a conjugated double bond system. Both of these chemicals are thus chlorinated aliphatics and both were typically used as pesticides or in the production of pesticides. The three wastes represented by these chemicals have not been grouped with the chlorinated aliphatics due to the differences in use of the compounds. (The chlorinated aliphatics discussed in section III.A.2.a. are typically used as solvents.)

The Agency has incineration data for hexachlorobutadiene from the June, 1989 test burn. In addition to the data from

the June, 1989 test: burn, the Agency has detection limit data for hexachlorobutadiene in ash samples of K019. These K019 data consists of six sample sets of <10 ppm in the ash and <0.01mg/1 in the scrubber water from rotary kiln incineration. As a result, concentration-based standards based on detection limits for hexachlorobutadiene (using analysis of total constituent concentrations) are being proposed today for the U128 and U129.

Lindane is the most common isomer of hexachlorocyclohexane (BHC). Typical commercial mixtures of Lindane were manufactured such that three other isomers were present in reasonably high concentrations: alpha-, beta-, and delta-BHC. Analytical results for hexachlorocyclohexane are often reported for all four of these isomers (which are also Priority Pollutants). Accordingly, the Agency is today proposing concentration-based standards for all four isomers for wastes identified as U129. As with the other characteristic pesticide D wastes, the standard for D013 (Characteristic for Lindane) is being proposed as two sets of concentration-based standards. One set of standards is based on the characteristic levels and the other set of standards were developed from incineration treatment data.

BDAT TREATMENT STANDARDS FOR K032

[Nonwastewaters]	
Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
Hexachlorocyclopentadiene	2.0
Chlordane	0.13
Heptachlor	0.066
Heptachlor epoxide	0.066

BDAT TREATMENT STANDARDS FOR K032

[Wastewaters]	
Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
Hexachlorocyclopentadiene	0.047
Chlordane	0.00039
Heptachlor	0.00022
Heptachlor epoxide	0.00022

BDAT TREATMENT STANDARDS FOR K033

[Nonwastewaters]	
Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
Hexachlorocyclopentadiene	2.0

BDAT TREATMENT STANDARDS FOR K033

[Wastewaters]	
Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
Hexachlorocyclopentadiene	0.047

BDAT TREATMENT STANDARDS FOR K034

[Nonwastewaters]	
Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
Hexachlorocyclopentadiene	2.0

BDAT TREATMENT STANDARDS FOR K034

[Wastewaters]	
Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
Hexachlorocyclopentadiene	0.047

BDAT TREATMENT STANDARDS FOR K041

[Nonwastewaters]	
Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
Toxaphene	0.13

BDAT TREATMENT STANDARDS FOR K041

[Wastewaters]	
Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
Toxaphene	0.00039

BDAT TREATMENT STANDARDS FOR K042

[Nonwastewaters]	
Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
1,2,4,5-Tetrachlorobenzene	4.4
o-Dichlorobenzene	4.4
p-Dichlorobenzene	4.4
Pentachlorobenzene	4.4
1,2,4-Trichlorobenzene	4.4

BDAT TREATMENT STANDARDS FOR K042

[Wastewaters]	
Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
1,2,4,5-Tetrachlorobenzene	0.092
o-Dichlorobenzene	0.092
p-Dichlorobenzene	0.092
Pentachlorobenzene	0.092
1,2,4-Trichlorobenzene	0.092

BDAT TREATMENT STANDARDS FOR K085

[Nonwastewaters]	
Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
Benzene	4.4
Chlorobenzene	4.4
o-Dichlorobenzene	4.4
m-Dichlorobenzene	4.4
p-Dichlorobenzene	4.4
1,2,4-Trichlorobenzene	4.4
1,2,4,5-Tetrachlorobenzene	4.4
Pentachlorobenzene	4.4
Hexachlorobenzene	4.4
Aroclor 1016	0.13
Aroclor 1221	0.13
Aroclor 1232	0.13
Aroclor 1242	0.13
Aroclor 1248	0.13
Aroclor 1254	0.13
Aroclor 1260	0.13

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BDAT TREATMENT STANDARDS FOR K085

[Wastewaters]	
Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
Benzene.....	0.092
Chlorobenzene.....	0.092
o-Dichlorobenzene.....	0.092
m-Dichlorobenzene.....	0.092
p-Dichlorobenzene.....	0.092
1,2,4-Trichlorobenzene.....	0.092
1,2,4,5-Tetrachlorobenzene.....	0.092
Pentachlorobenzene.....	0.092
Hexachlorobenzene.....	0.092
Aroclor 1016.....	0.00036
Aroclor 1221.....	0.00036
Aroclor 1232.....	0.00036
Aroclor 1242.....	0.00036
Aroclor 1248.....	0.00036
Aroclor 1254.....	0.00036
Aroclor 1260.....	0.00036

BDAT TREATMENT STANDARDS FOR K097

[Nonwastewaters]	
Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
Hexachlorocyclopentadiene.....	2.0
Chlordane.....	0.13
Heptachlor.....	0.066
Heptachlor epoxide.....	0.066

BDAT TREATMENT STANDARDS FOR K097

[Wastewaters]	
Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
Hexachlorocyclopentadiene.....	0.047
Chlordane.....	0.00039
Heptachlor.....	0.00022
Heptachlor epoxide.....	0.00022

BDAT TREATMENT STANDARDS FOR K098

[Nonwastewaters]	
Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
Toxaphene.....	0.13

BDAT TREATMENT STANDARDS FOR K098

[Wastewaters]	
Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
Toxaphene.....	0.00039

BDAT TREATMENT STANDARDS FOR K105

[Nonwastewaters]	
Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
Benzene.....	4.4
Chlorobenzene.....	4.4
o-Dichlorobenzene.....	4.4
p-Dichlorobenzene.....	4.4
2,4,5-Trichlorophenol.....	4.4
2,4,6-Trichlorophenol.....	4.4
2-Chlorophenol.....	4.4
Phenol.....	4.4

BDAT TREATMENT STANDARDS FOR K105

[Wastewaters]	
Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
Benzene.....	0.092
Chlorobenzene.....	0.092
o-Dichlorobenzene.....	0.092
p-Dichlorobenzene.....	0.092
2,4,5-Trichlorophenol.....	0.092
2,4,6-Trichlorophenol.....	0.092
2-Chlorophenol.....	0.092
Phenol.....	0.092

BDAT TREATMENT STANDARDS FOR P004,

P037, P050, P051, P059, P060, P123, U036, U037, U038, U060, U061, U070, U071, U072, U127, U128, U129, U130, U132, U142, U183, U185, U207, U240, AND U247

[Nonwastewaters]

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
P004	Aldrin.....	0.066
P037	Dieldrin.....	0.13
P050	Endosulfan I.....	0.066
P050	Endosulfan II.....	0.13
P050	Endosulfan sulfate.....	0.13
P051	Endrin.....	0.13
P051	Endrin aldehyde.....	0.13
P059	Heptachlor.....	0.066
P059	Heptachlor epoxide.....	0.066
P060	Isodrin.....	0.010
P123	Toxaphene.....	1.3

BDAT TREATMENT STANDARDS FOR P004, P037, P050, P051, P059, P060, P123, U036, U037, U038, U060, U061, U070, U071, U072, U127, U128, U129, U130, U132, U142, U183, U185, U207, U240, AND U247—Continued

[Nonwastewaters]

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
U036	Chlordane.....	0.13
U037	Chlorobenzene.....	5.7
U038	Chlorobenzilate.....	6.6
U060	o,p'-DDD.....	0.087
U060	p,p'-DDD.....	0.087
U061	o,p'-DDT.....	0.087
U061	p,p'-DDT.....	0.087
U061	o,p'-DDD.....	0.087
U061	p,p'-DDD.....	0.087
U061	o,p'-DDE.....	0.087
U061	p,p'-DDE.....	0.087
U070	o-Dichlorobenzene.....	6.2
U071	m-Dichlorobenzene.....	6.2
U072	p-Dichlorobenzene.....	6.2
U127	Hexachlorobenzene.....	37
U128	Hexachlorobutadiene.....	28
U129	alpha-BHC.....	0.066
U129	beta-BHC.....	0.066
U129	delta-BHC.....	0.066
U129	gamma-BHC (Lindane).....	0.066
U130	Hexachlorocyclopentadiene.....	4.8
U132	Hexachlorophene.....	1.1
U142	Kepone.....	0.043
U183	Pentachlorobenzene.....	37
U185	Pentachloronitrobenzene.....	4.8
U207	1,2,4,5-Tetrachlorobenzene.....	19
U240	2,4-D.....	10
U247	Methoxychlor.....	0.18

BDAT TREATMENT STANDARDS FOR P004,

P037, P050, P051, P059, P060, P123, U036, U037, U038, U060, U061, U070, U071, U072, U127, U128, U129, U130, U132, U142, U183, U185, U207, U240, AND U247

[Wastewaters]*

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
P004	Aldrin.....	0.00024
P037	Dieldrin.....	0.00052
P050	Endosulfan I.....	0.00024
P050	Endosulfan II.....	0.00052
P050	Endosulfan sulfate.....	0.00052
P051	Endrin.....	0.00052
P051	Endrin aldehyde.....	0.00052
P059	Heptachlor.....	0.00022
P059	Heptachlor epoxide.....	0.00024
P060	Isodrin.....	0.00020
P123	Toxaphene.....	0.014
U036	Chlordane.....	0.00044
U037	Chlorobenzene.....	0.014
U038	Chlorobenzilate.....	0.292
U060	o,p'-DDD.....	0.00036
U060	p,p'-DDD.....	0.00036
U061	o,p'-DDT.....	0.00036
U061	p,p'-DDT.....	0.00036
U061	o,p'-DDD.....	0.00036

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BDAT TREATMENT STANDARDS FOR P004, P037, P050, P051, P059, P060, P123, U036, U037, U038, U060, U061, U070, U071, U072, U127, U128, U129, U130, U132, U142, U183, U185, U207, U240, AND U247—Continued

[Wastewaters]*

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
U061	p,p'-DDD.....	0.00036
U061	o,p'-DDE.....	0.00036
U061	p,p'-DDE.....	0.00036
U070	o-Dichlorobenzene.....	0.058
U071	m-Dichlorobenzene.....	0.072
U072	p-Dichlorobenzene.....	0.058
U127	Hexachlorobenzene.....	0.055
U128	Hexachlorobutadiene.....	0.031
U129	alpha-BHC.....	0.00024
U129	beta-BHC.....	0.00024
U129	delta-BHC.....	0.00024
U129	gamma-BHC (Lindane).....	0.00024
U130	Hexachlorocyclopentadiene.....	0.096
U132	Hexachlorophene.....	58
U142	Kepona.....	0.0011
U183	Pentachlorobenzene.....	0.096
U185	Pentachloronitrobenzene.....	0.096
U207	1,2,4,5-Tetrachlorobenzene.....	0.023
U240	2,4-D.....	0.013
U247	Methoxychlor.....	0.00036

*Note: Alternative standards for these U and P wastewaters are also proposed and are presented in section III.A.7. as standards for the corresponding chemical in wastewater forms of Multi-source Leachate. See background on these alternative standards in section III.A.1.h.(6).(b.).

BDAT TREATMENT STANDARDS FOR D012, D013, D014, D015, D016, AND D017 BASED ON TREATMENT

[Nonwastewaters]

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
D012	Endrin.....	0.13
D013	Lindane.....	0.066
D014	Methoxychlor.....	0.18
D015	Toxaphene.....	1.3
D016	2,4-D.....	10
D017	2,4,5-TP.....	2.8

BDAT TREATMENT STANDARDS FOR D012, D013, D014, D015, D016, AND D017 BASED ON TREATMENT

[Wastewaters]

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
D012	Endrin.....	0.00052
D013	Lindane.....	0.00024
D014	Methoxychlor.....	0.00036

BDAT TREATMENT STANDARDS FOR D012, D013, D014, D015, D016, AND D017 BASED ON TREATMENT—Continued

[Wastewaters]

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
D015	Toxaphene.....	0.014
D016	2,4-D.....	0.013
D017	2,4,5-TP.....	2.5

BDAT TREATMENT STANDARDS FOR U240—SALTS AND ESTERS OF 2,4-D

[Nonwastewaters]

Incineration as a method of treatment

BDAT TREATMENT STANDARDS FOR U240—SALTS AND ESTERS OF 2,4-D

[Wastewaters]

Wet air oxidation or chemical oxidation, followed by carbon adsorption; or incineration as methods of treatment

d. Halogenated Phenolics.

- U039—p-Chloro-m-cresol
- U048—2-Chlorophenol
- U081—2,4-Dichlorophenol
- U082—2,6-Dichlorophenol

EPA has grouped these four U wastes together because all of the chemicals represented by these waste codes are mono- and di-substituted phenols. These chemicals consist of a phenol (a benzene with a hydroxyl group attached) substituted with one or more chlorine atoms and/or a methyl group (U039) attached to the benzene ring.

The Agency is proposing concentration-based standards for these halogenated phenolics based on incineration treatment performance data for 2,4- and 2,6-dichlorophenol. These data were directly used to develop treatment standards for U081 and U082. Treatment standards for U039 and U048 were developed by examining the detection limit data for these constituents from the fourteen incineration treatment tests. More information on these data can be found in the background document for these wastes.

The treatment standards for wastewater forms of the U wastes

presented in the tables following this section, have been calculated based primarily on the detection limits of these constituents in scrubber waters from incineration of 2,4- and 2,6-dichlorophenol nonwastewaters. However, additional data are available for the treatment of these constituents in wastewaters and alternative standards based on these data are presented in section III.A.7. of today's notice for wastewater forms of multi-source leachate. (See previous discussions on these data and alternative standards in section III.A.1.h.(6.) and III.A.2.a.(3.)).

BDAT TREATMENT STANDARDS FOR U039, U048, U081, AND U082

[Nonwastewaters]

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
U039	p-Chloro-m-cresol.....	14
U048	2-Chlorophenol.....	5.7
U081	2,4-Dichlorophenol.....	14
U082	2,6-Dichlorophenol.....	14

BDAT TREATMENT STANDARDS FOR U039, U048, U081, AND U082

[Wastewaters]¹

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
U039	p-Chloro-m-cresol.....	0.062
U048	2-Chlorophenol.....	0.056
U081	2,4-Dichlorophenol.....	0.052
U082	2,6-Dichlorophenol.....	0.018

¹ Note: Alternative standards for these U and P wastewaters are also proposed and are presented in section III.A.7. as standards for the corresponding chemical in wastewater forms of Multi-source Leachate. See background on these alternative standards in section III.A.1.h.(6).(b.).

e. Brominated Organics.

- P017—Bromoacetone
- U129—Methyl Bromide
- U030—4-Bromophenyl phenyl ether
- U066—1,2-Dibromo-3-chloropropane
- U067—Ethylene dibromide (EDB)
- U068—Dibromomethane
- U225—Bromoform

The chemicals represented by these six U wastes and one P waste are all hydrocarbons or oxygenated hydrocarbons that contain the halogen, bromine. The presence of bromine in the structure complicates the evaluation of incineration for these wastes: The primary complication is the release of significant quantities of molecular

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bromine (Br₂) from the incineration chambers. Thus, these seven wastes have been grouped together and identified as the brominated organics treatability group.

While cyanogen bromide (U246) is also an organic chemical containing bromine, it is not grouped with these other brominated organics due to its instability in water under alkaline conditions. It breaks down relatively quickly into soluble bromide and soluble cyanide. Consequently, the soluble cyanide must then be treated and thus, the Agency has grouped U246 with the cyanide wastes rather than with these brominated organics. Standards for U246 are proposed in section III.A.6.a.(4.) of today's notice.

EPA is proposing concentration-based standards for the six brominated organic compounds amenable to quantification in waste treatment residuals, namely U029, U030, U066, U067, U068 and U225. The methodology used to develop these standards differs from that used for other organic U and P wastes. Incineration data from an Office of Toxic Substances burn of ethylene dibromide included analysis of ethylene dibromide in the untreated waste as well as the ash and scrubber water treatment residuals, but did not include analysis for any of the other brominated organics. EPA used these data to develop the proposed treatment standards for U067 (EDB) wastes. At the same time, the Agency is proposing to directly transfer these standards to U029, U030, U066, U068 and U225 wastes.

Bromoacetone (P017) is relatively unstable in water and therefore cannot be reliably analyzed in wastewaters or other residues where contact with water might be expected. Based on this relative instability of bromoacetone, the resultant difficulty in analyzing treatment residues for bromoacetone, and the demonstration of incinerability of ethylene dibromide (which is more difficult to incinerate than bromoacetone), the Agency is proposing to establish "Incineration as a Method of Treatment" as a treatment standard for P017 nonwastewaters.

During the EPA-sponsored rotary kiln incineration of the ethylene dibromide wastes, the Agency determined that certain operating conditions were required in order to prevent the release of toxic bromine gas. In order to oxidize the bromine released in the organobromine compound combustion process to soluble bromide which can be removed effectively with an air pollution control device such as a scrubber, sulfur was added to modify flame stoichiometry to form soluble bromide

rather than molecular bromine gas. These specific conditions are outlined in the background document for these wastes.

Federal regulations currently do not limit the amount of bromine emitted to the air. The Agency is specifically soliciting comment and data on whether these particular incinerator operating conditions can or should be specified as part of the incineration requirements for these wastes. The Agency recognizes that different incinerators have different designs, and that the conditions identified in the test burn may not be reasonably extrapolated to other incinerators.

As an alternative to specifying these conditions, the Agency is also considering establishing a maximum bromide level in the feed to the incinerators for these seven brominated organic wastes and thereby establish a blending requirement. However, the Agency has not identified a maximum level for bromide and thus has not determined the resultant blending requirements for these seven brominated organics. Another alternative to achieve the same results may be to establish an overall maximum loading of the concentrated brominated organics in the incinerator feed stream.

The Agency is therefore soliciting comment and data that would assist the Agency in determining the viability of these alternative standards for these wastes. Specifically, the Agency solicits supporting evidence on concentrations of bromine in waste feeds that have been successfully incinerated including substantiation that emissions of bromine gas do not pose significant risk to human health and the environment. This information should include specific design and operating conditions established to prevent these emissions and/or specific established restrictions (either regulatory or company policy) on the concentrations of total bromine in waste feeds. Prospective commenters are referred to section III.A.1.i. for explanation of the special procedures that the Agency intends to utilize to provide additional rapid notice and comment on any new data and information received prior to the closure of the comment period and should identify their interest in receiving notice on data for brominated organics specifically as III.A.2.e.

The Agency is currently investigating recent information suggesting that concentrated brominated organics can be processed through a specific thermal unit designed to break off the bromine for purposes of recovery of bromine. Sufficient details of this process were not available in time to describe it in

this proposal. While the Agency may not be able to identify this process as BDAT in time for promulgation of the final rule, it is not precluded from establishing this as BDAT sometime in the future. Finally, the Agency reiterates that in-plant recycling preceding disposal is nowhere prohibited under RCRA.

The treatment standards for wastewater forms of these U wastes presented in the tables following this section, have been calculated based on the detection limits of these constituents in scrubber waters from incineration of the ethylenedibromide wastes. However, additional are available for the treatment of some of these constituents in wastewaters (see previous discussion in section III.A.2.a.(3.) on the proposed promulgation of standards based on these additional data) and will probably be used for the promulgation of the final standards.

While the Agency currently lacks data indicating the treatability of bromoacetone (P017) in water, its relative instability in water supports the inference that it should easily be destroyed with any chemical oxidant and most probably at ambient temperature and air pressure. Since wet air oxidation is typically operated at relatively high temperatures and pressures, the Agency believes that wet air oxidation should provide a more efficient oxidation than simple chemical oxidation. In order to ensure complete destruction, the Agency is therefore proposing that wet air oxidation represents BDAT for P017 wastewaters. However, because bromoacetone is relatively unstable in water, the Agency is also proposing chemical oxidation as an alternative method of treatment.

The Agency also believes that incineration, while not always practical for wastewaters, will provide an efficient destruction of P017 wastewaters. Since the Agency does not want to preclude the use of incineration for P017 wastewaters, it is also being proposed as an alternative treatment technology.

In a similar manner, while the Agency currently lacks data on the biodegradability of bromoacetone in wastewaters, biodegradation typically results in oxidation of organics. Again, due to the instability of this compound in water, the Agency believes that biodegradation can provide effective removal of P017 from wastewaters. EPA thus is also proposing biodegradation as an alternative treatment method. Since the Agency must specify treatment for P017 wastewaters and currently has no data or means of determining which of

the wastewater treatment technologies can provide the most effective treatment and since the technologies can theoretically provide efficient treatment for this relatively unstable compound, the Agency is proposing all four treatment technologies as BDAT.

BDAT TREATMENT STANDARDS FOR U029, U030, U066, U067, U068, U225

[Nonwastewaters]

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
U029	Methyl Bromide.....	15
U030	4-Bromophenyl phenyl ether..	15
U066	1,2-Dibromo-3-chloropropane.....	15
U067	Ethylene dibromide (EDB).....	15
U068	Dibromoethane.....	15
U225	Bromoform.....	15

BDAT TREATMENT STANDARDS FOR U029, U030, U066, U067, U068, U225

[Wastewaters]¹

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
U029	Methyl Bromide.....	16
U030	4-Bromophenyl phenyl ether..	16
U066	1,2-Dibromo-3-chloropropane.....	16
U067	Ethylene dibromide (EDB).....	16
U068	Dibromoethane.....	16
U225	Bromoform.....	16

¹ Note: Alternative standards for these U and P wastewaters are also proposed and are presented in section III.A.7. as standards for the corresponding chemical in wastewater forms of Multi-source Leachate. See background on these alternative standards in section III.A.1.h.(6).(b.).

BDAT TREATMENT STANDARDS FOR P017

[Nonwastewaters]

Incineration as a method of treatment

BDAT TREATMENT STANDARDS FOR P017

[Wastewaters]

Wet air oxidation; chemical oxidation; biodegradation; or incineration as a method of treatment

f. Miscellaneous Halogenated Organics. EPA has grouped all of the remaining halogenated organics (i.e.,

twenty-six U wastes and ten P wastes) together into a general category identified as miscellaneous halogenated organics. These U and P wastes represent a wide range of chemicals produced in a variety of individual processes. In general, these miscellaneous halogenated organics can be further distinguished by similarities in structure as were the previously mentioned halogenated organic treatability groups. To facilitate developing appropriate treatability standards, EPA thus divided this general category into seven subcategories: 1) chlorinated diphenyls; 2) chlorinated polynuclear aromatics; 3) chlorinated amines, amides, and nitriles; 4) chlorinated methylbenzenes; 5) halogenated aliphatics; 6) halogenated aldehydes, ethers and esters; and 7) halogenated organo-sulfur compounds.

EPA examined data from a total of fourteen test burns that were performed during the course of determining BDAT standards for First Third and Second Third wastes plus data generated in a rotary kiln incinerator test burn EPA performed in June, 1989. (See section III.A.1.h.(6.) of today's preamble for a more complete discussion of this test burn.) These data include analysis of untreated wastes and all residues, including ash and scrubber water, for virtually all the compounds which the BDAT program regulates by means of concentration-based standards (the "BDAT List" compounds) including the miscellaneous halogenated compounds in this subcategory. However, for most of these compounds the only data that were available were detection limits.

In today's notice, EPA is proposing concentration-based standards for fourteen of these thirty-six miscellaneous halogenated organic U and P nonwastewaters based on a transfer from other "surrogate" halogenated constituents that were determined to be similar in structure to the compounds within each subcategory of miscellaneous halogenated organics. EPA believes that nonwastewater forms of all thirty-six miscellaneous halogenated U and P compounds can be destroyed by incineration to detection limits. However, the Agency does not have specific data on the direct incineration of the majority of these miscellaneous halogenated U and P wastes or their corresponding constituents.

The treatment standards for wastewater forms of these U and P miscellaneous halogenated organics presented in the tables following this section, have been calculated based on the detection limits of these constituents

or surrogate halogenated organics in scrubber waters from incineration. However, additional data are available for the treatment of these constituents in wastewaters and alternative standards based on these data are presented in section III.A.7. of today's notice for wastewater forms of multi-source leachate. (See previous discussions on these data and alternative standards in section III.A.1.h.(6.) and III.A.2.a.(3.).)

For twenty-two of these miscellaneous halogenated organics there are analytical complications that preclude the establishment of concentration-based treatment standards. (See complete discussion of analytical complications for U and P wastes in section III.A.1.h.(2.) of today's preamble.) In addition, the quality of the data and resultant concentration-based standard for U017 (benzal chloride) is being re-examined to determine whether the concentration-based standard is valid. As a result EPA is specifying "Incineration as a Method of Treatment" for nonwastewater forms of twenty-three of these miscellaneous halogenated organic wastes and "Wet Air Oxidation or Chemical Oxidation, Followed by Carbon Adsorption; or Incineration as Methods of Treatment" for the corresponding wastewater forms. (See discussion on selecting these technologies as BDAT for halogenated organics in section III.A.2.a. (2.) and (4.) above.) The specified technologies are appropriate for these constituents and have been demonstrated and/or promulgated for similar halogenated organic U and P waste codes. The Agency reminds commenters that there are very few (if any) of these twenty-three wastes that are currently being generated as originally listed and that in practice, the standards will probably only be necessary for residues from previous disposal. The Agency believes that these residues should be less difficult to treat than the original waste as generated.

(1) *Chlorinated Diphenyls.* There are two miscellaneous halogenated organics that are classified as chlorinated diphenyls; 3,3'-dichlorobenzidine (U073) and 4,4-methylene-bis-(2-chloroaniline) (U158). Diphenyls are compounds consisting of two benzene rings attached to a single, common carbon atom. (Diphenyls are not to be confused with biphenyls which have the structure of two benzene rings attached directly to each other.) The chlorinated diphenyls represented by these waste codes differ from those previously mentioned in the halogenated pesticide category (e.g., DDD, DDT, and Methoxychlor) because these diphenyls contain fewer chlorine

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atoms and also include methylene and amine functional groups.

DDD, DDT, and Methoxychlor are believed to be more difficult to destroy than the U073 and U158 because the chlorines at the carbon bridge in DDD, DDT, and Methoxychlor are believed to stabilize the aromatic ring. The Agency has data on the incineration of wastes containing Methoxychlor and another structurally similar halogenated organic known as Pronamide (U192) that were used in developing the standards for U073 and U158 wastes. The Agency believes that Pronamide, a halogenated organo-nitrogen compound (3,5-dichloro N-(1,1-dimethyl-2-propynyl)-benzamide), is more difficult to incinerate than these two chlorinated diphenyls.

Both of the chemicals represented by U073 and U158 are amenable to quantification in treatment residuals by verified SW-846 methods. EPA believes these can both be incinerated to detection limits in ash and scrubber water based on data indicating that DDD, DDT and methoxychlor can be incinerated to detection levels. Therefore EPA is proposing concentration-based standards for U073 and U158 wastewaters and nonwastewaters.

(2) *Chlorinated Polynuclear Aromatics.* Chloronaphazine (U026) and 2-chloronaphthalene (U047) are both classified as chlorinated polynuclear aromatic hydrocarbons. This means that both chemicals contain fused aromatic rings (i.e., polynuclear aromatics) with one having only one attached chlorine while the other has an attached chlorinated amine functional group. The Agency believes that both U026 and U047 can be incinerated to detection limits in ash and scrubber water because of their similarity to Pronamide. The Agency believes that Pronamide, a halogenated organo-nitrogen compound (3,5-dichloro N-(1,1-dimethyl-2-propynyl)-benzamide), is more difficult to incinerate than these chlorinated polynuclear aromatics. Therefore, EPA is proposing treatment standards for U026 and U047 based on incineration as BDAT.

Only U047 is amenable to quantification in treatment residuals by verified SW-846 methods. While chloronaphazine (U026) is amenable to analysis by HPLC, EPA currently rejects HPLC methods as the sole means of establishing treatment standards for reasons discussed in III.A.1.h.(2.). EPA is therefore proposing concentration-based standards for all forms of U047, "Incineration as a Method of Treatment" for nonwastewater forms of U026, and "Wet Air Oxidation or Chemical

Oxidation, Followed by Carbon Adsorption; or Incineration as Methods of Treatment". (See discussion on selecting these technologies as BDAT for all halogenated organics in section III.A.2.a.(4.) and in the introductory discussion for miscellaneous halogenated organics above.)

(3) *Chlorinated Amides, Amines, and Nitriles:*

P024—p-Chloroaniline
P027—3-Chloropropionitrile
P057—2-Fluoroacetamide
U049—4-Chloro-o-toluidine hydrochloride
U097—Dimethylcarbonyl chloride
U192—Pronamide
U222—o-Toluidine hydrochloride

These seven miscellaneous halogenated organics were grouped together because they contain an amide, amine, or nitrile group attached to a relatively simple hydrocarbon structure. Only p-chloroaniline (P024) and Pronamide (U192) are amenable to quantification in treatment residuals by verified SW-846 methods. EPA has data on the incineration of Pronamide that indicate Pronamide can be incinerated to detection levels in the ash and the scrubber water. Thus, concentration-based standards for U192 nonwastewaters are proposed in today's notice based directly on these data. The Agency believes p-chloroaniline (P024) resembles Pronamide closely enough that incineration will also destroy p-chloroaniline to detection limits, and is therefore proposing concentration-based standards for P024 based on a transfer of these data.

While 2-fluoroacetamide (P057) is amenable to analysis by HPLC, EPA currently rejects HPLC methods as the sole means of establishing treatment standards for reasons discussed in III.A.1.h.(2.). In addition, no analytical methods have been verified for 4-chloro-o-toluidine hydrochloride (U049), dimethylcarbonyl chloride (U097), or 3-Chloropropionitrile (P027). Information also indicates that o-Toluidine hydrochloride (U222) is unstable in water. EPA believes incineration is effective for P027, P057, U049, U097 and U222, because three are halogenated aliphatics and expected to be less stable than Pronamide (an aromatic molecule), and the other two are polar aromatics, similar in stability to Pronamide. Thus EPA is proposing a standard of "Incineration as a Method of Treatment" for P027, P057, U049, U097 and U222, based on the incineration data for Pronamide.

For the wastewater forms of P027, P057, U049, U097 and U222, EPA is proposing a treatment standard of "Wet

Air Oxidation or Chemical Oxidation, Followed by Carbon Adsorption; or Incineration as Methods of Treatment". (See discussion on selecting these technologies as BDAT for halogenated organics in section III.A.2.a.(4.) above.) These wastewater technologies are appropriate for these constituents and have been demonstrated and/or promulgated for similar halogenated U and P waste codes.

(4) *Chlorinated Methylbenzenes.* Benzyl chloride (P028) and benzal chloride (U017) have been grouped together because they both consist of a toluene moiety with chlorines attached to the methyl group. In section II.A.6.(d.) of today's notice EPA is proposing concentration-based standards for benzal chloride in K015 wastes (still bottoms from the distillation of benzyl chloride) based on a transfer of K019 incineration data for p-dichlorobenzene. Wastewater standards for benzal chloride in K015 wastewaters were promulgated with the First Third Wastes. Therefore, the Agency is proposing these treatment standards for U017 wastewaters and nonwastewaters based on a similar transfer.

Benzal chloride (U017) is relatively unstable in water and the Agency is concerned that the analysis for this compound in treatment residuals may not be reproducible. As an alternative to the concentration-based standard for U017 nonwastewaters, the Agency is also proposing "Incineration as a Method of Treatment" as BDAT. Commenters on this approach should submit QA/QC data that verify their particular position of this matter. The Agency points out that it currently has no QA/QC data that support the reproducibility of the benzal chloride analysis for treatment residues, and that the Agency prefers to establish a method of treatment rather than a concentration-based standard for U017 wastewaters and nonwastewaters.

In a similar manner, benzyl chloride (P028) is unstable in water. The Agency is thus proposing a standard of "Incineration as a Method of Treatment" for P028 nonwastewaters, based on the incineration data that indicates p-dichlorobenzene and Pronamide can be destroyed to detection levels in incinerator ash. Both of these chemicals are more stable than P028.

For the wastewater forms of U017 and P028, EPA is also proposing a treatment standard of "Wet Air Oxidation or Chemical Oxidation, Followed by Carbon Adsorption; or Incineration as Methods of Treatment". (See discussion on selecting these technologies as BDAT for halogenated organics in section

III.A.2.a.(4.) above.) These wastewater technologies are appropriate for these constituents and have been demonstrated and/or promulgated for similar U and P waste codes.

(5) *Halogenated Aliphatics.*

U043—Vinyl chloride
U045—Chloromethane
U075—Dichlorodifluoromethane
U121—Fluorotrichloromethane
U138—Iodomethane

This subcategory of miscellaneous halogenated organics consists of five chemicals that have been grouped together because they have one or two carbon atoms with at least one chlorine, fluorine, or iodine attached. EPA believes that 1,1,1-trichloroethylene and carbon tetrachloride, which also contain one or two carbons with three or four chlorines attached, represent the degree of difficulty anticipated in incinerating the simple halogenated aliphatics belonging to this subgroup. While the carbon-fluoride bonds in U075 and U121 are known to be much stronger than the carbon-chlorine bond in carbon tetrachloride molecule, EPA believes that the overall degree of difficulty of incineration is similar enough to justify a transfer of these incineration data for the purposes of developing treatment standards for land disposal of these wastes.

Thus, EPA concludes incineration will reduce these wastes to detection limits in ash and scrubber water and is proposing concentration-based standards accordingly. Since all five of these compounds are amenable to quantification in treatment residuals by verified SW-846 methods, EPA is proposing concentration-based standards for wastewater and nonwastewater forms of U043, U045, U075, U121 and U138.

(6) *Halogenated Aldehydes, Ethers and Esters.*

P016—Bis-chloromethyl ether
P023—Chloroacetaldehyde
P058—Fluoroacetic acid, sodium salt
P095—Phosgene
U006—Acetyl Chloride
U024—Bis 2-chloroethoxymethane
U025—Dichloroethyl ether
U027—Bis-2-chloroisopropyl ether
U033—Carbonyl fluoride
U034—Trichloroacetaldehyde
U041—n-Chloro-2,3-epoxypropane
U042—2-Chloroethyl vinyl ether
U046—Chloromethyl methyl ether
U156—Methyl chlorocarbonate

This subcategory of miscellaneous halogenated organics consists of fourteen chemicals grouped together

because they are relatively simple oxygenated hydrocarbons with various degrees of halogenation. The oxygenated hydrocarbons include ethers, esters, and aldehydes.

Of these fourteen chemicals, only bis-2-chloroethoxymethane (U024), dichloroethyl ether (U025), bis-2-chloroisopropyl ether (U027), and 2-chloroethyl vinyl ether (U042) are amenable to quantification in treatment residuals by verified SW-846 methods. However, EPA's data on the detection limits of 2-chloroethyl vinyl ether (U042) in incinerator ash are so variable that the resultant calculated treatment standard results in a standard that is in the low percent range. Since the data show that incineration can achieve detection limits for a variety of wastes, and since the resultant high treatment standard could potentially allow a waste with high concentrations of U042 to go untreated, the Agency has chosen to propose "Incineration as a Method of Treatment" as a treatment standard for U042 nonwastewaters. The Agency believes that this will ensure these wastes will be treated to levels that represent BDAT. For U024, U025, and U027 (which are also amenable to quantification) EPA is proposing concentration-based standards based on the ability of incineration technologies to destroy Pronamide and chlorobenzene to detection limits in ash and scrubber water. The Agency believes that Pronamide (a halogenated organo-nitrogen compound also identified as 3,5-dichloro N-(1,1-dimethyl-2-propynyl)-benzamide) and chlorobenzene are more difficult to incinerate than these halogenateds because both have more complex structures and stronger bonding than U024, U025, and U027 wastes.

There are currently no verified SW-846 methods for the constituents represented by P058, U034, or U156. In addition, constituents represented by P016, P023, P095, U006, U033, U041, and U046 are all unstable in water. As a result, EPA is proposing "Incineration as a Method of Treatment" as treatment standards for nonwastewater forms of P016, P023, P058, P095, U006, U033, U034, U041, U042, U046, and U156. Based on the simplicity of structure, EPA believes all of these compounds are easier to incinerate than chlorobenzene and/or Pronamide. This is particularly substantiated by the aforementioned relative instability of seven of these U and P wastes.

For the wastewater forms of P016, P023, P058, P095, U006, U033, U034,

U041, U042, U046, and U156, EPA is proposing a treatment standard of "Wet Air Oxidation or Chemical Oxidation, Followed by Carbon Adsorption; or Incineration as Methods of Treatment". (See discussion on selecting these technologies as BDAT for halogenated organics in section III.A.2.a.(4.) above.) These wastewater technologies are appropriate for these constituents and have been demonstrated and/or promulgated for similar U and P waste codes.

(7) *Chlorinated Organo-Sulfur.*

P026—1-(o-Chlorophenyl) thiourea
P118—Trichloromethanethiol
U020—Benzenesulfonyl chloride
U062—Diallate

These four miscellaneous halogenated organics have been grouped together because they are chlorinated organo-sulfur chemicals. The majority of the organo-sulfur compounds are discussed in section III.A.3. of today's preamble. Note: The Agency is soliciting comment on the potential need for control of sulfur dioxide emissions from the incineration of these wastes.

The Agency is proposing a standard of "Incineration as a Method of Treatment" in nonwastewaters for all four of these wastes. While P026 and U062 are amenable to analysis by HPLC, EPA currently rejects HPLC methods as the sole means of establishing treatment standards for reasons discussed in "Analytical Considerations". In addition, no verified SW-846 analytical methods are available for the constituents represented by P118 or U020. The Agency bases this choice of incineration as a method on the incineration data that indicates 1,1,1-trichloroethane as well as tetrachloroethene, Pronamide, and chlorobenzenes can all be destroyed to detection levels in incinerator ash and scrubber water.

For the wastewater forms of P026, P118, U020, and U052, EPA is proposing a treatment standard of "Wet Air Oxidation or Chemical Oxidation, Followed by Carbon Adsorption; or Incineration as Methods of Treatment". (See discussion on selecting these technologies as BDAT for halogenated organics in section III.A.2.a.(4.) above.) These wastewater technologies are appropriate for these constituents and have been demonstrated and/or promulgated for similar U and P waste codes.

BDAT TREATMENT STANDARDS FOR P024, U017, U024, U025, U027, U043, U045, U047, U073, U075, U121, U138, U158, AND U192

[Nonwastewaters]

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
P024	p-Chloroaniline.....	16
U017	Benzal chloride.....	6.2
U024	Bis (2-chloroethoxy) methane.....	7.2
U025	Dichloroethyl ether.....	7.2
U027	Bis-2-chloroisopropyl ether.....	7.2
U043	Vinyl chloride.....	0.035
U045	Chloromethane.....	5.6
U047	2-Chloronaphthalene.....	5.6
U073	3,3'-Dichlorobenzidine.....	16
U075	Dichlorodifluoromethane.....	10
U121	Fluorotrichloromethane.....	33
U138	Iodomethane.....	65
U158	4,4-Methylene-bis-(2-chloroaniline).....	29
U192	Pronamide.....	1.5

BDAT TREATMENT STANDARDS FOR P024, U017, U024, U025, U027, U043, U045, U046, U073, U075, U121, U138, U158, AND U192

[Wastewaters] ¹

Waste code	Regulated constituent	Maximum for single grab sample, total composition (mg/l)
P024	p-Chloroaniline.....	0.28
U017	Benzal chloride.....	0.28
U024	Bis (2-chloroethoxy) methane.....	0.064
U025	Dichloroethyl ether.....	0.013
U027	Bis-2-chloroisopropyl ether.....	0.064
U043	Vinyl chloride.....	0.033
U045	Chloromethane.....	0.023
U047	2-Chloronaphthalene.....	0.073
U073	3,3'-Dichlorobenzidine.....	0.022
U075	Dichlorodifluoromethane.....	0.14
U121	Fluorotrichloromethane.....	0.13
U138	Iodomethane.....	0.23
U158	4,4-Methylene-bis-(2-chloroaniline).....	0.74
U192	Pronamide.....	0.039

¹ Note: Alternative standards for these U and P wastewaters are also proposed and are presented in section III.A.7. as standards for the corresponding chemical in wastewater forms of Multi-source Leachate. See background on these alternative standards in section III.A.1.h.(6.)b).

BDAT TREATMENT STANDARDS FOR P016, P023, P026, P027, P028, P057, P058, P095, P118, U006, U017, U020, U026, U033, U034, U041, U042, U046, U049, U062, U097, U156, AND U222

[Nonwastewaters]

Incineration as a Method of Treatment

BDAT TREATMENT STANDARDS FOR P016, P023, P026, P027, P028, P057, P058, P095, P118, U006, U017, U020, U026, U033, U034, U041, U042, U046, U049, U062, U097, U156, AND U222

[Wastewaters]

Wet air oxidation or chemical oxidation, followed by carbon adsorption; or incineration as methods of treatment

3. Proposed Treatment Standards for Additional Organic Wastes—a.

Introduction. In the previous section of today's preamble (III.A.2.), the Agency identified that many of the chemicals represented by the U, P, and K wastes fall under a general category of chemicals known as halogenated organics. The majority of the remaining organic U and P wastes have been grouped together into seven additional subcategories of "nonhalogenated" organic wastes and a discussion of each is presented in this section (III.A.3.) of today's preamble. The seven major subcategories of wastes are based primarily on similarities in the structure of these organic chemicals (i.e., elemental composition and the presence of organic functional groups). These subcategories are also based partially on the industrial use (e.g., the wastes of a pharmaceutical nature) and waste generation patterns of the U and P wastes. These major subcategories include: aromatics and other hydrocarbons, polynuclear aromatic hydrocarbons, phenolics, oxygenated hydrocarbons and heterocyclics, organo-nitrogen compounds, organo-sulfur compounds, and wastes of a pharmaceutical nature.

(1) Fuel Substitution as an Alternative Treatment Method. BDAT standards for the nonwastewater forms of these U and P nonhalogenated organics are proposed based primarily on performance data from incineration of similar wastes. Since many of the nonhalogenated chemicals represented by these U and P waste codes generally have reasonably high BTU values (e.g., the aromatics and the polynuclear aromatics) and since U and P wastes are typically off-specification or discarded products, they might be expected to be well suited for fuel substitution purposes. However, despite this fuel value and the fact that these compounds consist primarily of hydrogen and carbon, many of these wastes may be considered unacceptable for fuel substitution due to their relatively high toxicity and acid formation capability (due incineration).

In addition, it appears that there is sufficient incineration capacity to accommodate these wastes, so that use of fuel substitution capacity is not needed to avoid granting a national capacity variance for these wastes. It also appears that only the oxygenated hydrocarbons and heterocyclics (seventeen of the eighty two U and P nonhalogenated wastes) are likely candidates for use as fuel substitutes. The Agency does not believe that fuel substitution is a viable alternative for the majority (sixty five) of the specific U and P waste codes identified in this section.

In today's rule, the Agency is proposing that incineration represents BDAT for all of the nonhalogenated organics presented in this section. Where the Agency is proposing "Incineration as a Method of Treatment" as the nonwastewater treatment standard for a particular organic waste code, it has not included fuel substitution as an alternative except for seventeen of the oxygenated hydrocarbon and heterocyclic wastes. However, where the Agency has proposed concentration-based standards (i.e., sixty one U and P nonhalogenated wastes), thermal destruction in fuel substitution units is not precluded. The Agency points out that all facilities incinerating these wastes must comply with 40 CFR 264 Subpart O or 265 Subpart O.

(2) Additional Wastewater Treatment Data. Additional wastewater treatment data primarily from the Agency's Office of Water have been recently analyzed for incorporation into the treatment standards for many of the U and P wastes in this section. These data include the treatment of wastewaters that are not specifically listed as U or P wastewaters, but do contain many of the corresponding U or P constituents. While these data were not available in time to incorporate into this discussion or into the background document for these wastes, these data are being placed in the administrative record for today's notice. Therefore, the Agency is not precluded from using these data in promulgating the standards for these wastes. Further information on these data can be found in section III.A.1.h.(6.).

Alternative standards based on these data are anticipated to be similar to those presented in section III.A.7. of today's notice for wastewater forms of multi-source leachate. These standards are presented on a constituent basis and correspond to what may be promulgated for the respective U or P wastewater. Thus, the Agency is proposing these

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standards as alternative standards for all U and P wastewaters for which concentration-based standards based on incinerator scrubber waters have been proposed in the following sections.

(3) *Specifying Technologies for Nonhalogenated Wastewaters.* Based on analytical complications previously discussed in section III.A.1.h.(2.), the Agency is also proposing certain methods of treatment as the treatment standards for many of the nonhalogenated U and P wastewaters. In the following sections (III.A.3.b. through h.) of the preamble the Agency identifies eighty two specific nonhalogenated organic U and P wastes for which the Agency is proposing four treatment technologies as alternative BDAT treatment standards: (1) Wet air oxidation followed by carbon adsorption; (2) Chemical oxidation followed by carbon adsorption; (3) Biodegradation followed by carbon adsorption; or (4) Incineration of wastewaters. Since these technologies are known to provide effective treatment for the other nonhalogenated organic constituents within each treatability group (as identified in III.A.3.) that can be analyzed, the Agency is therefore proposing these multiple treatment technologies for all of the eighty two U and P constituents that require specified methods of treatment.

Biodegradation has been specified as an alternative technology for these nonhalogenated organics in wastewaters, because these chemicals are generally thought of as more easily biodegraded than the halogenated organics due to the overall higher toxicity of the halogenated compared to their nonhalogenated counterparts. This is further supported by the fact that there are certain forms of biota that utilize the nitrogen or the sulfur contained in many of these nonhalogenated organics for metabolic purposes and that the hydrogen, carbon, and oxygen contained in the majority of the structures of these chemicals serve as a food source for many forms of the biota.

Carbon adsorption has been specified as part of the treatment train because the eighty two nonhalogenated U and P organics are believed to be adsorbable when present in low concentrations, as might be expected in an effluent from either wet air oxidation, chemical oxidation, or biodegradation. The Agency further recognizes that while difficulties can arise in specifying only one treatment method for these wastewaters (as outlined in greater detail in section III.A.1.h.(7.)), the Agency must develop a treatment

standard for these wastes to avoid the hard hammer and at the same time, somehow justify that these technologies provide significant treatment. None of these technologies have been specifically identified as better than the others by the Agency, because of the lack of data for these constituents (due to the identified analytical complications) or for any surrogate parameters.

b. Aromatics and Other Hydrocarbons

U019—Benzene

U055—Cumene (isopropyl benzene)

U056—Cyclohexane

U186—1,3-Pentadiene

U220—Toluene (methyl benzene)

U239—Xylenes (dimethyl benzenes)

EPA grouped these waste codes together because the primary constituents for which the waste was listed are either aromatic or alicyclic compounds. This group of chemicals, except for cyclohexane (U056) and 1,3-Pentadiene (U186), all contain one benzene ring. Cumene (U055), toluene (U220), and xylenes (U239) consist of a benzene ring with aliphatic side chains. Cyclohexane (U056), a cycloalkane, has been included in this group because of its ability to be converted by catalytic reforming into aromatic hydrocarbons. Conversely, the addition of hydrogen (hydrogenation) to an aromatic compound yields cyclic aliphatic compounds, specifically cyclohexane derivatives, e.g., the hydrogenation of benzene yields pure cyclohexane. 1,3-pentadiene (U186) is a five carbon chain with two conjugated double bonds (i.e., a diene) that provide a certain degree of aromaticity to the chemical, making it somewhat similar to the others in the group. For the purpose of determining BDAT, all of these wastes have been grouped together into one treatability group identified as aromatics and other hydrocarbons. The proposed treatment standards for this waste group are presented expressed either as a concentration-based standard or as a method of treatment.

(1) *Wastes for Which EPA is Proposing Concentration-Based Standards.* In developing the standards for aromatics and other hydrocarbon wastes, the Agency incorporated into its analysis some chemical variability by reviewing data from several incineration test burns conducted by EPA for various F and K wastes. Analysis of these data identified extensive treatment and detection limit data for benzene (U019), toluene (U220), and xylenes (U239) from the test burns of K001, K037, K048, K051, K087, K101, and K102 wastes. These data represent a myriad of different

hazardous waste types generated and treated at several different facilities. The waste characterization data indicates that for these three constituents, concentrations in the different wastes varied from very low levels in some wastes to high levels in others. For example, toluene concentrations in the wastes ranged from 17 ppm in K087 waste to 2,000 ppm in K037 waste.

Concentration-based treatment standards for U019, U220 and U239 wastes are thus proposed based on the analysis of data on the performance of incineration of: (1) K001 (bottom sediment sludge from the treatment of wastewaters from wood preserving processes that use creosote and/or pentachlorophenol); (2) K037 (wastewater treatment sludges from the production of disulfoton); (3) K048 (dissolved air flotation (DAF) float from the petroleum refining industry); (4) K051 (API separator sludge from the petroleum refining industry); (5) K087 (decanter tank tar sludge from coking operations); (6) K101 (distillation tar residues from the distillation of aniline-based compounds in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds) and (7) K102 (residue from the use of activated carbon for decolorization in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds) wastes.

Treatment standards for K001, K037, K048, K051, K087, K101 and K102 wastewaters and nonwastewaters were promulgated in the First Third final rule on August 8, 1988. These standards, measured as concentrations found in the ash and scrubber water, were based on the performance of rotary kiln or fluidized bed incineration.

EPA analyzed for benzene (U019), toluene (U220) and xylenes (U239) in the incineration residues (ash and scrubber water) from these test burns as follows: (1) six data sets for benzene and toluene in K001; (2) six data sets for xylene in K037; (3) six data sets for benzene and toluene in K048 and K051; (4) six data sets for benzene, toluene and xylene in K087; (5) six data sets for toluene in K101 and (6) six data sets for toluene and xylene in K102. In general, data from the test burns showed that the majority of the measured values for the three aromatic constituents were analyzed at concentrations below detection levels in the incineration residues. Detection limits for the ash ranged from 0.005 ppm to 10 ppm. The detection limits for the scrubber water ranged from 0.002 ppm to 0.010 ppm.

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The Agency also reviewed performance data on the treatment of toluene and xylenes obtained from a rotary kiln incinerator test burn EPA performed in June, 1989. The feed also included other RCRA hazardous wastes that contained these constituents yielding total concentrations of these constituents at the percent level. (See further discussion of this test burn in section III.A.1.h.(6.) of today's preamble.)

The Agency believes that all of these data represent a sufficient range of concentrations of these aromatic hydrocarbons in the untreated wastes and are thus considered representative of what the Agency would anticipate to find present in the respective U wastes. The Agency has reviewed both characterization and performance data from all seven test burns to develop concentration-based treatment standards for U019, U220, and U239 and has determined, as explained in the background document, that K001 is most appropriate for the transfer to these U wastes.

The Agency is regulating xylenes (U239) by setting a single concentration-based treatment standard which will represent the sum of the concentrations of o-xylene, m-xylene, and p-xylene present in the waste treatment residual. The basis of concentration numbers therefore will be the sum of the areas under all peaks identified as o-xylene, m-xylene or p-xylene in the chromatographic spectrum. The forthcoming first update to the third edition of SW-846 includes Method 8260 (GC/MS for volatile organics using a capillary column) which can quantify the individual isomers of xylene. Nevertheless, the Agency chooses to regulate xylenes as a collective unit, rather than individually, to allow the regulated community to use SW-846 Method 8240 because it is already validated for xylenes, less cumbersome and available in current editions of SW-846. More information on the development of treatment standards can be found in the Background Document for Aromatic Compounds in the RCRA docket.

(2) *Wastes for Which EPA is Proposing a Method of Treatment as BDAT.* The Agency does not believe that concentration-based standards can be established for U055, U056 and U186 wastes at this time. The major problem in establishing concentration-based standards for these wastes is that EPA does not currently have a verified SW-

846 analytical method that can analyze for the concentrations of cumene (U055), cyclohexane (U056), or 1,3-pentadiene (U186) in treatment residues. As a result, a concentration-based treatment standard for these waste codes is apparently not feasible and thus, the Agency is proposing a treatment standard of "Incineration as a Method of Treatment" for U055, U056 and U186 nonwastewaters. For U055, U056 and U186 wastewaters, EPA is proposing "Wet Air Oxidation or Chemical Oxidation, Followed by Carbon Adsorption; Biodegradation Followed by Carbon Adsorption; or Incineration as a Method of Treatment." These wastewater technologies are appropriate for these constituents and have been demonstrated and/or promulgated for similar U and P waste codes (see preceding discussion in III.A.3.a.(3)).

BDAT TREATMENT STANDARDS FOR U019, U220, AND U239

[Nonwastewaters]

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
U019	Benzene.....	36
U220	Toluene.....	28
U239	Xylene(s).....	33

BDAT TREATMENT STANDARDS FOR U019, U220, AND U239

[Wastewaters]¹

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
U019	Benzene.....	0.033
U220	Toluene.....	0.028
U239	Xylene(s).....	0.032

¹ Note: Alternative standards for these U and P wastewaters are also proposed and are presented in section III.A.7. as standards for the corresponding chemical in wastewater forms of Multi-source Leachate. See background on these alternative standards in section III.A.1.h.(6)(b.).

BDAT TREATMENT STANDARDS FOR U055, U056 AND U186

[Nonwastewaters]

Incineration as a Method of Treatment		
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BDAT TREATMENT STANDARDS FOR U055, U056 AND U186

[Wastewaters]

Wet air oxidation or chemical oxidation followed by carbon adsorption; biodegradation followed by carbon adsorption; or incineration as methods of treatment

c. Polynuclear Aromatic Hydrocarbons.

- U005—2-Acetylaminofluorene
- U016—Benz(c)acridine
- U018—Benz(a)anthracene
- U022—Benzo(a)pyrene
- U050—Chrysene
- U051—Creosote
- U063—Dibenzo(a,h)anthracene
- U064—1,2,7,8-Dibenzopyrene
- U094—7,12-Dimethyl benz(a)anthracene
- U120—Fluoranthene
- U137—Indeno(1,2,3-c,d)pyrene
- U157—3-Methylchloanthrene
- U165—Naphthalene

EPA grouped these thirteen U wastes together because the primary constituents for which the wastes were listed are polynuclear aromatic hydrocarbons. All of these compounds are very similar in chemical composition and structure (i.e., they all consist of multiple fused-ring aromatic hydrocarbons). For purposes of determining BDAT, all of these wastes have been grouped together into one treatability group identified as polynuclear aromatic hydrocarbons.

(1) *Wastes for Which EPA is Proposing Concentration-Based Standards.* In developing the treatment standard for polynuclear aromatic wastes, the Agency incorporated into its analysis some chemical variability by reviewing data from incineration test burns conducted by EPA for various F and K wastes. Analysis of these data identified extensive treatability and detection limit data for many polynuclear aromatic constituents from the test burns of F024, K001, K019, K048, K051, and K087 wastes. These data represent a myriad of different hazardous waste types generated and treated at several different facilities. The characterization data for untreated wastes indicate that concentrations of these polynuclear aromatics varied from very low levels in some wastes to high levels in others. For example, chrysene waste concentrations ranged from 0.41 ppm in F024 to 6500 ppm in K087.

Concentration-based treatment standards for U005, U016, U022, U050, U063, U120, U137, U157, and U165 wastes are thus proposed based on data

on the performance of incineration of: (1) F024 (various wastes from the production of chlorinated aliphatics such as distillation residues, heavy ends, tars, and reactor clean-out wastes); (2) K001 (bottom sediment sludge from the treatment of wastewaters from wood preserving processes that use creosote and/or pentachlorophenol); (3) K019 (heavy ends from the distillation of ethylene dichloride in ethylene dichloride production); (4) K048 (dissolved air flotation (DAF) float from the petroleum refining industry); (5) K051 (API separator sludge from the petroleum refining industry); and (6) K087 (decanter tank tar sludge from coking operations) nonwastewaters.

Treatment standards for K001, K019, K048, K051, and K087 wastewaters and nonwastewaters were promulgated in the First Third rule on August 8, 1988. Treatment standards for F024 wastes were promulgated in the Second Third rule on June 8, 1989. These standards, measured as concentrations found in the ash and scrubber water, were based on the performance of rotary kiln or fluidized bed incineration.

EPA analyzed for various polynuclear aromatic compounds in the incineration residues (ash and scrubber water) from these test burns as follows: (1) six data sets for benz(a)anthracene, benzo(a)pyrene, chrysene, and indeno(1,2,3-c,d)pyrene in F024; (2) six data sets for benz(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, and naphthalene in K001; (3) six data sets for naphthalene in K019; (4) six data sets for benz(a)anthracene, chrysene, and naphthalene for K048; (5) six data sets for benz(a)anthracene, chrysene, and naphthalene in K051; and (6) six data sets for benz(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, indeno(1,2,3-c,d)pyrene and naphthalene in K087. In general, the majority of the measured values for polynuclear aromatics were below detection for the six constituents analyzed.

The Agency has determined that the waste characterization and incineration performance data from F024, K001, K019, K048, K051, and K087 wastes were sufficient to develop concentration-based treatment standards for U005, U018, U022, U050, U063, U064, U120, U137, U157, and U165 wastes. While specific data were not available on all of these polynuclear aromatic chemicals, EPA is proposing concentration-based standards for the remaining wastes based on a transfer of performance data from structurally similar polynuclear aromatics where data do exist. More information on the development of

treatment standards for these wastes can be found in the Background Document for Polynuclear Aromatic Compounds in the RCRA docket.

(2) *Standards for U051 Waste.* Treatment standards for U051 (creosote) wastes are proposed based on the transfer of performance data from incineration of K001 wastes. Treatment standards for K001 wastewaters and nonwastewaters were promulgated in the First Third final rule on August 8, 1988. The standards for organics in K001 wastes were based on the performance of rotary kiln incineration of K001 nonwastewaters. Treatment standards for the leachable metal constituents in K001 nonwastewaters were established based on the performance of stabilization. The metal constituents in K001 wastewaters were based on chemical precipitation.

The Agency is also proposing to revise the concentration-based treatment standards for K001 organics due to a mathematical error that was made in the calculation of the standards. The revised standards are being proposed along with the corrected standards for U051. Additional information on the revised standards can be found in the amendment to the K001 Background Document.

U051 wastes differ from other U wastes in the polynuclear aromatic group in that the waste is not defined by one chemical or constituent, but by a group of chemicals defined by the generic term of "creosote". Creosote is a derivative of coal that contains a wide range of constituents including cresols, phenols, naphthalene, benz(a)anthracene, benzo(a)pyrene, fluoranthene, chrysene, indeno(1,2,3-cd)pyrene and acenaphthalene. The presence of these polynuclear aromatics is the main reason why this waste code has been placed in this treatability group.

The transfer of performance data from K001 waste is particularly appropriate for U051 because data on the incineration of a K001-creosote waste and a K001-pentachlorophenol waste were used in the development of the treatment standards for that waste. Based on the similarities in concentration of the major hazardous organic constituents anticipated in creosote (U051) to those in K001, and the primary use of creosote as a wood preservative (and hence the relationship to K001) the Agency has decided to propose to regulate the same constituents in U051 as were regulated in K001.

Incineration in a rotary kiln will achieve a level of performance that

represents BDAT for the organics in U051. Thus, EPA is proposing concentration-based standards for six organic constituents in U051. These are naphthalene, pentachlorophenol, phenanthrene, pyrene, toluene, and xylenes. Since the performance data for K001 indicate the presence of treatable quantities of lead in the incinerator ash and based on the anticipated similarities of U051 wastes to K001 wastes, EPA is also proposing treatment standards for lead. These standards are based on stabilization as BDAT for U051 nonwastewaters and chemical precipitation as BDAT for U051 wastewaters.

EPA notes, however, that if U051 is simply discarded before it is used, for example because it is off-specification, then it would be unlikely to have all of the same contaminants as K001 wastes. On the other hand, when U051 is spilled at a wood preserving site, then it could contain the same contaminants, in particular pentachlorophenol and lead, as K001 wastes due to the high potential for cross-contaminated due to prior use of pentachlorophenol at the site. Since the Agency anticipates that most of the U051 wastes come from spill residues at wood preserving sites, EPA is conservatively proposing standards that include those constituents that are likely to be present in this form of the waste. In situations where a facility never used pentachlorophenol or where the U051 is only anticipated to be generated as an off-spec product (and pentachlorophenol was never used in the production equipment), EPA anticipates that the facility's waste analysis plan could be revised so that only the constituents that are likely to be present in that form of the waste are monitored. (See also the discussion in section III.A.1.f.(3.) on waste analysis plans.)

(3) *Wastes for Which EPA is Proposing a Method of Treatment as BDAT.* The Agency has determined that currently, there are no calibration reagents that are routinely available for the measurement of benzo(c)acridine (U016), 1,2,7,8-dimethylbenzo(a)anthracene (U064) and 7,12-dimethylbenzo(a)anthracene in treatment residuals. As a result, a concentration-based standard for these constituents is apparently not feasible. See section III.A.1.h.(2.) (b.) of today's preamble for a further discussion of the Agency's approach in such instances. Since 3004(m) allows the Agency to establish either levels or methods of treatment, the Agency is proposing a standard of "Incineration as a Method of Treatment" for U016, U064 and U094 nonwastewaters. For U016, U064, and

U094 wastewaters the Agency is proposing "Wet Air Oxidation or Chemical Oxidation Followed by Carbon Adsorption; Biodegradation Followed by Carbon Adsorption; or Incineration as a Methods of Treatment." The Agency believes that these technologies are appropriate for treatment of these constituents and have been demonstrated and/or promulgated for similar U and P waste codes (see preceding discussion in III.A.3.a.(3.)).

BDAT TREATMENT STANDARDS FOR U005, U018, U022, U050, U063, U120, U137, U157, AND U165

[Nonwastewaters]

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
U005	2-Acetylaminofluorene	13
U018	Benz(a)anthracene	3.6
U022	Benzo(a)pyrene	3.6
U050	Chrysene	3.6
U063	Dibenzo(a,h)anthracene	13
U120	Fluoranthene	3.6
U137	Indeno(1,2,3-c,d)pyrene	3.6
U157	3-Methylchloanthrene	33
U165	Naphthalene	5.9

BDAT TREATMENT STANDARDS FOR U005, U018, U022, U050, U063, U120, U137, U157, AND U165

[Wastewaters]¹

Waste Code	Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
U005	2-Acetylaminofluorene	0.058
U018	Benz(a)anthracene	0.030
U022	Benzo(a)pyrene	0.030
U050	Chrysene	0.15
U063	Dibenzo(a,h)anthracene	0.012
U120	Fluoranthene	0.030
U137	Indeno(1,2,3-c,d)pyrene	0.030
U157	3-Methylchloanthrene	0.58
U165	Naphthalene	0.007

¹ Note: Alternative standards for these U and P wastewaters are also proposed and are presented in section III.A.7. as standards for the corresponding chemical in wastewater forms of Multi-source Leachate. See background on these alternative standards in section III.A.1.h.(6).(b).

BDAT TREATMENT STANDARDS FOR U051 AND K001

[Nonwastewaters]

Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
Naphthalene	1.5
Pentachlorophenol	7.4
Phenanthrene	1.5
Pyrene	1.5
Toluene	28
Xylene(s)	33

Regulated constituent	Maximum for any single grab sample, TCLP (mg/l)
Lead	0.51

BDAT TREATMENT STANDARDS FOR U051 AND K001

[Wastewaters]

Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
Naphthalene	0.031
Pentachlorophenol	0.18
Phenanthrene	0.031
Pyrene	0.028
Toluene	0.028
Xylene(s)	0.032
Lead	0.037

BDAT TREATMENT STANDARDS FOR U016, U064 AND U094

[Nonwastewaters]

incineration as a method of treatment

BDAT TREATMENT STANDARDS FOR U016, U064 AND U094

[Wastewaters]

Wet air oxidation or chemical oxidation followed by carbon adsorption; biodegradation followed by carbon adsorption; or incineration as methods of treatment

- d. Phenolics.*
 P020—2-sec-Butyl-4,6-dinitrophenol (Dinoseb)
 P034—2-cyclohexyl-4,6-dinitrophenol

- P047—4,6-dinitrocresol and salts
 P048—2,4-dinitrophenol
 U052—Cresol (Cresylic Acid)
 U101—2,4-Dimethyl phenol
 U170—4-Nitrophenol
 U188—Phenol
 U201—Resourcinol

EPA grouped these four P wastes and five U wastes together because the chemicals they represent are all nonhalogenated organic compounds in which one or more hydroxyl groups (OH) are attached to the benzene ring (i.e., phenolics). These compounds are further divided into two subcategories based on whether or not a nitro group (NO₂) is attached to the phenolic compound.

EPA selected one compound that is representative of the treatability of both subcategories for the purpose of transferring standards. Dinoseb is a representative of the nitrophenolics and phenol is a representative of the other phenolics. Because the representative wastes are so similar to the other wastes in this treatability group, the Agency is proposing to transfer treatment performance data to the other waste codes they represent in each subcategory with the exception of P034, as discussed at the end of this section.

(1) P020, P047, P048, U101, U170, U188, and U201. The Agency has performance data on the treatment of Dinoseb and phenol obtained from a rotary kiln incinerator test burn EPA performed in June, 1989. The feed included three hazardous wastes and fifteen commercial chemical products representing a number of treatability groups. Dinoseb and phenol were present in the waste feed at concentrations of 8.9% and 1.4%, respectively. (More information on the test burn can be found in section III.A.1.h.(6.) of today's preamble as well as in the Onsite Engineering Report of the Third Third Incineration Treatability Test, July, 1989).

Additional treatment data exist for phenol and p-cresol. The wastes for which these data exist include: (1) K001 (bottom sediment sludge from the treatment of wastewaters from wood preserving processes that use creosote and/or pentachlorophenol); (2) K019 (heavy ends from distillation of dichloride in ethylene dichloride production); (3) K022 (distillation bottom tars from the production of phenol/acetone from cumene); (4) K087 (decanter tank tar sludge from coking operations); and (5) K102 (residue from the use of activated carbon for

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decolorization in the production of veterinary pharmaceuticals from arsenic or organoarsenic compounds).

These data represent different waste types containing phenol and p-cresol that were treated by incineration. Six sample sets were analyzed in K001, nine in K019, six in K022, and five samples in K102. In general, phenol and p-cresol were treated to the detection limits in the ash and scrubber water. The detection limits ranged from 0.50 ppm to 3.8 ppm for the ash, and 0.002 mg/l to 0.023 mg/l for the scrubber water. The concentrations in the untreated waste ranged from 4 ppm to 1000 ppm.

These data, along with the data from the June, 1989 test burn, were used to develop concentration-based standards for nonwastewater forms of P020, P047, P048, U101, U170, U188, and U201. These incineration data are also the only available treatment data for these wastes.

The Agency is in the process of conducting wastewater treatment tests for wastewater forms of these wastes using wet air oxidation, PACT (powdered activated carbon treatment), and carbon adsorption. These data are available in the administrative record for today's notice. Where the Agency has actual wastewater treatment data, it prefers to use that data rather than use scrubber water concentrations to develop wastewater treatment standards. Today's concentration-based wastewater standards are based on incinerator scrubber water.

(2) P034. Because no calibration standard exists for 2-cyclohexyl-4,6-dinitrophenol (P034), the compound cannot be routinely analyzed. When the Agency is unable to set a concentration-based treatment standard, the Agency prefers to set a method of treatment. Thus, the Agency is proposing a standard of "Incineration as a Method of Treatment" for P034 nonwastewaters. This is justified because of the structural similarity between 2-cyclohexyl-4,6-dinitrophenol and 2-sec-Butyl-4,6-dinitrophenol (P020—Dinoseb), and because the Agency has data on P020 demonstrating incineration can achieve detection limits for these phenolics.

For P034 wastewaters the Agency is proposing "Wet Air Oxidation or Chemical Oxidation, Followed by Carbon Adsorption; Biodegradation Followed by Carbon Adsorption; or Incineration as Methods of Treatment." The Agency believes that these technologies are appropriate for treatment of P034 and have been

demonstrated and/or promulgated for similar phenolics (see also preceding discussion in III.A.3.a.(3)).

(3) P047. According to 40 CFR 261.33(e), wastes identified as P047 are listed for the presence of 4,6-dinitrocresol and salts. Because these salts are not analyzed as 4,6-dinitrocresol, the Agency is today proposing standards of "Incineration as a Method of Treatment" for P047 nonwastewaters identified as "salts of 4,6-dinitrocresol" and "Wet Air Oxidation or Chemical Oxidation, Followed by Carbon Adsorption; Biodegradation Followed by Carbon Adsorption; or Incineration as Methods of Treatment" for P047 wastewaters identified as "salts of 4,6-dinitrocresol". This is justified because of the structural similarity between 4,6-dinitrocresol and 2-sec-Butyl-4,6-dinitrophenol (P020—Dinoseb), and because the Agency has data on P020. (See preceding discussion in sections III.A.3.a.(3.) on specifying treatment for wastewaters containing nonhalogenated organics and the related discussion of treatment standards for U240 wastes (2,4-D, salts and esters) in section III.A.2.c.(4.)(c).)

For P047 wastes expected to be simply 4,6-dinitrocresol, the Agency is also proposing concentration-based standards based on the analysis for only 4,6-dinitrocresol. Thus, where a facility can reasonably assume that only 4,6-dinitrocresol is being handled, only the concentration-based treatment standard for 4,6-dinitrocresol would be applied. However, should one expect that salts or esters could be formed during storage, treatment, or disposal, the P047 wastes would have to be treated by the specified methods depending upon the form of the waste.

(4) U052. U052 is listed as "cresols (cresylic acid)". Cresylic acid is the name given to a mixture of three isomeric cresols (methyl phenols), in which the meta-cresol predominates. Thus, U052 typically contains various levels of ortho-cresol, meta-cresol and para-cresol. Analytical methods are usually reported for o-cresol and a combination of m- and p-cresol, because m-cresol and p-cresol cannot be distinguished by the analytical method. Thus, the Agency is today proposing concentration-based standards for U052 based on an analysis for o-cresol and the mixture of m-cresol and p-cresol.

BDAT TREATMENT STANDARDS FOR P020, P047, P048, U052, U101, U170, U188, AND U201

[Nonwastewaters]

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
P020	2-sec-Butyl-4,6-dinitrophenol.....	2.5
P047	4,6-dinitrocresol (incineration for salts).....	140
P048	2,4-dinitrophenol.....	140
U052	o-Cresol.....	5.6
U052	Cresol (m- and p-isomers).....	3.2
U101	2,4-Dimethyl phenol.....	14
U170	4-Nitrophenol.....	65
U188	Phenol.....	6.2
U201	Resourcinol.....	1.8

BDAT TREATMENT STANDARDS FOR P020, P047, P048, U052, U101, U170, U188, AND U201

[Wastewaters]¹

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
P020	2-sec-Butyl-4,6-dinitrophenol...	0.036
P047	4,6-dinitrocresol (wet air/carbon for salts).....	0.18
P048	2,4-dinitrophenol.....	0.18
U052	o-Cresol.....	0.0068
U052	Cresol (m- and p-isomers).....	0.028
U101	2,4-Dimethyl phenol.....	0.045
U170	4-Nitrophenol.....	0.18
U188	Phenol.....	0.091
U201	Resourcinol.....	8.2

¹ Note: Alternative standards for these U and P wastewaters are also proposed and are presented in section III.A.7. as standards for the corresponding chemical in wastewater forms of Multi-source Leachate. See background on these alternative standards in section III.A.1.h.(6.)(b).

BDAT TREATMENT STANDARDS FOR P034 AND P047 (SALTS)

[Nonwastewaters]

Incineration as a method of treatment

BDAT TREATMENT STANDARDS FOR P034 AND P047 (SALTS)

[Wastewaters]

Wet air oxidation or chemical oxidation followed by carbon adsorption; biodegradation followed by carbon adsorption; or incineration as methods of treatment

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e. Oxygenated Hydrocarbons and Heterocyclics

P001—Warfarin (<3%)
 P003—Acrolein
 P005—Allyl alcohol
 P088—Endothall
 P102—Propargyl alcohol
 U001—Acetaldehyde
 U002—Acetone
 U004—Acetophenone
 U008—Acrylic acid
 U031—n-Butanol
 U053—Crotonaldehyde
 U057—Cyclohexanone
 U085—1,2,3,4-Diepoxybutane
 U108—1,4-Dioxane
 U112—Ethyl acetate
 U113—Ethyl acrylate
 U117—Ethyl ether
 U118—Ethyl methacrylate
 U122—Formaldehyde
 U123—Formic acid
 U124—Furan
 U125—Furfural
 U126—Glycidaldehyde
 U140—Isobutanol
 U147—Maleic anhydride
 U154—Methanol
 U159—Methyl ethyl ketone
 U161—Methyl isobutyl ketone
 U162—Methyl methacrylate
 U166—1,4-Naphthoquinone
 U182—Paraldehyde
 U197—p-Benzoquinone
 U213—Tetrahydrofuran
 U248—Warfarin (<3%)

EPA grouped these five P wastes and twenty nine U wastes together because the primary constituents for which the wastes were listed are oxygenated hydrocarbons. The hydrocarbons contain at least one oxygen atom integrated into the chemical structure by a single or double bond to a carbon. As a result, this group includes functional groups such as ketones, aldehydes, and alcohols. These compounds are also distinguished from other nonhalogenated organics by the absence of nitrogen, sulfur, and/or phosphorous in their elemental composition.

(1) *Wastes for Which Concentration-Based Standards are Proposed as BDAT.* The Agency has identified incineration or fuel substitution as an applicable technology for treatment of nonwastewater forms of P003 (wastewaters), U002, U004, U031, U057, U108, U112, U117, U118, U140, U159, U161, U162, U166, and U197 wastes. While the Agency has been unable to obtain performance data based on incineration or fuel substitution for these particular U and P wastes, the Agency is aware that many facilities generating these wastes also incinerate them prior to land disposal. Therefore, the Agency believes incineration and fuel substitution are BDAT for these U and P wastes. As a result, EPA is proposing concentration-based treatment standards for these wastes based on the

transfer of available incineration performance data on these constituents (or structurally similar constituents) as they appear in other RCRA hazardous wastes. Detailed information for EPA's rationale and the source of performance data for each waste are provided in the BDAT Background Document for U and P Hydrocarbon and Heterocyclic wastes.

The Agency notes that the primary constituents for which U031, U112, and U117 are listed as hazardous wastes in the 40 CFR 261.33 (n-Butanol, ethyl acetate, and ethyl ether respectively) were not originally considered BDAT List Constituents. The primary constituents of these wastes are now considered BDAT List Constituents because EPA has identified several EPA SW-846 Test Methods that may be able to quantify them in wastewaters. The identified EPA SW-846 Test Methods are as follows: 8015 for U031 (GC/MS) and 8240 for both U112 (direct injection—GC/MS) and U117 (Purge and Trap—GC/MS). As a result, the Agency urges facilities that are unable to meet the proposed concentration based treatment standards to submit comments addressing the use of these EPA SW-846 test methods or test methods that are used routinely by them. The treatment standards for wastewater forms of the U wastes presented in the tables following this section, have been calculated based primarily on the detection limits of these constituents in scrubber waters. However, additional data are available for the treatment of these constituents in wastewaters and alternative standards based on these data are presented in section III.A.7. of today's notice for wastewater forms of multi-source leachate. (See previous discussions on these data and alternative standards in section III.A.1.h.(6.) and III.A.3.a.(2.)).

(2) *Wastes for Which the Agency is Proposing a Method of Treatment as BDAT.* The Agency had identified incineration and fuel substitution as BDAT for treatment of nonwastewaters forms of P001, P003, P005, P088, P102, U001, U008, U053, U085, U113, U122, U123, U124, U125, U126, U147, U154, U182, U213, and U248 wastes. For various reasons outlined in the background document for these wastes, all of these chemicals except P003 and U154 currently lack analytical methods that can satisfactorily analyze for their constituents of concern in complex waste matrices. Thus, as discussed in detail in section III.A.1.h.(2.) of today's preamble, the Agency is proposing a standard of "Incineration as a Method of Treatment" for these U and P nonwastewaters.

For wastewater forms of these wastes, the Agency is proposing "Wet Air Oxidation or Chemical Oxidation, Followed by Carbon Adsorption; Biodegradation Followed by Carbon Adsorption; or Incineration as a Method of Treatment." The Agency believes that these technologies are appropriate for treatment of these constituents and have been demonstrated and/or promulgated for similar U and P waste codes (see preceding discussion in III.A.3.a.(3.)).

(3) *Standards for P003 and U154 Wastes.* EPA's limited data on the detection limits of acrolein (P003) in incinerator ash are highly variable. Since these data do show that incineration can achieve detection limits for acrolein in a variety of wastes, and since a high treatment standard could potentially allow a waste with high concentrations of P003 to go untreated; the Agency has chosen to propose both "Incineration as a Method of Treatment" P003 nonwastewaters. For methanol (U154) EPA lacks characterization data from incineration ash or scrubber water. However, EPA believes that methanol can be effectively treated by incineration based on the information that other alcohols of higher molecular weight can be incinerated. As a result, EPA is proposing "Incineration as a Method of Treatment" for U154 nonwastewaters and wastewaters. EPA notes that it prefers promulgation of a concentration-based standard for reasons discussed in section III.A.1.a. and therefore is soliciting comment and data that could be used as additional support for the establishment of an achievable concentration-based standard for acrolein and methanol in P003 and U154 wastes, respectively.

The main reason that the Agency lacks data on methanol is that it typically utilizes data for volatile compounds that are obtained through the analysis of samples by gas chromatography/mass spectrometry (GC/MS). The mass spectrum of methanol is difficult to distinguish from other low molecular weight species. Therefore the quantification of methanol by GC/MS techniques is difficult and as a result methanol is not routinely analysed.

The Agency is aware of GC methods that can analyze for methanol in wastewaters; however, it currently has no data for the analysis of nonwastewaters using GC methods. Additional data primarily from the Agency's Office of Water are available for the treatment of alcohols similar to methanol in wastewaters. A concentration-based standard for

methanol in wastewater forms of multi-source leachate has been calculated using these data and is presented in section III.A.7. of today's notice. (See previous discussions on these data and alternative standards in section III.A.1.h.(6.) and III.A.2.a.(3.)). The Agency may promulgate this standard for U154 wastewaters based on a transfer of these data. The Agency specifically solicits comment and data that support the establishment of a concentration-based standard for U154 wastes.

BDAT TREATMENT STANDARDS FOR U002, U004, U031, U057, U108, U112, U117, U118, U140, U159, U161, U162, U166, AND U197

[Nonwastewaters]

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
U002	Acetone	0.14
U004	Acetophenone	9.6
U031	n-Butanol	2.6
U057	Cyclohexanone	1.9
U108	1,4-Dioxane	280
U112	Ethyl acetate	5.6
U117	Ethyl ether	140
U118	Ethyl methacrylate	160
U140	Isobutanol	170
U159	Methyl ethyl ketone	200
U161	Methyl isobutyl ketone	33
U162	Methyl methacrylate	160
U166	1,4-Naphthoquinone	1.9
U197	p-Benzoquinone	180

BDAT TREATMENT STANDARDS FOR P003, U002, U004, U031, U057, U108, U112, U117, U118, U140, U159, U161, U162, U166, AND U197

[Wastewaters]¹

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
P003	Acrolein	3.6
U002	Acetone	0.25
U004	Acetophenone	0.17
U031	n-Butanol	0.56
U057	Cyclohexanone	1.4
U108	1,4-Dioxane	0.80
U112	Ethyl acetate	0.0052
U117	Ethyl ether	0.28
U118	Ethyl methacrylate	0.47
U140	Isobutanol	1.4
U159	Methyl ethyl ketone	0.14
U161	Methyl isobutyl ketone	0.028
U162	Methyl methacrylate	0.47
U166	1,4-Naphthoquinone	0.073
U197	p-Benzoquinone	13

¹ Note: Alternative standards for these U and P wastewaters are also proposed and are presented in section III.A.7. as standards for the corresponding chemical in wastewater forms of Multi-source Leachate. See background on these alternative standards

in section III.A.1.h.(6)(b).

BDAT TREATMENT STANDARDS FOR P001, P003, P005, P088, P102; U001, U008, U053, U085, U113, U122, U123, U124, U125, U126, U147, U154, U182, U213, AND U248

[Nonwastewaters]

Incineration or fuel substitution as methods of treatment

BDAT TREATMENT STANDARDS FOR P001, P005, P088, P102, U001, U008, U053, U085, U113, U122, U123, U124, U125, U126, U147, U154, U182, U213, AND U248

[Wastewaters]

Wet air oxidation or chemical oxidation followed by carbon adsorption; biodegradation followed by carbon adsorption; or incineration as methods of treatment

f. Organo-Nitrogen Compounds. EPA has grouped eleven P wastes and thirty seven U wastes together into a single general treatability category, identified as organo-nitrogen compounds. These P and U wastes represent a wide range of chemicals produced in a variety of individual processes. EPA's reasons for grouping these organic chemicals together is that they all contain nitrogen and do not contain chlorine or any other halogen. To facilitate transferring appropriate treatability data, EPA further divided this category into six subgroups based on structure, giving functional group similarities particular priority. These subgroups are: (1) Nitrogen Heterocyclics; (2) Amines and Amides; (3) Nitrogen-Bearing Diphenyls; (4) Nitriles; (5) Nitro Compounds and (6) Nitroso Compounds.

(1) Concentration-based Standards for Organo-Nitrogens. In today's notice, EPA is proposing concentration-based standards for these U and P nonwastewaters based on a transfer of performance data from other "surrogate" organo-nitrogen constituents that were determined to be similar in structure to the compounds within each subcategory of organo-nitrogen compounds. As a result, EPA believes all of these U and P constituents can be destroyed by incineration to detection limits. However, the Agency does not have specific data on the direct incineration of the majority of these

specific U and P wastes or their corresponding constituents.

The concentration-based treatment standards for wastewater forms of these U and P organo-nitrogen compounds presented in the tables following this section, have been calculated based primarily on the detection limits of these constituents (or surrogates) as measured in scrubber waters from incineration of nonwastewaters containing these organo-nitrogen constituents. However, additional data are available for the treatment of these constituents in wastewaters and alternative standards based on these data are presented in section III.A.7. of today's notice for wastewater forms of multi-source leachate. (See previous discussions on these data and alternative standards in section III.A.1.h.(6.) and III.A.2.a.(3.)).

(2) Technology-based Standards for Organo-Nitrogens. The Agency has determined that currently there are considerable difficulties in analyzing many of these organo-nitrogen compounds. As a result, concentration-based standards for these constituents are apparently not feasible. See section III.A.1.h.(2)(b) of today's preamble for a further discussion of the Agency's approach in such instances. Since 3004(m) allows the Agency to establish either levels or methods of treatment, the Agency is proposing a standard of "Incineration as a Method of Treatment" for the nonwastewater forms and "Wet Air Oxidation or Chemical Oxidation Followed by Carbon Adsorption; Biodegradation Followed by Carbon Adsorption; or Incineration as a Methods of Treatment" for wastewaters. The Agency believes that these technologies are appropriate for treatment of these constituents and have been demonstrated and/or promulgated for similar U and P waste codes (see preceding discussion for wastewaters in III.A.3.a.(3.)).

The Agency reminds commenters that there are very few (if any) of these wastes that are currently being generated as originally listed and that in practice, the standards will probably only be necessary for residues from previous disposal. The Agency believes that these residues should be less difficult to treat than the original waste as generated. EPA also requests comment on the choice of transfer data for concentration-based standards and on the validity of the subgroupings used to assign standards.

(3) Potential Air Emission Concerns with Organo-Nitrogens. Because the Agency expects that the incineration of these organo-nitrogen compounds may adversely impact air quality due to the

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emission of nitrogen oxides, EPA is considering the need to impose additional air quality controls on the incineration of these wastes, either under RCRA or under the Clean Air Act. For a more complete discussion of the alternatives under consideration, see the discussion of organo-sulfur compounds later in this section.

(4) Discussion of Individual Treatability Groups—(a) Nitrogen Heterocyclic Compounds.

P008—4-Aminopyridine
P018—Brucine
P054—Aziridine
P067—2-Methylaziridine
U011—Amitrole
U148—Maleic Hydrazide
U179—N-Nitrosopiperidine
U180—N-Nitrosopyrrolidine
U191—2-Picoline
U196—Pyridine

This subgroup consists of ten wastes grouped together because they contain a ring of carbon atoms which also includes a nitrogen atom. Three have aromatic rings, six have rings made of single bonds. Only N-nitrosopiperidine (U179), N-nitrosopyrrolidine (U180), and pyridine (U196) are amenable to quantification in treatment residuals by SW-846 methods. Therefore, EPA is proposing concentration-based standards for only these three wastes in this treatability subcategory. EPA believes incineration will reduce U179, U180 and U196 to detection limits in ash and scrubber water because of the Agency's incineration data that indicate destruction to detection levels of Pronamide. The Agency believes that Pronamide, a halogenated organo-nitrogen compound (3,5-dichloro N-(1,1-dimethyl-2-propynyl)-benzamide), is more difficult to incinerate than these ten nitrogen-containing heterocycles.

Based on this, the Agency is also proposing specified methods of treatment for both wastewater and nonwastewater forms of the seven members of the nitrogen heterocyclic subcategory which are not amenable to quantification in waste treatment residual matrices. P054, P067, U011 and U048 are amenable only to analysis by HPLC. (Note: EPA rejects HPLC methods for waste treatment residual matrices for reasons discussed in section III.A.1.h.(2)(a).) For P008, P018, and U191 there are no verified SW-846 analytical methods available. The specified methods proposed as wastewater and nonwastewater treatment standards for all organo-nitrogen U and P wastes are presented in section III.A.3.f.(3.).

(b) Amine and Amide Compounds.

P046—alpha, alpha-Dimethylphenethylamine
P064—Isocyanic acid, ethyl ester

U007—Acrylamide
U012—Aniline
U092—Dimethylamine
U110—Dipropylamine
U167—1-Naphthylamine
U168—2-Naphthylamine
U194—n-Propylamine
U236—Ethyl carbamate

This subgroup consists of ten wastes grouped together because they contain either an amide or an amine group. Two are fused aromatic rings, four contain single benzene rings, three are amine groups attached to aliphatic carbon chains and three have amide groups attached to ether bonds or to double carbon bonds. Four of these wastes are amenable to quantification in waste treatment residual matrices by current SW-846 methods: acrylamide (U007), aniline (U012), 1-naphthylamine (U167), and 2-naphthylamine (U168); however, the Agency does not have adequate analytical data characterizing incinerator ash and scrubber water to set concentration-based standards based on detection limits for U007. Therefore, EPA is proposing concentration-based treatment standards only for U012, U167 and U168 nonwastewaters. These standards are based on data showing how 4-nitrophenol can be incinerated to detection limits in ash and scrubber water. EPA believes that 4-nitrophenol is more difficult to incinerate than the amines and amides identified as in this treatability group.

In a similar manner, for P046, P064, U092, U110, U194, and U236 (the six members of the amines and amides subcategory not amenable to quantification)—plus U007 which can be quantified but for which no analytical data is available—EPA is proposing treatment standards based on incineration as BDAT. U007 and U236 have amide groups and thus are easier to incinerate than 4-nitrophenol, which has been proven to be treated to detection levels by incineration. P064 has an amide-like structure with an attached nitrile group, where the nitrogen has a double bond to a carbonyl group which appears to be more amenable to destruction by incineration than 4-nitrophenol or pronamide. P046, U092, U110, and U194, have amine groups which are more easily destroyed by incineration than nitro-groups.

Six wastes in this treatability group are not amenable to quantification for the following reasons: (1) calibration reagents are not commercially available for P046 and P064; (2) U236 is only quantifiable by HPLC methods (Note: EPA rejects HPLC methods for waste treatment residual matrices for reasons

discussed in section III.A.1.h.(2)(a).); and (3) for U092, U110 and U194 there are no verified SW-846 analytical methods available. The specified methods proposed as wastewater and nonwastewater treatment standards for all organo-nitrogen U and P wastes are presented in section III.A.3.f.(3.).

(c) Aminated Diphenyls and Biphenyls.

U014—Auramine
U021—Benzidine
U091—3,3-Dimethoxybenzidine
U093—p-Dimethylaminoazobenzidine
U095—3,3'-Dimethylbenzidine
U236—Trypan Blue

This subgroup consists of six wastes grouped together because they contain two benzene rings joined by a single bond or bridged by a single carbon or by a nitrogen-nitrogen double bond. Each biphenyl has at least one amine functional group. Trypan blue has a complex structure including a binuclear double benzene ring on each phenyl with NaO₃S moieties on each double benzene ring.

Although three of these wastes are amenable to quantification in treatment residuals by SW-846 methods (U091, U093 and U095), EPA is only proposing concentration-based standards for U093 alone because the Agency encountered problems with analytical data in determining detection limits for U091 and U095. The concentration based treatment standards for U093 wastewaters and nonwastewaters are proposed based on incineration to detection limits transferred from data showing that methoxychlor (a chlorinated diphenyl believed to be more difficult to incinerate) and Pronamide can be destroyed to detection limits in incinerator ash and scrubber water.

EPA believes U014, U021, U091, U095 and U236 can be effectively incinerated for the same reason as U093. For these remaining five members of the aminated diphenyls and biphenyls subcategory, in addition to U091 and U095, EPA is proposing treatment standards based on incineration as BDAT. Three wastes, however, are not amenable to quantification for the following reasons: (1) U014 and U236 are only quantifiable by HPLC methods (Note: EPA rejects HPLC methods for waste treatment residual matrices for reasons discussed in section III.A.1.h.(2)(a).); and (2) U021 is unstable in water (see background discussion in III.A.1.h.(2)(c)). The specified methods proposed as wastewater and nonwastewater treatment standards for all organo-nitrogen U and P wastes are presented in section III.A.3.f.(3.).

(d) Nitriles.

- P069—Methylacetonitrile
- P101—Propanenitrile
- U003—Acetonitrile
- U009—Acrylonitrile
- U149—Malononitrile
- U152—Methacrylonitrile

This subgroup consists of six wastes grouped together because they contain nitrile groups, which consist of a nitrogen carbon triple bond. All are straight-chain aliphatics; two have a carbon-carbon double bond in the chain and one has two attached nitrile groups.

EPA believes incineration will treat all six of these nitriles to detection limits in ash and scrubber water based on data showing that incineration treats 1,1,1-trichloroethylene and Pronamide to detection limits. The Agency believes both Pronamide and 1,1,1-trichloroethane are more difficult to incinerate than these six compounds. Four of these are amenable to quantification in treatment residuals by SW-846 methods: P101, U003, U009 and U152. Two of these nitriles are not amenable to quantification for the following reasons: (1) calibration reagents are not commercially available for P069 (see background discussion in III.A.1.h.(2).(b.)); and (2) for U149 wastes there are no verified SW-846 analytical methods available. The specified methods proposed as wastewater and nonwastewater treatment standards for all organo-nitrogen U and P wastes are presented in section III.A.3.f.(3.).

(e) Nitro Compounds.

- P077—p-Nitroaniline
- U105—2,4-Dinitrotoluene
- U106—2,6-Dinitrotoluene
- U169—Nitrobenzene
- U171—2-Nitropropane
- U181—5-Nitro-o-toluidine
- U234—sym-Trinitrobenzene

This subgroup consists of seven wastes grouped together because they contain at least one nitro functional group: a nitrogen atom attached to two oxygen atoms. Seven have single benzene rings and one has a three-carbon aliphatic chain.

Five of these wastes are amenable to quantification in treatment residuals by SW-846 methods: P077, U105, U106, U169, and U181. Concentration-based standards for wastewater and nonwastewater forms of U105 are proposed based directly on incineration data for 2,4-dinitrotoluene. Concentration-based standards for wastewater and nonwastewater forms of U169, U181, P077 and U106 are proposed based on incineration to detection limits in ash and scrubber water of 2,4-dinitrotoluene, 4-nitrophenol, and nitrobenzene. All three

of these are structural representatives of this subcategory of organo-nitrogens identified simply as the Nitro Subcategory.

In a similar manner, the Agency is proposing incineration as the basis for treatment standards for U234 and U171. These two members of the Nitro Subcategory that are not amenable to quantification in waste treatment residuals because there are no verified SW-846 analytical methods available, therefore, the Agency is proposing specified methods of treatment for P084, U173, U176, U177, and U178. The specified methods proposed as wastewater and nonwastewater treatment standards for all organo-nitrogen U and P wastes are presented in section III.A.3.f.(3.).

(f) Nitroso Compounds.

- P082—N-Nitrosodimethylamine
- P084—N-Nitrosomethylvinylamine
- U111—Di-n-propylnitrosoamine
- U172—N-Nitroso-di-n-butylamine
- U173—N-Nitroso-di-n-ethanolamine
- U174—N-Nitrosodiethylamine
- U176—N-Nitroso-N-ethylurea
- U177—N-Nitroso-N-methylurea
- U178—N-Nitroso-N-methylurethane

This subgroup consists of nine wastes grouped together because they contain a nitroso functional group: a nitrogen double bonded to an oxygen. In all nine of these U and P chemicals, the nitroso group is attached to another nitrogen molecule within a relatively small aliphatic structure. Four chemicals also contain oxygen in functional groups such as amides, ethers and ketones.

Four of these are amenable to quantification in treatment residuals by SW-846 methods: P082, U111, U172 and U174. EPA believes that all nine of these nitroso compounds are less difficult to incinerate than Pronamide and is therefore proposing concentration-based treatment standards based on detection limits for P082, U111, U172 and U174 and is proposing specified methods of treatment for P084, U173, U176, U177, and U178. These five members of the Nitroso Subcategory are not amenable to quantification in waste treatment residual matrices because there are no verified SW-846 analytical methods available. The specified methods proposed as wastewater and nonwastewater treatment standards for all organo-nitrogen U and P wastes are presented in section III.A.3.f.(3.).

BDAT TREATMENT STANDARDS FOR U179, U180, U196, U012, U167, U168, U093, P101, U003, U009, U152, P077, U105, U106, U169, U181, P082, U111, U172, AND U174

[Nonwastewaters]

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
U179	N-Nitrosopiperidine	220
U180	N-Nitrosopyrrolidine	220
U196	Pyridine	16
U012	Aniline	14
U167	1-Naphthylamine	15
U168	2-Naphthylamine	15
U093	p-Dimethylaminoazobenzene.	29
P101	Propanenitrile	360
U003	Acetonitrile	0.35
U009	Acrylonitrile	0.28
U152	Methacrylonitrile	84
P077	p-Nitroaniline	28
U105	2,4-Dinitrotoluene	140
U106	2,6-Dinitrotoluene	28
U169	Nitrobenzene	14
U181	5-Nitro-o-toluidine	56
P082	N-Nitrosodimethylamine	56
U111	Di-n-propylnitrosoamine	14
U172	N-Nitroso-di-n-butylamine	54
U174	N-Nitrosodiethylamine	28

BDAT TREATMENT STANDARDS FOR U179, U180, U196, U012, U167, U168, U093, P101, U003, U009, U152, P077, U105, U106, U169, U181, P082, U111, U172, AND U174

[Wastewaters]*

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
U179	N-Nitrosopiperidine	1.3
U180	N-Nitrosopyrrolidine	1.3
U196	Pyridine	0.031
U012	Aniline	0.033
U167	1-Naphthylamine	0.37
U168	2-Naphthylamine	1.8
U093	p-Dimethylaminoazobenzene.	0.74
P101	Propanenitrile	0.64
U003	Acetonitrile	0.42
U009	Acrylonitrile	0.64
U152	Methacrylonitrile	0.47
P077	p-Nitroaniline	0.25
U105	2,4-Dinitrotoluene	0.17
U106	2,6-Dinitrotoluene	0.051
U169	Nitrobenzene	0.033
U181	5-Nitro-o-toluidine	2.2
P082	N-Nitrosodimethylamine	0.67
U111	Di-n-propylnitrosoamine	0.065
U172	N-Nitroso-di-n-butylamine	0.67
U174	N-Nitrosodiethylamine	0.67

* Note: Alternative standards for these U and P wastewaters are also proposed and are presented in section III.A.7. as standards for the corresponding chemical in wastewater forms of Multi-source Leachate. See background on these alternative standards

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in section III.A.1.h.(6)(b).

BDAT TREATMENT STANDARDS FOR P008, P018, P046, P054, P064, P067, P069, P084, U007, U011, U014, U021, U091, U092, U095, U110, U148, U149, U171, U173, U176, U177, U178, U191, U194, U234, U236, AND U238

[Nonwastewaters]

Incineration as a Method of Treatment

BDAT TREATMENT STANDARDS FOR P008, P018, P046, P054, P064, P067, P069, P084, U007, U011, U014, U021, U091, U092, U095, U110, U148, U149, U171, U173, U176, U177, U178, U191, U194, U234, U236, AND U238

[Wastewaters]

Wet Air Oxidation or Chemical Oxidation Followed by Carbon Adsorption; Biodegradation Followed by Carbon Adsorption; or Incineration as Methods of Treatment

g. Organo-Sulfur Compounds.

- P002—1-Acetyl 2-thiourea
- P014—Benzene thiol (Thiophenol)
- P022—Carbon disulfide
- P045—Thiofanox
- P049—2,4-Dithiobiuret
- P066—Methomyl
- P070—Aldicarb
- P072—1-Naphthyl-2-thiourea (Bantu)
- P093—N-Phenylthiourea
- P116—Thiosemicarbazide
- U114—Ethylene bis-dithiocarbamic acid
- U116—Ethylene thiourea
- U153—Methane thiol
- U119—Ethyl methane sulfonate
- U193—1,3-Propane sultone
- U218—Thioacetamide
- U219—Thiourea
- U244—Thiram

The chemicals in the Organo-Sulfur treatability group are all basically hydrocarbons that contain sulfur. Some also contain nitrogen and/or oxygen in their structure. EPA is proposing treatment standards as specified methods for all eighteen of these organo-sulfur compounds. While several of these organo-sulfurs are amenable to quantification in waste treatment residual matrices by current SW-846 analytical methods, the Agency has not obtained any data characterizing either treated or untreated organo-sulfur wastes. In addition, the Agency has not determined a surrogate compound from which to transfer concentration-based standards.

The other members of the Organo-Sulfur treatability group are not amenable to quantification in waste treatment residual matrices because there are no verified SW-846 analytical

methods available. The specified methods proposed as wastewater and nonwastewater treatment standards for all organo-sulfur U and P wastes are the same as those for all of the organo-nitrogen subcategories. These technologies are presented in section III.A.3.f.(3.) as they relate to organo-nitrogens.

The Agency also points out that many of these compounds have very offensive or strong odors associated with them. In fact, the Agency attempted to include benzene thiol (Thiophenol-P014) and carbon disulfide (P022) as representatives of this treatability group in its massive test burn (see discussion of this burn in section III.A.1.h.(6)(a)), however permitting problems arose (due to the odors specifically associated with these compounds) that could not be solved in a reasonable time frame. This jeopardized the completion of the test burn, so the Agency had to drop these chemicals from the list of chemicals to be burned. However, the Agency does believe that these odor problems could have been resolved with appropriate technical precautions (given the Agency had had more time). These odor problems also present an interesting reason for specifying technologies rather than concentration-based standards, i.e., the less handling of these compounds, the better. (Note: In case the reader has had no experience with these compounds, methane thiol (U153) has the distinct odor of rotten cabbage.)

EPA believes that these compounds are all amenable to treatment by incineration because they resemble aliphatic, aromatic and other organic compounds that have been successfully treated by incineration. EPA requests comments on the choice of incineration as the method of treatment for organosulfur wastes. Specifically, the Agency solicits supporting evidence on concentrations of sulfur in waste feeds that have been successfully incinerated. This information should include specific design and operating conditions established for incineration of these specific organo-sulfur compounds and/or specific established restrictions (either regulatory or company policy) on the concentrations of total sulfur in waste feeds. Prospective commenters are referred to section III.A.1.i. for explanation of the special procedures that the Agency intends to utilize to provide additional rapid notice and comment on any new data and information received prior to the closure of the comment period and should identify their interest in receiving notice on these data as "Organosulfur Wastes III.A.3.g."

The Agency is concerned, however, with the potential nitrogen and sulfur emissions generated from the incineration of these wastes. The formation of nitrogen or sulfur oxides in the process of incinerating any of these compounds may require additional controls in order to meet air quality requirements pursuant to Section 108, 110, and 111 of the Clean Air Act or New Source Review under the CAA's Prevention of Significant Deterioration program. Therefore, EPA requests comment on incinerator design and operation. EPA particularly seeks operating data addressing nitrogen and sulfur oxide generation and control in burning wastes containing nitrogen or sulfur, information on combustion units equipped with nitrogen or sulfur oxide controls such as selective noncatalytic reduction or selective catalytic reduction, and information concerning the availability of facilities that can incinerate these wastes while meeting applicable air quality requirements for sulfur and nitrogen oxide emissions. (This information also bears on the issue of availability of sufficient treatment capacity for purposes of RCRA section 3004(h).) EPA also solicits comment on the advisability of invoking the omnibus permitting requirements of RCRA (section 3005(c), final sentence) for all sources burning these wastes, or restricting the treatment of these wastes to combustion units that have appropriate air pollution controls, in order to reduce the adverse human health and environmental effects of burning these wastes. See also Section V.D. in today's notice for further discussion of regulatory control mechanisms available under the Clean Air Act.

BDAT TREATMENT STANDARDS FOR P002, P014, P022, P045, P049, P066, P070, P072, P093, P116, U114, U116, U119, U153, U193, U218, U219, AND U244

[Nonwastewaters]

Incineration as a method of treatment

BDAT TREATMENT STANDARDS FOR P002, P014, P022, P045, P049, P066, P070, P072, P093, P116, U114, U116, U119, U153, U193, U218, U219, AND U244

[Wastewaters]

Wet air oxidation or chemical oxidation followed by carbon adsorption; biodegradation followed by carbon adsorption; or incineration as methods of treatment

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h. Wastes of a "Pharmaceutical" Nature.

- P007—Muscimol (5-Aminoethyl 3-isoxazolol)
- P042—Epinephrine
- P075—Nicotine and salts
- P108—Strychnine and salts
- U010—Mitomycin C
- U015—Azaserine
- U035—Chlorambucil
- U059—Daunomycin
- U089—Diethyl stilbestrol
- U090—Dihydrosafrole
- U141—Isosafrole
- U143—Lasiocarpine
- U150—Melphalan
- U155—Methapyrilene
- U163—N-Methyl N-nitro N-nitroguanidine
- U164—Methylthiouracil
- J187—Phenacetin
- J200—Reserpine
- J202—Saccharin and salts
- J203—Safrole
- J206—Streptozotocin
- J237—Uracil mustard

EPA has grouped these four P wastes and eighteen U wastes together into a single general treatability group, identified as "Pharmaceutical" Wastes. These U and P wastes are complex organic chemicals, many of which are typically generated by the pharmaceutical industry as discarded raw materials, byproducts or off-specification products. While some of these compounds may not be specifically identified as "drugs" and a few are not specifically generated by the pharmaceutical industry, EPA's main reasons for grouping these 22 waste codes together is the relative similarities in structures within this treatability group versus the compounds in the other treatability groups (i.e., all of twenty two of these chemicals are relatively large complex heavily substituted molecules). Eighteen of the twenty two compounds have aromatic rings, nine of which also contain nitrogen or sulfur incorporated into the ring. Six of these wastes include aromatic rings that are used into polynuclear aromatic structures. All have multiple double bonds and all include oxygen, nitrogen or sulfur atoms.

The Agency has data on incineration of Isosafrole that were used in developing the standards for this treatability subgroup of "pharmaceutical" wastes. The new data from EPA's June, 1989 testing of rotary kiln incineration indicate that Isosafrole can be incinerated to detection limits as

measured in both the ash and scrubber water. Given the size and complexity of these waste molecules, EPA believes they can all be incinerated to the limit of detection in ash and scrubber water and is therefore proposing wastewater and nonwastewater standards based on incineration as BDAT.

Four of these wastes, Isosafrole (U141), Methapyrilene (U155), Phenacetin (U187), and Safrole (U203) are amenable to quantification in treatment residuals by SW-846 methods. EPA is transferring the incineration performance data for Isosafrole to all four of these wastes and thus is proposing concentration-based standards. Although Strychnine (P108) is also amenable to quantification (by Method 8270 of SW-846), EPA is proposing incineration as a treatment standard in order not to stimulate generation of this acutely toxic chemical for use as a calibration reagent.

The Agency is proposing specified methods of treatment for the seventeen remaining "pharmaceutical" wastes which are not amenable to quantification in waste treatment residual matrices. All of these are large molecules with significant branching, less stable than similar polynuclear aromatic hydrocarbons and chlorinated aromatic pesticides known to be effectively treated by incineration. These seventeen chemicals are not amenable to quantification for the following reasons: (1) P007, P075, U010, U015, U035, U059, U089, U143, U150, U164, U200, U202 and U206 are only quantifiable by HPLC methods (Note: EPA rejects HPLC methods for waste treatment residual matrices for reasons discussed in section III.A.1.h.(2).(a).); (2) calibration reagents are not commercially available for U090 and U237 (see background discussion in III.A.1.h.(2).(b).); and (3) for P042 or U163 wastes there are no verified SW-846 analytical methods available. The specified methods proposed as wastewater and nonwastewater treatment standards for all "pharmaceutical" U and P wastes are the same as those for all of the organo-nitrogen subcategories. These technologies are presented in section III.A.3.f.(3.) as they relate to organo-nitrogens.

BDAT TREATMENT STANDARDS FOR U141, U155, U187 AND U203

[Nonwastewaters]

Waste code	Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
U141	Isosafrole.....	2.6
U155	Methapyrilene.....	6.9
U187	Phenacetin.....	16
U203	Safrole.....	22

BDAT TREATMENT STANDARDS FOR U141, U155, U187 AND U203

[Wastewaters]

Waste code	Regulated Constituent	Maximum for any single grab sample, total composition (mg/l)
U141	Isosafrole.....	0.076
U155	Methapyrilene.....	0.15
U187	Phenacetin.....	0.36
U203	Safrole.....	1.3

*Note: Alternative standards for these U and P wastewaters are also proposed and are presented in section III.A.7. as standards for the corresponding chemical in wastewater forms of Multi-source Leachate. See background on these alternative standards in section III.A.1.h.(6).(b.).

BDAT TREATMENT STANDARDS FOR P007, P042, P075, P108, U010, U015, U035, U059, U089, U090, U143, U150, U163, U164, U200, U202, U206, AND U237

[Nonwastewaters]

Incineration as a method of treatment

BDAT TREATMENT STANDARDS FOR P007, P042, P075, P108, U010, U015, U035, U059, U089, U090, U143, U150, U163, U164, U200, U202, U206, AND U237

[Wastewaters]

Wet air oxidation or chemical oxidation followed by carbon adsorption; biodegradation followed by carbon adsorption; or incineration as methods of treatment

4. Proposed Treatment Standards for Ignitable, Corrosive, and Reactive Wastes—a. Introduction. This section of

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today's preamble presents a discussion of the proposed treatment standards for ignitable (D001), corrosive (D002), and reactive (D003) characteristic wastes. This section also presents proposed treatment standards for certain U and P wastes that either have the potential to be reactive, particularly in the concentrated form, or are structurally similar to one another. Discussion of the general issues related to all characteristic wastes and an overview of the major options that the Agency considered in proposing treatment standards for all characteristic wastes are presented in sections III.A.1.g. and III.C. of today's preamble.

Ignitable and reactive wastes are already subject to some restrictions on placement in surface impoundments, waste piles, land treatment units, and landfills according to 40 CFR 264.229, 264.256, 264.281, 264.312, 265.229, 265.256, 265.281, and 265.312. Additional requirements for disposing lab packs containing ignitable and reactive wastes in landfills are established in 40 CFR 264.316. Preamble section III.A.4.f. presents a discussion of the impact that today's proposed treatment standards will have on these provisions. When today's proposed rule is promulgated, these wastes are subject to the land disposal restrictions (40 CFR 268) including waste analysis, record keeping, and treatment standards.

(1) *Treatment of All Characteristic Properties.* The use of a specified treatment method for a particular characteristic waste does not necessarily ensure that the residues from this treatment are no longer a characteristic hazardous waste. In other words, treatment for a given characteristic may not, under today's proposal, completely satisfy the requirements to treat other characteristics in the waste or any new characteristics appearing in the treatment residue. For example, ash residues from the incineration of an ignitable waste will no longer be ignitable, but may exhibit the characteristic of EP toxicity for metals (due to the metals concentrating in the ash) even though the waste may not have been EP toxic prior to incineration; this residue may therefore require further treatment.

The Agency expects that residues from treating many corrosive or reactive wastes may exhibit EP toxicity for metals. As discussed in preamble section III.C., the Agency is therefore requiring that no characteristic wastes or their treatment residues may be land disposed unless the treatment standard for the particular characteristic is above

the characteristic level or the residue has complied with the applicable specified method. Proposed treatment standards for EP toxic metal wastes (D004-D011) are presented in section III.A.5. of today's preamble.

Because of the nature of some subcategories of these D001, D002, or D003 wastes, the Agency is not distinguishing wastewater versus nonwastewater standards in all cases. Sometimes this is because there is no way to physically distinguish one from the other (e.g. D001 compressed gases are neither wastewaters nor nonwastewaters), or sometimes it is prudent to apply the same technology to both wastewaters and nonwastewaters. In other cases, only nonwastewater standards or only wastewater standards are proposed for subcategories of these characteristic wastes. The Agency solicits comment on the potential for generation of forms of these wastes where no standards are specified for that particular form or where the commenter believes that there is a different technology that should be specified.

(2) *Treatment Below Characteristic Levels.* The Agency is proposing two options for treatment standards for wastes in the D001 Ignitable Liquids, D002 Acid, D002 Alkaline, D002 Other Corrosives, D003 Reactive Cyanide, and D003 Reactive Sulfides treatability groups. As discussed in detail in section III.C. of today's preamble, the Agency has initially determined that it has the authority to establish treatment standards below the characteristic level for these wastes or at least to make failure to treat to the lower level a violation of section 3004(m). Therefore, the Agency is proposing such standards in particular for wastes in the D001 Ignitable Liquids, D002 Acid, D002 Alkaline, D002 Other Corrosives, D003 Reactive Cyanide and D003 Reactive Sulfides Subcategories. (The specific standards are presented in the respective discussions of the treatability subcategories below.) The Agency is soliciting comment on the option of treating to reach the characteristic level (i.e., removing the characteristic).

These particular subcategories of D001, D002, and D003 wastes are defined by specific testing requirements or narrative standards (i.e., reactive cyanides and reactive sulfides). Thus, the Agency is also proposing a second option of limiting these treatment standards to the respective characteristic levels for these D001, D002, or D003 subcategories only (i.e., other subcategories of these wastes do not have specific testing requirements or

guidance). The Agency specifically solicits comments on these two options.

(3) *Deactivation as a Treatment Standard.* The Agency is proposing a general treatment standard of "Deactivation as a Method of Treatment" for several subcategories of D001, D002, and D003 wastes (i.e., D001 Ignitable Reactives, D001 Oxidizers, D002 Other Corrosives, D003 Explosives, D003 Water Reactives, and D003 Other Reactives). The Agency has determined that within each of these subcategories there appear to be a further variety of different waste groups, each with a certain degree of uniqueness with respect to hazard and handling requirements. Therefore, the Agency believes that the actual method of "Deactivation" chosen for each waste may be specific to that waste and may be best determined by the generator or the treater most knowledgeable as to the waste's unique hazards and handling requirements.

Further, the Agency currently has no information that suggests that one particular technology may be generally applicable to all the wastes within each particular characteristic subcategory, nor that there is one particular technology that can be identified as "Best".

Note: This does not preclude the Agency from making such a determination in the future should additional information and data become available.

However, information does suggest that all of these wastes can be treated by some form of deactivation (e.g., open detonation, thermal destruction, specialized incineration, chemical oxidation, chemical reduction, and controlled reaction with water) and that there apparently are no wastes that require land disposal without treatment to remove these particular characteristics (i.e., ignitable reactivity, oxidizing potential, explosivity, water reactivity, and other corrosivity or reactivity).

The Agency considered proposing a "No Land Disposal" standard to these subcategories of wastes; however, some commenters to previous land disposal restriction rules have raised concerns over the effect of these standards. (Note: This concern should be moot, in that, today's notice proposes to revoke all "No Land Disposal" standards that were previously promulgated.) There may be similar concerns that the proposed "Deactivation as a Method of Treatment" is also not a treatment standard per se. As a result, the Agency is proposing an alternative of specifying a treatment standard identified as

"Thermal Destruction, Specialized Incineration, Chemical Oxidation, Chemical Reduction, and Controlled Reaction with Water as Methods of Treatment" for all wastes in the characteristic subcategories identified as D001 Ignitable Reactives, D001 Oxidizers, D002 Other Corrosives, D003 Explosives, D003 Water Reactives, and D003 Other Reactives. The Agency is specifically soliciting comment and data on these technologies (or other technologies) that could assist the Agency in promulgating these as an alternative standard for these particular subcategories of characteristic wastes.

The Agency believes, however, the proposed standard of "Deactivation as a Method of Treatment" provides a needed flexibility in choice of protective treatment technology for the anticipated uniqueness of these wastes at specific sites, while at the same time allowing safe handling procedures for the waste because of their overall "reactive" nature. The Agency believes this is an appropriate approach for these wastes since the hazardous characteristic is based on imminent hazard (e.g., violent reactions and ignition) rather than on other criteria such as levels of hazardous constituents.

The Agency considered another option, that of specifying one technology (e.g., open detonation) for all the wastes that could be included in each subcategory and deal with cases where a waste could not be treated by that technology through the variance procedures of 40 CFR 268.44. The Agency does not prefer this option because of the time and resources that are necessary to process a large number of petitions for a variance from the treatment standard.

Furthermore, there are no known analytical methods to measure the characteristics for which the majority of these wastes are identified, nor a test that distinguishes the reactive chemical from the deactivated chemical in the treatment residues. The Agency solicits comment and data on the proposed overall approach for setting treatment standards for these subcategories of characteristic wastes.

B. Ignitable Characteristic Wastes. According to 40 CFR 261.21, there are four criteria for identifying a waste as D001 Ignitable. Paraphrasing these criteria, a waste is a D001 Ignitable if: (1) it is a liquid with a flash point less than 140 °F; (2) it is an ignitable compressed gas; (3) it is not a liquid and is capable of causing fire through friction, absorption of moisture, or spontaneous chemical changes and when ignited burns vigorously and persistently; or (4) it is an oxidizer. EPA

has determined that these four criteria translate directly into four major D001 Subcategories. If a waste is classified as D001 because it fits under more than one D001 subcategory, the waste must be treated by the specified treatment method that is the treatment standard for each applicable subcategory.

(1) *Ignitable Liquids Subcategory.* The first D001 subcategory is described as the Ignitable Liquids Subcategory and refers to those D001 wastes that exhibit the properties listed in § 261.21(a)(1). Data indicate that the majority of all D001 wastes generated fall into this subcategory and are typically described as solvents, paint thinners, contaminated oils, and various organic hydrocarbons.

These wastes are typically classified as nonwastewaters due to their high organic content (usually greater than 1% TOC). The major organic constituents in these wastes are volatile flammable hydrocarbons or oxygenated hydrocarbons that provide the characteristic of ignitability to the waste (i.e., a flash point of less than 140 °F). Some of these organics are water soluble and can theoretically be biodegraded in some wastewater treatment systems. Typically these constituents must be diluted to significantly lower concentrations in the wastewater in order for microorganisms to degrade them. Also, the biodegradation processes often require an aeration step. During the dilution and aeration steps, significant amounts of these volatile organic compounds (VOCs) can be emitted to the air. While biodegradation processes may be applicable for certain D001 Ignitable Liquids, the Agency believes this process is not as protective as thermal destruction technologies.

Thermal destruction technologies such as incineration and reuse as a fuel will completely remove the characteristic of low flash point by completely destroying the VOCs, thereby rendering the waste nonignitable. Based on the fact that these techniques remove the characteristic of ignitability permanently and completely, EPA is proposing a treatment standard of "Incineration, Fuel Substitution, or Recovery as Methods of Treatment" for D001 in the Ignitable Liquids subcategory. This standard will establish incineration, fuel substitution, or recovery as mandatory processes for handling D001 Ignitable Liquids.

The Agency has data showing that the majority of D001 Ignitable Liquids are already treated by incineration, reused as a fuel substitute due to their high BTU content, or recovered for reuse through processes such as distillation. The

Agency does not want to preclude anyone from using distillation or other recovery techniques for these wastes. At the same time, the Agency does not believe that most of these wastes are necessarily recoverable by processes such as distillation. While recovery options may be preferable over incineration or fuel substitution for some of the D001 wastes in this subcategory, the end result is the same. The choice between incineration, fuel substitution, or recovery may then be made by the generator or treater, based on economics and on the ability of the particular recovery system to handle the waste. (Additional discussion on fuel substitution as a treatment method for these wastes is contained in the discussion of national capacity variances in section III.B.)

Some D001 Ignitable Liquids have been shown to contain organic constituents that are also constituents in F001-F005 solvents. The Agency studied the option of transferring the standards for these constituents from the corresponding F001-F005 standards promulgated in the November 7, 1988 final rule (51 FR 40642). However, the Agency believes that this option would create an unnecessary burden on the regulated community in several ways. The majority of D001 wastes in the Ignitable Liquids subcategory probably do not contain these constituents. It seems an unreasonable burden to require generators of D001 wastes to conduct the significant amount of testing and certification required under the land disposal restrictions, when it is likely that constituents are not present. Also, the F001-F005 standards are based on analysis of an extract obtained from use of the TCLP, not on analysis of the total concentration in a representative sample of the waste. Therefore, the Agency prefers to deal with this difference in required testing in a future rulemaking, by establishing treatment standards based on analysis of total constituent concentrations to replace the F001-F005 standards; the new standards could then be transferred to the appropriate wastes in the Ignitable Liquids subcategory. The Agency has not investigated all the technical issues associated with transferring data based on analysis of the TCLP extract to constituents measured by a total waste analysis. Therefore, the Agency is not proposing concentration-based D001 treatment standards based on a transfer of F001-F005 data at this time, although it may reevaluate this decision in the future.

The Agency is currently unable to determine whether any D001 wastes in

this subcategory conform to the definition of wastewaters (i.e., containing less than 1% TOC and 1% TSS) as initially generated. The Agency believes, however, if wastewater forms are generated, the treatment standard proposed for nonwastewaters apply to these wastewaters as well, since the end result will be the removal of the ignitability characteristic and destruction of the hazardous constituents.

(2) Ignitable Compressed Gases Subcategory. The second subcategory is classified as the Ignitable Compressed Gases subcategory and refers to those D001 wastes that exhibit the properties listed in § 261.21(a)(3) and meet the definitions in 49 CFR 173.300. The Agency has very limited information on the generation and characterization of D001 wastes in this subcategory, but suspects that while these wastes may be generated, it is unlikely that they require placement in any type of land disposal unit. The Agency believes that there are no gas cylinders containing compressed ignitable gases placed in surface impoundments, and that it is physically impossible to dispose them by means of deep well injection. Some cylinders containing D001 ignitable gases may be placed in waste piles; however, such placement of a container in a storage unit is not land disposal under section 3004(k). In addition, these types of cylinders are usually returned to distribution facilities to be refilled. The Agency does not intend to prevent short-term storage of cylinders prior to refilling.

The Agency considered several options for proposing treatment standards for compressed ignitable gases. The preferred option is that of recovery by direct reuse, since typically, the cylinders are directly refilled. A second option is incineration by venting the gas into an incinerator. There may be cases when it is preferable to vent the gas into an appropriate adsorbent material (provided that air emissions can be controlled), and then incinerate the adsorbed gas/adsorbent material combination to permanently remove the characteristic, because this would reduce the risk of explosion. The Agency is not proposing to specify fuel substitution as a method because it knows too little about these wastes. EPA will reconsider this question if additional data adequately characterizing these wastes are submitted.

Today, the Agency is proposing a treatment standard of "Recovery or Incineration of Vented Ignitable Gases" for these wastes. This treatment

standard will apply to all forms of the Ignitable Compressed Gases, since the definitions of wastewater and nonwastewater do not apply to this group of wastes (see section III.A.1.g of today's preamble).

(3) Ignitable Reactives Subcategory. The third subcategory is classified as the Ignitable Reactives subcategory and refers to those D001 wastes that exhibit the properties listed in § 261.21(a)(2). D001 wastes in the Ignitable Reactives subcategory are primarily inorganic solids or wastes containing reactive materials. These include materials such as reactive alkali metals or metalloids (such as sodium and potassium) and calcium carbide slags. All of these are very reactive with water and will generate gases that can ignite due to heat generated from the reaction with water. Other ignitable solids in this subcategory include metals such as magnesium and aluminum that, when finely divided, can vigorously react with the oxygen in the air when ignited.

There appears to be an overlap between wastes in this D001 subcategory and certain D003 (characteristic of reactivity) wastes. A close examination of the definitions in § 261.21(a)(2) for ignitable wastes and §§ 261.23(a) (2), (3) and (6) for reactive wastes reveals the distinction between these two groups. The key difference is in the definition of ignitable wastes which states: " * * * when ignited, burns vigorously and persistently." This phrase implies that the hazard is due primarily to the ignition potential rather than to the extreme reactivity.

D001 Ignitable Reactives are generated on a sporadic basis and generally in low volumes. They typically are not placed in surface impoundments because they often react with water, thus creating a fire hazard. Current management practices for some of these wastes, such as calcium carbide slag, involve placing the wastes in specially designed units for the purpose of controlled deactivation with water. EPA has determined previously that such deactivation does not constitute land disposal. See 51 FR at 40577 (Nov. 7, 1986) and 52 FR 21011 (June 4, 1987). Thus, this treatment practice is permissible. Where residues from deactivation in land disposal units (such as waste piles) leave an EP toxic residue on the land (within the meaning of section 3004(k)), a different method of deactivation may be necessary. EPA solicits comment on this point, including comment regarding implications for availability of adequate treatment capacity pursuant to the section 3004(h)(2) determination.

Other D001 Ignitable Reactives, such as those containing reactive alkali metals (sodium or potassium) are sometimes open-detonated. The Agency also has data indicating that these wastes are sometimes chemically deactivated.

Radioactive zirconium fines that are pyrophoric under 40 CFR 261.21(a)(2) (i.e., that cause fire through friction) have been included in this D001 subcategory. The Department of Energy submitted data that appears to indicate that this waste can be stabilized to remove the reactivity characteristic. Stabilization is not usually considered to be a method of deactivation, and EPA is concerned that this treatment may be a form of impermissible dilution rather than a chemical reaction (i.e., oxidation) that removes the reactivity characteristic. The Agency solicits comment and additional data on whether stabilization is appropriate for radioactive zirconium fines. Furthermore, the Agency requests comment on whether stabilization is an appropriate deactivation treatment for all zirconium fine wastes, as well as for the other reactive metals.

The Agency is proposing a treatment standard of "Deactivation as a Method of Treatment" for wastes in the D001 Ignitable Reactive subcategory. The Agency believes this is an appropriate approach for these wastes since the hazardous characteristic is based on imminent hazard (i.e., ignition and violent reaction) rather than on other criteria such as levels of hazardous constituents, and that technologies exist that can completely remove this characteristic. A more complete discussion of the implications of this standard is presented in section III.A.4.a.(2.) above, as well as an alternative proposed standard for wastes in this subcategory.

(4) Oxidizers Subcategory. The fourth subcategory is classified as the Oxidizers subcategory and refers to those D001 wastes that exhibit the properties listed in § 261.21(a)(4) and meet the definitions in 49 CFR 173.151. D001 wastes in the Oxidizers subcategory are primarily inorganic, and include such things as waste peroxides, perchlorates, and permanganates. The Agency has very limited information on the generation and characterization of D001 wastes in this subcategory. It is possible that certain aqueous solutions of these oxidizers may be useful in the treatment of other hazardous wastes. These wastes must, however, be used as treatment reagents in tanks and not in surface impoundments due to the potential release of heat and volatile

organics during the oxidation/reduction reactions (see 40 CFR 264.229 and 265.229).

The Agency is proposing a treatment standard of "Deactivation as a Method of Treatment" for wastes in the D001 Oxidizers Subcategory. The Agency believes this is an appropriate approach for these wastes since the hazardous characteristic is based on imminent hazard (i.e., oxidizers can react violently with organics or other materials and result in the rapid generation of fires) rather than on other criteria such as levels of hazardous constituents, and that technologies exist that can completely remove this characteristic. A more complete discussion of the implications of this standard is presented in section III.A.4.a.(2.) above, as well as an alternative proposed standard for wastes in this subcategory.

(5) *Need to Treat Rather Than Dilute Ignitable Wastes.* In section III.D. below, EPA discusses the issue of dilution to remove a characteristic and proposes that a prohibited form of dilution that is used to remove a characteristic from a prohibited hazardous waste would be a violation of the dilution prohibition in section 268.3. In this section the Agency addresses policy concerns that lead to the conclusion that dilution is not automatically a legitimate mode of treatment of ignitable wastes (and therefore is not a prohibited form of dilution for purposes of the section 268.3 dilution prohibition).

On first impression, one might assume that it does not matter how the ignitability characteristic is removed so long as the waste ends up non-ignitable. Ignitability, however, reflects presence of volatile organic compounds (VOC), which are ozone precursors. If ignitable wastes are diluted, VOC will ordinarily be emitted in concentrations far exceeding those emitted by treatment processes in which these volatiles are destroyed. Control of VOC is a legitimate concern under RCRA (section 3004 (m)) specifically calls for minimizing threats to the environment as well as to human health, and the Agency has specifically called attention to control of VOC in the 1987 proposed rule implementing RCRA section 3004 (n)). Volatile emissions from dilution also may pose a reignition hazard. Dilution of ignitable wastes also fails to utilize the wastes' energy value, contravening a fundamental RCRA goal of encouraging recovery of energy from wastes (RCRA section 1002 (d)). EPA also believes that allowing dilution of D001 wastes will create an incentive for generators to miscode the listed,

prohibited solvent wastes (F001-F005) as D001 wastes, frustrating the treatment requirements for those wastes.

Accordingly, the Agency believes that dilution should not be a legitimate method for treating ignitable wastes. Commenters on this point should address policy reasons for allowing dilution as treatment, or identify circumstances when dilution may occur as a legitimate adjunct to treatment.

**BDAT TREATMENT STANDARDS FOR D001
IGNITABLE LIQUIDS 261.21(a)(1)**

Incineration; Fuel Substitution; or Recovery as
Methods of Treatment

**BDAT TREATMENT STANDARDS FOR D001
IGNITABLE COMPRESSED GASES
261.21(a)(3)**

Incineration of Vented* Ignitable Gases; or Recovery
as Methods of Treatment

*Ignitable gases may be vented directly into an incinerator or vented into a suitable adsorbent prior to incineration. Although the gases, once vented, are no longer compressed in a cylinder the Agency does not consider that treatment has occurred until the ignitable gas has been incinerated. Adsorption of the ignitable gas into either a solid or liquid adsorbent is typically a reversible physical process. Thus, the ignitable chemical has not been destroyed.

**BDAT TREATMENT STANDARDS FOR D001
IGNITABLE REACTIVES 261.21(a)(2)**

Deactivation as a Method of Treatment

**BDAT TREATMENT STANDARDS FOR D001
OXIDIZERS 261.21(a)(4)**

Deactivation as a Method of Treatment

C. Corrosive Characteristic Wastes. Paraphrasing the criteria for defining a waste as a D002 Corrosive waste (40 CFR 261.22), a waste can be a D002 waste if it is aqueous and has a pH less than or equal to 2, or greater than or equal to 12.5; or it is a liquid and corrodes steel at a specified rate and temperature. EPA determined that these criteria translated into three subcategories for D002 wastes, the Acid Subcategory, the Alkaline Subcategory, and the Other Corrosives Subcategory.

(1) *D002 Acid and Alkaline Subcategory.* The Acid Subcategory and the Alkaline Subcategory, refer to those D002 wastes that exhibit the properties

listed in 40 CFR 261.22(a)(1) and are distinguishable by the appropriate pH specifications. The Acid subcategory is defined as those wastes with a pH of less than or equal to 2.0, and the Alkaline Subcategory is defined as those with a pH of greater than or equal to 12.5. Also by definition, D002 wastes in these two subcategories only include wastes which are considered to be "aqueous", due to the fact that standard pH measurements can only be performed in the presence of significant amounts of water (i.e., pH is the measure of the concentration of hydronium ions in water).

D002 wastes in the Acid subcategory typically include concentrated spent acids, acidic wastewaters, and spent acid strippers and cleaners. Wastes in the Alkaline subcategory typically include concentrated spent bases, alkaline wastewaters, and spent alkaline strippers and cleaners. D002 wastes represent a significant portion of all hazardous wastes generated by almost every industry.

The Agency believes that many D002 wastes in both the Acid and Alkaline subcategories are already being treated by chemical neutralization. These subcategories have been defined as hazardous due to their extremes in pH; therefore, any chemical neutralization technology will completely remove the extremes of pH and thereby render the waste noncorrosive. The choice of neutralizing reagents are dependent upon the subcategory of the waste, i.e., the acid wastes will require bases for neutralization and alkaline wastes will require acids.

Based on this, EPA is proposing a treatment standard of "Base Neutralization to pH 6-9 and Insoluble Salts" for the D002 Acidic Subcategory. Likewise, EPA is proposing a treatment standard of "Acid Neutralization to pH 6-9 and Insoluble Salts" for the D002 Alkaline Subcategory.

Neutralization with chemicals is not the same as simple dilution to achieve a neutral pH. While dilution will change the pH (i.e., the concentration of the hydronium ions), neutralization with chemicals involves a chemical reaction. Dilution is merely the addition of significant quantities of water in order to arrive at a neutral pH with the anions associated with the acid (or base) remaining in solution. Neutralization with acids or bases involves a reaction which utilizes a chemical change to achieve neutral pH with the anions either remaining in solution or precipitating as a sludge.

The Agency is proposing a range of pH 6 to 9 instead of the characteristic

range of pH 2-12.5 for several reasons. First, hydronium ions from acids solubilize metals from clay liners, impacting their ability to act as barriers to migration. Moreover, acid wastes between pH 2 and 6 can increase the mobility of many hazardous constituents in groundwater relative to wastes in the pH range of 6 to 9. Another reason the Agency is proposing this range because this matches the buffering of natural aquatic systems based on carbonate/bicarbonate pH relationship (i.e., pH 5.5 and 8.5 are carbonate/bicarbonate pH levels indicating what is referred to as the acidity and alkalinity (respectively) of an aqueous environmental sample).

The Agency notes, however, that the pH range of 6 to 9 may not be appropriate for deep well injection into certain formations. A different pH range may be specified in permits to ensure that injected fluid flows properly through the injection zone without plugging. Moreover, deep well injection zones are not near surface aquatic ecosystems. The Agency does not want to create anomalous results in the context of injected wastes and solicits comments on whether any pH range specified in an underground injection control permit should supercede the proposed treatment standard range of pH 6 to 9.

The Agency prefers neutralization of corrosive wastes over simple dilution because dilution simply creates a larger volume of wastes but does not treat or remove hazardous constituents in the wastes. Moreover, neutralization is more conservative of natural resources and more protective of aquatic ecosystems. An example of how neutralization conserves natural resources (i.e., water) is shown in the following scenario. Dilution of one gallon of the most frequently used industrial acid, concentrated sulfuric acid, to a pH of just above 2 requires 3,600 gallons of water. Dilution to completely neutralize the concentrated sulfuric acid to a level that is expected to have no ecological impact on fresh water systems would require 360,000,000 gallons of water. On the other hand, one gallon of this acid can be neutralized to pH 7 with only 12 pounds of caustic (sodium hydroxide) or only 11 pounds of lime (calcium hydroxide). Treatment to achieve pH 2 actually requires slightly less caustic or lime; however, the amount is not substantially less than the amount required to neutralize to pH 7.

The Agency recognizes, however, that dilution in order to facilitate treatment may be necessary (i.e., the added water serves as a heat sink that is necessary to control very exothermic reactions or

toxic air emissions). Dilution in order to facilitate treatment is not prohibited (see sections III.A.1.g. and III.H. for further discussion of dilution of characteristic wastes).

When selecting neutralization reagents, it is important to consider the solubility of the salts produced as a result of neutralization. This is illustrated by the following scenario. Chemical neutralization of one gallon of concentrated sulfuric acid with caustic (sodium hydroxide) results in 22 pounds of dissolved salts (in the form of sodium sulfate) that, if improperly managed, could adversely impact fresh water ecosystems. However, chemical neutralization with lime (calcium hydroxide) results in 19 pounds of relatively insoluble, nontoxic sludge which would have to be land disposed or otherwise recovered. (This solid waste could potentially be recycled or reused depending upon other constituents such as metals that may co-precipitate along with the solids.) In fact, data from the Toxic Release Inventory (TRI) indicates that sodium sulfate is the chemical being discharged in largest volumes to surface water. Therefore, the Agency prefers to neutralize D002 wastes such that relatively nontoxic solid wastes are generated rather than wastewater discharges with high dissolved solid contents that could potentially have adverse impacts on fresh water ecosystems. This is further illustrated by the discharge of soluble nitrate (from either neutralization or dilution of nitric acid, the second largest acid used in industry) and soluble phosphate (from phosphoric acid). Both of these ions are considered nutrients to aquatic ecosystems and at low levels contribute to the overall growth of fresh water ecosystems. However, the discharge of excessive amounts (or slugs of concentrations) of these ions could expedite algal growth and adversely impact the balance of the ecosystems.

It is important to point out that when neutralizing some concentrated acids such as nitric acid, the point that the acid enters the treatment reactor should be under the surface of water to avoid possible toxic gas generation (i.e., NO_x). Some facilities generate waste streams which fluctuate from the Acid subcategory to the Alkaline subcategory depending upon what process is used on a given day. These facilities might be able to utilize these fluctuations in pH as a means of performing on-site neutralization.

(2) *Recoverable Acids.* Recovery options have been demonstrated for a variety of corrosive wastes. The Agency

prefers recovery as a treatment standard, in that it results in no discharge of acidic constituents into the environment and conserves resources. The legislative history of the land disposal restriction provisions also indicates that recovery is the preferred management alternative. The Agency lacks waste characterization data which indicates the wastes that are most amenable to recovery, therefore, the Agency is establishing for this subcategory "Recovery as a Method" as the treatment standard. The choice between neutralization and recovery may be made by the generator or the centralized treatment operation, according to the applicability and performance of a given type of acid/base recovery system.

By establishing these treatment standards, the Agency is leaving open the opportunity to the regulated community to apply for a variance from the treatment standard to account for D002 wastes which cannot be effectively neutralized or recovered (40 CFR 268.44). Such a situation could occur for small quantities of corrosive materials that contain extremely toxic or otherwise hazardous chemicals that may cause an unnecessary risk during neutralization.

The Agency promulgated regulations for liquid hazardous wastes having a pH of less than or equal to 2.0 in the California list final rule (52 FR 25760, July 8, 1987) by codifying this statutory pH level into 40 CFR 268.32. This regulation, however, is not adequate to address the universe of D002 wastes. The California list restrictions apply only to liquid corrosive wastes without specifically identifying them as D002 wastes. Furthermore, the California list final rule did not specify neutralization as a required treatment standard; in fact, the waste may be merely rendered nonliquid prior to land disposal and still satisfy the California list requirements. Therefore, the Agency is today proposing treatment standards for D002 wastes that will supercede the California list regulations because they are more specific. (Note the discussion in section III.M., however, regarding continued applicability of the California list prohibitions during the periods of a national capacity variance.)

(3) *Other D002 Corrosives.* The third major subcategory is classified as the Other Corrosives subcategory and is defined as those D002 wastes that exhibit corrosivity to steel as defined in § 261.22(a)(2). They often are nonaqueous corrosive wastes such as certain organic liquids, but can represent inorganic chemicals as well.

Wastes in the Other D002 Corrosives subcategory are generated on a sporadic basis and generally in low volumes. The Agency suspects that these wastes are often identified as corrosive without performing the specified testing with steel (i.e., the corrosivity of the waste may be assumed due to the presence of known corrosive constituents). This may also be due, in part, to the high cost of testing and to the difficulties in identifying laboratories that are experienced in steel corrosion testing.

The physical and chemical characteristics of this group of wastes vary greatly. The wastes may be aqueous or they may be primarily organic. In addition, a large variety of corrosive chemicals may appear as constituents in this type of corrosive waste. Depending on the concentration of these corrosive chemicals, they may corrode SAE 1020 steel. Examples of chemicals that may contribute to corrosivity include ferric chloride, benzene sulfonyl chloride, benzotrichloride, acetyl chloride, formic acid, hydrofluoric acid, some catalysts, various resins, metal cleaners, and etchants. Highly concentrated acids that have no water content may also be included in this subcategory, since pH measurements are not possible on these wastes.

Wastes in the Other Corrosives subcategory are often treated by deactivating the corrosive constituents of the waste with an appropriate chemical reagent. Wastes that contain high concentrations of corrosive organics are often incinerated, however. Due to the great variety of potential corrosive organics, the Agency does not believe that it should establish concentration-based standards based on incineration for these D002 wastes. Removal and recovery of either organic or inorganic corrosive constituents may also be applicable technologies, since recovery could extract the corrosive constituents until the waste itself is no longer corrosive to steel.

EPA is proposing a treatment standard of "Deactivation: SAE 1020 Steel Corrosion Rate <6.35 mm/yr" for D002 wastes in the Other Corrosives subcategory. The Agency believes this is an appropriate approach for these wastes since the hazardous characteristic is based on imminent hazard (i.e., the corrosivity to steel may cause rupture of a tank or container, thus releasing the contents either suddenly or through leaks) rather than on other criteria such as levels of hazardous constituents, and that technologies exist that can completely remove this characteristic. A more

complete discussion of the implications of this standard is presented in section III.A.4.a.(2.) above, as well as an alternative proposed standard for wastes in this subcategory.

The Agency is soliciting comments and data on the physical and chemical characterization of all three subcategories of D002 wastes, as well as on the applicability of chemical deactivation and recovery. Facilities with D002 wastes that are not amenable to neutralization or deactivation techniques should submit data on the characteristics of their wastes and technically justify why they are not amenable to neutralization or deactivation early in the comment period for this proposal.

BDAT TREATMENT STANDARDS FOR D002 ACID SUBCATEGORY 261.22(a)(1)

Neutralization with Bases to: $6 < \text{pH} < 9$ and Insoluble Salts; or Recovery as a Method of Treatment

BDAT TREATMENT STANDARDS FOR D002 ALKALINE SUBCATEGORY 261.22(a)(1)

Neutralization with Acids to: $6 < \text{pH} < 9$ and Insoluble Salts; or Recovery as a Method of Treatment

BDAT TREATMENT STANDARDS FOR D002 OTHER CORROSIVES 261.22(a)(2)

Deactivation to: SAE 1020 Steel Corrosion Rate <6.35 mm/yr as a Method of Treatment

d. Reactive Characteristic Wastes. According to 40 CFR 261.23, there are eight criteria for defining a waste as a D003 Reactive waste. Paraphrasing these criteria, a waste can be a D003 waste if: (1) It is unstable and readily undergoes violent changes without detonating; or (2) it reacts violently with water; or (3) it forms potentially explosive mixtures with water; or (4) when mixed with water, it generates toxic gases; or (5) it is a cyanide or sulfide bearing waste which under certain conditions can generate toxic gases; or (6) it is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement; or (7) it is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure; or (8) it is a forbidden explosive, a Class A explosive, or a Class B explosive.

EPA determined that these eight criteria translated into five subcategories for D003 wastes. The first subcategory is classified as the Reactive Cyanides subcategory and refers to those D003 wastes that exhibit the properties listed in § 261.23(a)(5) for cyanide. The second subcategory is classified as the Explosives subcategory and refers to those D003 wastes that exhibit the properties listed in §§ 261.23(a)(6) through 261.23(a)(8). The third subcategory is classified as the Water Reactive subcategory and refers to those D003 wastes that exhibit the properties listed in §§ 261.23(a)(2) through 261.23(a)(4). The fourth subcategory is classified as the Reactive Sulfides subcategory and refers to those D003 wastes that exhibit the properties listed in § 261.23(a)(5) for sulfide. The fifth subcategory is classified as the Other Reactives subcategory and refers to those D003 wastes that exhibit the properties listed in § 261.23(a)(1).

All of the known treatment processes for the five D003 subcategories can result in significant amounts of solid residues. These residues may or may not exhibit the characteristic of EP toxicity for metals. As discussed in preamble section III.C., no residue which is a characteristic waste may be land disposed unless the treatment standard is a level above the characteristic level or the residue has otherwise complied with the applicable specified methods.

For all subcategories of D003 wastes except the Reactive Cyanides, the Agency believes that development of concentration-based treatment standards would be difficult because there are no known analytical tests that are specifically designed to measure the particular reactivity associated with each D003 treatability subcategory, nor is there a test that distinguishes the reactive chemical from the deactivated chemical (e.g., sodium is always measured as "total").

The Agency is soliciting comments and data on the physical and chemical characterization of all five subcategories of D003 wastes. The Agency also requests comment on the applicability of chemical deactivation, incineration, open detonation, and any other type of chemical or physical deactivation technology to these wastes. Facilities with D003 wastes that are not amenable to treatment using these technologies should submit data on the characteristics of their wastes and technically justify why they are not amenable to the proposed treatment methods early in the comment period for this proposal.

(1) *Reactive Cyanides*. D003 wastes in the Reactive Cyanides subcategory are by definition those cyanide-bearing wastes that generate toxic gases (assumed to be hydrogen cyanide) when exposed to pH conditions between 2 and 12.5, in a sufficient quantity to present a danger to human health and the environment. The Reactive Cyanide wastes typically are generated by the electroplating and metal finishing industries, and include mixed cyanide salts, cyanide solutions, and cyanide-bearing sludges. Most of the volume of all D003 wastes that are generated can be identified as the Reactive Cyanides subcategory. Reactive cyanide wastes are not typically placed directly in most types of land disposal units without treatment; however, it is possible that some are placed in surface impoundments.

Reactive Cyanide wastes are already subject to special requirements prior to disposal in landfills, surface impoundments, and waste piles under existing regulations. Also, as of July 8, 1987 (the statutory deadline for the California list prohibitions), liquid hazardous wastes having a free cyanide concentration in excess of 1,000 mg/kg (ppm) were prohibited from land disposal. These existing regulations and prohibitions are insufficient, however, to apply to the Reactive Cyanides subcategory. The statute did not specifically identify the California list cyanides as D003 wastes, and furthermore, it did not specify a required method of treatment, nor did it establish the 1,000 mg/kg prohibition level as a "treatment standard".

The Agency is proposing to transfer concentration-based treatment standards for total and amenable cyanides from treatment standards developed in the Second Third final rule (54 FR 26594, June 23, 1989) for P030 nonwastewaters, to the Reactive Cyanides subcategory. The Agency believes that D003 wastes resemble P030 rather than the cyanide-containing F006-F009 wastes because D003 wastes are described as "reactive" cyanides and P030 is listed as "soluble" cyanides. Soluble cyanides are most likely to be reactive because they are dissolved. Reactive Cyanides are thus expected to be easily treated by treatment technologies such as alkaline chlorination and wet air oxidation to meet today's proposed treatment standard for total cyanide of 110 mg/kg and amenable cyanide of 9.1 mg/kg. (Note: The treatment standards for P030 were developed based on a transfer from data on the treatment of an F011 waste containing low levels of iron and

high levels of simple, soluble cyanides (i.e., low levels of complexed cyanides). However, the principle of relating P030 wastes, i.e., "soluble" cyanides, to D003 "reactive" cyanides remains essentially the same.)

The Agency is also proposing that if data are submitted in public comments that clearly indicate that D003 wastes in the Reactive Cyanides subcategory more closely resemble F006 wastes containing high concentrations of iron or other complexed cyanide, the Agency will promulgate the higher F006 treatment standards for cyanides that were established in the Second Third rule which reflect the presence of iron cyanide complexes. The Agency believes that F006 wastes containing high concentrations of iron represent wastes that are more difficult to treat than those containing only reactive cyanides (or those containing low concentrations of iron). Thus, if D003 Reactive Cyanides are shown to be more similar to F006, they will be subject to a total cyanide level of 590 mg/kg and an amenable cyanide level of 30 mg/kg.

The Agency will not promulgate the higher (i.e., F006) treatment standards for D003 Reactive Cyanides unless the data clearly indicate that the wastes are not merely mislabeled F006, F007, F008, F009, F010, F011, F012, F019 or P cyanide wastes. The Agency suspects that some generators are currently misclassifying these wastes as D003. The Agency believes that this is primarily an issue for enforcement. However, by promulgating the lower treatment standards (transferred from P030) for D003 Reactive Cyanides, proper identification of the F and P cyanide wastes will be encouraged. Of greater importance is the fact that the Agency believes that *soluble* cyanide wastes (e.g., P030) and wastes containing low iron (e.g., some F011) are more likely to be similar to D003 *Reactive* Cyanides, so that the lower cyanide standards are achievable and therefore would apply. (See also section III.A.6.(a) of today's preamble for a further discussion of proposed cyanide treatment standards for other wastes and a proposed clarification of the analytical methodology for compliance with the promulgated standards.)

(2) *Reactive Sulfides Subcategory*. D003 wastes in the Reactive Sulfides subcategory are by definition those sulfide-bearing wastes that generate toxic gases (assumed to be H₂S) when exposed to a pH between 2 and 12.5, in a sufficient quantity to present a danger to human health and the environment. The Agency is in the process of

developing a quantitative threshold for toxic gas generated from reactive sulfide wastes. The interim value the Agency is considering is 500 mg of H₂S generated per kilogram of waste. Although this number is only an interim guideline, for the purpose of BDAT determinations the Agency is proposing to use this number to identify the wastes in this subcategory (given the need for an objective means of determining the subcategory's applicability).

Reactive sulfides may be treated and chemically converted to relatively inert sulfur, to insoluble metallic sulfide salts, or to soluble sulfates that can be removed or recovered. Some data indicate that these wastes can be treated by alkaline chlorination, specialty incineration, or other chemical deactivation techniques. The Agency believes that some of these wastes may also be contaminated with organic sulfides known as mercaptans. These malodorous chemicals are believed to complicate the treatment of these reactive sulfide wastes. It is believed that these wastes have posed particular treatment problems for the petroleum refining industry and the paper and pulp industry.

The Agency is proposing a treatment standard of "Alkaline Chlorination, Chemical Oxidation, or Incineration Followed by Precipitation to Insoluble Sulfates" for the Reactive Sulfide subcategory. (Note: While alkaline chlorination is a form of chemical oxidation, the Agency did not want to specifically preclude the use of any particular oxidant.) The treatment standard is expressed as a required method of treatment rather than as a concentration-based standard because the Agency has not approved a standard analytical method for testing either sulfides or "reactive" sulfides in hazardous wastes or in treatment residues (however, as noted above, the Agency is working to develop a quantitative threshold for reactive sulfides). The Agency solicits waste characterization and treatment data that could potentially be used to develop concentration-based treatment standards for these wastes.

(3) *Explosives subcategory*. D003 wastes in the Explosives subcategory are by definition those wastes that are capable of detonation or explosive reaction under various conditions, or are forbidden, Class A, or Class B explosives (according to 49 CFR 173.52, 173.53, and 173.88 respectively). These wastes have typically been identified as being generated by the explosives industry and by the U.S. Department of Defense. While these wastes are not

generated as frequently as the Reactive Cyanides, they are generated more often than all other Reactive subcategories. Explosives are already subject to special requirements prior to disposal in landfills, surface impoundments, and waste piles under existing regulations. These explosive wastes are not typically placed in most types of land disposal units; rather, they are treated by either open burning, open detonation, or incineration in specially designed units. Such treatment is expected to permanently remove the explosive characteristic of this D003 waste.

Incineration also appears to be an applicable technology, so long as the incineration units must be specially designed and fitted with explosion-proof equipment. Such units are not typically found at commercial incineration facilities. The Agency is aware that these types of units are currently used by the Department of Defense to treat explosive wastes, and there appears to be a decrease in reliance on open detonation. Due to the large number of explosive formulations and the difference in applicable treatments (see Department of the Army Technical Manual TM9-1300-214, Military Explosives) the Agency is proposing a general standard of "Deactivation as a Method of Treatment" for the D003 Explosives subcategory. By establishing this standard, the Agency is allowing the regulated community to use that treatment technology (e.g., incineration, chemical deactivation) that best fits the type of explosive waste. The Agency believes this is an appropriate approach for these wastes since the hazardous characteristic is based on imminent hazard (i.e., explosivity) rather than on other criteria such as levels of hazardous constituents, and that technologies exist that can completely remove this characteristic. A more complete discussion of the implications of this standard is presented in section III.A.4.a.(2.) above, as well as an alternative proposed standard for wastes in this subcategory. (See also the Background Document for Characteristic Wastes for more information on explosive waste characterization.)

(4) *Water Reactive and Other Reactives Subcategories.* D003 wastes in the Water Reactive or Other Reactives subcategories can be either organic or inorganic. Water Reactive D003 wastes are either very reactive with water, or can generate toxic or explosive gases with water. These reactions are usually very vigorous and therefore difficult to control. Wastes in both of these

subcategories are generated on a sporadic basis and generally in low volumes. These wastes are not typically placed in land disposal units nor are they placed in surface impoundments due to their violent reactivity.

The Agency has information that suggest that some water reactives are being open detonation. It is theorized that the reactive organic constituents are destroyed by the explosion, and the reactive inorganic constituents form less hazardous oxides or react with other chemicals in the explosion (such as moisture from the air).

In today's notice, the Agency is proposing a general standard of "Deactivation as the Method of Treatment" for the D003 Water Reactives and Other Reactives subcategories. The Agency believes this is an appropriate approach for these wastes since the hazardous characteristic is based on imminent hazard (i.e., potential violent reactions with water) rather than on other criteria such as levels of hazardous constituents, and that technologies exist that can completely remove these reactive characteristics. A more complete discussion of the implications of this standard is presented in section III.A.4.a.(2.) above, as well as an alternative proposed standard for wastes in these subcategories.

(5) *Treatment of Reactive Wastes Does Not Automatically Include Dilution.* As discussed with respect to ignitable wastes, EPA is proposing to classify dilution that removes a prohibited waste's characteristic as impermissible in certain circumstances (see section III.D. below). This part of the preamble addresses why dilution of reactive wastes should not automatically be considered to be a legitimate form of treatment.

For reactive wastes that contain cyanide or sulfides, the dilution prohibition should clearly apply for the same reason that it applies to any toxic waste. Indeed, the legislative history to the treatment standard provision states specifically that cyanides should be destroyed. 130 Cong. Rec. S 9178-79 (July 25, 1984) (statement of Sen. Chafee). With respect to other reactive wastes, most cannot be diluted without violent reaction so that dilution is not a viable management alternative in any event. It thus is the Agency's view that dilution is not automatically a permissible means of treating reactive hazardous wastes.

BDAT TREATMENT STANDARDS FOR D003 REACTIVE CYANIDES 261.23(a)(5)

[Nonwastewaters]

Regulated constituent	Maximum for any single grab sample, total composition (mg/kg)
Cyanides (Total).....	110
Cyanides (Amenable).....	9.1

BDAT TREATMENT STANDARDS FOR D003 REACTIVE CYANIDES 261.23(a)(5)

[Wastewaters]

Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
Cyanides (Total).....	1.9
Cyanides (Amenable).....	0.10

BDAT TREATMENT STANDARDS FOR D003 REACTIVE SULFIDES 261.23(a)(5)

Alkaline chlorination, chemical oxidation, or incineration followed by precipitation to insoluble sulfates as methods of treatment

BDAT TREATMENT STANDARDS FOR D003 EXPLOSIVES, WATER REACTIVES, AND OTHER REACTIVES 261.23(a)(6), 261.23(a)(2) THROUGH (4), AND 261.23(a)(1) RESPECTIVELY

Deactivation as a method of treatment

e. Effect of Treatment Standards on Disposal Provisions in 40 CFR 264 and 265 for Ignitable and Reactive Wastes. Management practices have been established for ignitable and reactive wastes in surface impoundments, waste piles, land treatment units, and landfills (see 40 CFR 264.229, 264.256, 264.281, and 264.312, as well as 265.229, 265.256, 265.281, and 265.312). When finalized, the treatment standards proposed today for ignitable (D001) and reactive (D003) wastes will supersede the above-mentioned provisions and exclusions for permissible land disposal of these waste outlined in Part 264 and 265; therefore, the Agency is proposing to amend these sections to reflect the new regulations in Part 268. Facilities handling ignitable and reactive wastes will have to comply with the promulgated treatment

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standards for these wastes in order to land dispose them.

f. *U and P Wastes That are Potentially Reactive.* These wastes were grouped together because they are either highly reactive or explosive, or they are polymers that tend to be highly reactive. These wastes pose a significant risk during handling due to their reactivity; this is reflected in the fact that there are no standard SW-846 methods for analyzing reactivity. Because of the difficulties in handling and analyzing these wastes, the Agency is proposing treatment standards expressed as required methods of treatment (thus eliminating the need to analyze treatment residues).

The Agency investigated several options for developing treatment standards for these wastes, including incineration, open burning, open detonation, and chemical deactivation. Most of these wastes are currently managed by incineration. Other wastes included in this group can be recovered or recycled.

For the purpose of BDAT determinations, the Agency has identified four subcategories according to similarities in treatment, chemical composition, and structure. These groups are: (1) Incinerable Reactive Organics and Hydrazine Derivatives; (2) Incinerable Inorganics; (3) Fluorine Compounds; and, (4) Recoverable Metallics. The discussion of the treatment standards applicable to each subcategory are as follows.

(1) *Incinerable Reactive Organics and Hydrazine Derivatives.*

P009—Ammonium picrate
P081—Nitroglycerin
P112—Tetranitromethane
U023—Benzotrifluoride
U096—*a,a*-Dimethyl benzyl hydroperoxide
U103—Dimethyl sulfate
U160—Methyl ethyl ketone peroxide
P068—Methyl hydrazine
U086—*N,N*-Diethylhydrazine
U098—1,1-Dimethylhydrazine
U099—1,2-Dimethylhydrazine
U109—1,2-Diphenylhydrazine
U133—Hydrazine

Incineration represents BDAT for the wastes in this treatability group. Data indicate that these wastes are currently incinerated by commercial, as well as military facilities. The Agency does not believe, however, that concentration-based treatment standards based on incineration can be established for these wastes at this time. The major problems in establishing concentration-based standards for these wastes are: (1) EPA does not currently have an analytical method for measuring many of these wastes in treatment residues; and (2) where the Agency does have methods,

there are no data available on the treatment of these chemicals. In cases when there is no verified analytical method for a particular waste, EPA tries to find an appropriate measurable surrogate or indicator compound; however, no constituent has been identified in these wastes that could be used as a surrogate or indicator compound. (See section III.A.1.h.(2) for a detailed discussion of analytical problems.)

One of the specific problems encountered in analysis of P068, P112, U023, U098, U099, and U103 is that these wastes break down quickly in water (hydrolyze) and that the analysis of wastewater forms of these wastes is very difficult as well as often hazardous due to the intensity of the reaction. See further discussion on the impact of instability in water on the development of treatment standards in section III.A.1.h.(2)(c) of today's notice. In addition, the Agency lacks data on what effects the hydrolysis products would have on the environment. Besides, verified analytical methods do not currently exist for the quantification of these hydrolysis products in treatment residues.

Another analytical problem is created because P081 wastes are only quantifiable by HPLC methods (Note: EPA rejects HPLC methods for waste treatment residual matrices for reasons discussed in section III.A.2.h.(2)(a).) In addition, there are no verified SW-846 analytical methods for measuring P009 and U133 in treatment residues.

These analytical problems preclude setting concentration-based treatment standards. The Agency is thus proposing "Thermal Destruction" (e.g., incineration) as a required method of treatment for the nonwastewater forms of these U and P wastes. Although there is an SW-846 method for U109, the Agency is not proposing a numerical standard for this waste since it is very similar to P068, U086, U098, U099, and U133 (all are hydrazine compounds) and it is the Agency's belief that thermal destruction will be effective treatment for this waste.

The Agency is proposing "Carbon Adsorption" as a required method of treatment for the wastewater forms of this group of U and P wastes. Wastewater forms of these wastes can easily be adsorbed due to the branched and ionic nature of their structures. After adsorption (and before disposal) the contaminated carbon must be incinerated (in compliance with the proposed treatment standard for nonwastewaters).

Data indicate that some of these wastes (i.e., P068) can be treated by

ozone/ultraviolet light oxidation. For complete removal and destruction of these wastes from wastewaters, however, ozone/ultraviolet light oxidation must be followed by carbon adsorption in order to meet the treatment standard when it is promulgated.

The Agency is unaware of any alternative treatment or recycling technologies that have been examined specifically for these U and P wastes and is, therefore, soliciting data and comments on such technologies. In any case, today's proposed treatment standard does not preclude recycling (provided the recycling does not involve burning as fuel or is not a use constituting disposal; see § 261.33, first sentence).

(2) *Incinerable Inorganics.*

P006—Aluminum phosphide
P096—Phosphine
P105—Sodium azide
P122—Zinc phosphide (<10%)
U135—Hydrogen sulfide
U189—Phosphorus sulfide
U249—Zinc phosphide (<10%)

These wastes were grouped together because they consist of compounds containing only inorganics such as sulfur, nitrogen, phosphorous, and metals. Data indicate that these wastes are currently being incinerated by some commercial facilities. The Agency does not believe, however, that numerical treatment standards based on incineration can be established for these wastes at this time. The major problem in establishing concentration-based standards for these wastes is that EPA does not currently have an analytical method for measuring these wastes in treatment residues. In cases when there is no analytical method for a particular waste, EPA tries to find an appropriate measurable surrogate or indicator compound; however, no constituent has been identified in these wastes that could be used as a surrogate or indicator compound for nonwastewaters. See section III.A.1.h.(2) for a detailed discussion of analytical problems.

One of the specific problems encountered in analysis of P006 and P105 is that these wastes break down quickly in water (hydrolyze), making the analysis of wastewater forms of these wastes very difficult. In addition, SW-846 analytical methods do not exist for P105 and U189. In today's rule the Agency is proposing a treatment standard of "Thermal Destruction" for the nonwastewater forms of these wastes. While these wastes are inorganic, thermal destruction will convert these reactive and acutely toxic

materials to less toxic, nonreactive inorganic oxides. However, these wastes will probably contain high concentrations of sulfur and phosphorous when discarded as off-spec products, making their treatment more difficult. Incineration of these wastes will require the use of air pollution control equipment capable of controlling the emissions of phosphorous and sulfur to acceptable levels (see the discussion of this issue as it relates to organo-nitrogens and organo-sulfur U and P wastes in section III.A.3.g.).

For wastewater forms of P006, P096, P122, U135, U189, and U249, the Agency is proposing a standard of "Chemical Oxidation Followed by Precipitation as Insoluble Salts". For the wastewater forms of P105, the Agency is proposing "Chemical Oxidation" as a method of treatment because the sodium azide forms sodium ions in solution rather than forming salts.

The Agency is currently unaware of any alternative treatment or recycling technologies that have been examined specifically for these wastes and solicits data and comments on these. The proposed rule, in any case, does not preclude recycling (provided the recycling does not involve burning as fuel or is not a use constituting disposal; see § 261.33, first sentence).

(3) Fluorine Compounds.

P056—Fluorine
U134—Hydrofluoric Acid

These wastes were grouped together because of their physical form and because they contain fluorine. Both of these chemicals may be generated as gases (although U134 is often generated as an aqueous acid). Both of these chemicals are also highly reactive and highly corrosive.

The Agency is proposing a treatment standard of "Solubilization in Water Followed by Precipitation as Calcium Fluoride" as a method for the nonwastewater form of these wastes, based on the chemical properties of aqueous fluoride ions and the insolubility of calcium fluoride. The Agency is also proposing that recovery as an alternative specified method. The Agency is requesting comments and data on these options.

The Agency has recently collected data for the wastewater forms of these wastes (see BDAT Background Document for Wastewaters Containing BDAT List Constituents in the RCRA Docket). Based on these data, the Agency is proposing a concentration-based treatment standard of 35 mg/l.

(4) Recoverable Metallics.

P015—Beryllium dust
P073—Nickel carbonyl

P087—Osmium tetroxide

The Agency has identified the wastes in this group as metal wastes that have a high potential for recovery. Because there are so little data on these wastes, characterization is very difficult. All the wastes in this group contain metallic elements (i.e., beryllium, osmium, and nickel) that can be recovered due to their high economic value. Information available to the Agency indicates that recovery of these metallic elements from these waste is feasible and is currently practiced. The Agency is proposing a standard of "Recovery as a Method of Treatment" for both nonwastewater and wastewater forms of these wastes. At this time the Agency is not aware of any treatment alternative applicable to these wastes and is soliciting comments and information that may help to identify alternative treatment.

BDAT TREATMENT STANDARDS FOR
P009, P068, P081, P112, U023, U086,
U096, U098, U099, U103, U109, U133,
AND U160

[Nonwastewaters]

Thermal Destruction as a Method of Treatment

BDAT TREATMENT STANDARDS FOR
P009, P068, P081, P112, U023, U086,
U096, U098, U099, U103, U109, U133,
AND U160

[Wastewaters]

Incineration or Carbon Adsorption as Methods of
Treatment

BDAT TREATMENT STANDARDS FOR
P006, P096, P105, P122, U135, U189,
AND U249

[Wastewaters]

Chemical Oxidation Followed by Precipitation as
Insoluble Salts as a Method of Treatment

BDAT TREATMENT STANDARDS FOR
P006, P096, P105, P122, U135, U189,
AND U249

[Nonwastewaters]

Thermal Destruction as a Method of Treatment

BDAT TREATMENT STANDARDS FOR
P015, P073, AND P087

Recovery as a Method of Treatment

BDAT TREATMENT STANDARDS FOR
P056 AND U134

[Nonwastewaters]

Solubilization in Water Followed by Precipitation as
Calcium Fluoride; or Recovery as Methods of
Treatment

BDAT TREATMENT STANDARDS FOR
P056 AND 134

[Wastewaters]

Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
Fluoride.....	35

5. Proposed Treatment Standards for Metal Wastes—*a. Introduction.* Metal wastes are hazardous wastes containing metallic compounds such as metallic salts, organometallics, and bimetallic compounds. Certain K, U, and P wastes were listed specifically for the presence of metallic compounds. Additionally, a waste can be identified as an EP toxic characteristic waste based on the concentration of one of eight different metals (see 40 CFR 261.24). Paraphrasing the criteria in 40 CFR 261.24, a waste exhibits the characteristic of EP toxicity if the extract from the EPA-specified extraction procedure (EP) contains arsenic, barium, cadmium, chromium, lead, mercury, selenium, or silver at a concentration equal to or greater than the levels presented in Table I—Maximum Concentration of Contaminants for Characteristic of EP Toxicity.

(1) General Characterization of Metal Wastes. There are also patterns encountered in characterizing metal compounds that had to be dealt with in order to propose treatment standards for these wastes. Some waste characterization data was gathered by EPA in the National Survey of Treatment, Storage, Disposal, and Recovery Facilities (the TSDR Survey); however, the major source of waste characterization data was the National Survey of Hazardous Waste Generators

US EPA ARCHIVE DOCUMENT

(the Generator Survey). The Generator Survey was statistically designed to represent a cross-section of all major hazardous waste generators. Results of this survey have been used to develop today's proposed treatability groups and corresponding treatment standards whenever possible. (However, one problem encountered was that the U and P wastes are generated sporadically; thus, characterization data on the U and P forms of these metal wastes are limited.)

Results of the Generator Survey indicate that many metalbearing wastes often exhibit another characteristic such as reactivity, or contain concentrations of other metals above their characteristic levels. For example, P065 (mercury fulminate) exhibits the characteristic of reactivity which must be removed prior to land disposal. Another example is that of P114 (thallium selenite), where proposed treatment standards address both total thallium and total selenium. If metal wastes exhibit multiple characteristics, treatment must address each characteristic (including the characteristic of EP toxicity for each metal where a waste is EP toxic for a number of metal constituents), in addition to the primary metal constituent. Generally, this requirement presents no problem in that most metals are amenable to conventional metal hydroxide or sulfide precipitation and stabilization. There are problems, however, associated with arsenic, barium, selenium, and mercury. These metals are discussed separately in subsequent sections due to their unique chemistries.

There are certain analytical difficulties associated with metal compounds that EPA had to deal with in order to propose treatment standards for these wastes. Analytical methods are capable of measuring the concentration of a specific toxic metal in a waste. There is no way, however, to measure the concentration of a specific metallic compound (e.g., a metal salt). For example, given a mixture of chromium nitrate and chromium sulfate, analytical methods will measure chromium but will not determine whether it is in the sulfate or nitrate form. Further complications in identifying the specific metallic compound arise because many of these compounds will dissociate in water. Therefore, treatment standards for metallic compounds are based on a quantitative analysis for the metal constituent only, and not on the metallic salt. The Agency believes that by regulating the metal, the primary toxic hazard associated with these metallic

compounds will be controlled. For example, the Agency believes that by regulating total chromium in U032 (calcium chromate), the hazards associated with that waste will be addressed. The Agency requests comment on whether it is appropriate to regulate only the toxic metal constituents in these wastes.

(2) *Development of Treatment Standards for Metals.* Most metal wastes are generated in inorganic matrices such as inorganic solutions, wastewater treatment sludges, or incinerator ash-type residues. These wastes are typically amenable to conventional treatment such as metal hydroxide or sulfide precipitation and stabilization. Metal wastes may be present, however, in complex matrices such as contaminated soil or have significant quantities of organic constituents. Stabilization techniques may not always be effective treatment for these organometallic wastes; therefore, incineration is typically required to destroy the organic constituents prior to recovery or stabilization.

In today's notice, the Agency is proposing treatment standards for many of the D, F, K, U, or P wastes expressed as concentrations of specific metals. Performance data are available from treatment of various F and K wastes which contain these metals. Characterization data on many of these metal wastes are limited, and therefore, the Agency is proposing treatment standards for many metal-bearing wastes based on a transfer of performance data from other wastes containing these metals having similar waste characteristics. The Agency is soliciting comment on these transfers for metal wastes.

The Agency is proposing treatment standards for the characteristic metals expressed as concentration-based standards or as required methods of treatment. Consistent with the discussion in preamble section III.C., the Agency is, in some cases, proposing concentration-based treatment standards lower than the characteristic levels. In other cases, the Agency is specifying a method of treatment. EPA could possibly develop concentration-based treatment standards, however, if commenters submit data supporting such an action. The preamble sections that follow contain summaries of the Agency's initial conclusions. More detailed information is contained in the Background Document for each metal.

(3) *Relationship to California List Prohibitions.* There is regulatory overlap between the statutory levels in effect for

California list metals and the treatment standards for characteristic metal wastes being proposed today. The Agency has stated in previous rulemakings (see 52 FR 25773 (July 7, 1987); and 53 FR 31187 (August 17, 1989)) that in cases where there is regulatory overlap, the more waste-specific treatment standard applies.

The Agency is today proposing treatment standards for characteristic EP toxic metal wastes. The proposed concentration-based wastewater and/or nonwastewater treatment standards, when promulgated, will supercede the California list statutory levels for these metals because they are more specific. The California list statutory levels will continue to apply to the land disposal of liquid hazardous wastes containing nickel and thallium (except for those F, K, U, or P listed wastes for which treatment standards for nickel and/or thallium are promulgated) because these toxic metals are currently not covered by the EP toxicity test. (See also section III.M. below dealing with the issue of continued applicability of California list prohibitions including during national capacity variance periods.)

b. Arsenic and Selenium

- D004—EP toxic for arsenic
- D010—EP toxic for selenium
- K031—By-product salts generated in the production of MSMA and cacodylic acid.
- K084—Wastewater treatment sludges generated during the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds.
- K101—Distillation tar residues from the distillation of aniline-based compounds in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds.
- K102—Residue from the use of activated carbon for decolorization in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds.
- P010—Arsenic acid
- P011—Arsenic (V) oxide
- P012—Arsenic (III) oxide
- P036—Dichlorophenylarsine
- P038—Diethylarsine
- P103—Selenourea
- P114 Thallium selenite
- U136 Cacodylic acid
- U204—Selenious acid
- U205—Selenium disulfide

These wastes are grouped together because they all contain either arsenic or selenium as the primary hazardous constituent. The Agency considers arsenic and selenium to be in the same general treatability group due to similarities in their chemical behavior.

Although arsenic and selenium exhibit positive valence states, they show little tendency to exist as solitary cationic species in aqueous matrices. Arsenic and selenium typically exist in aqueous conditions as oxo-anions (e.g., arsenic appears primarily as anionic arsenite (AsO_2^-) or arsenate (AsO_4^{3-})). This behavior is important, in that selection and performance of treatment technologies for other metals are based primarily on the cationic behavior of the metals in aqueous conditions. Thus, treatment technologies for both wastewaters and nonwastewaters containing arsenic and selenium are often different compared to wastes containing only other metal constituents.

The treatment standards presented in today's preamble for all arsenic and selenium wastes are based on a limited amount of treatment data. In this notice the Agency is soliciting data on the characterization and treatment of wastes containing arsenic or selenium. Copies of any additional data pertaining to these proposed treatment standards that may be submitted during the public comment period can be specifically requested in writing by identifying the request for data as "Additional data on treatment of arsenic and selenium—Section III.A.5.b.". See section III.A.1.i. of today's preamble for additional information on procedures for requesting additional data on specific standards.

(1) *Identification of BDAT for Wastewaters.* When evaluating treatment technologies to establish wastewater treatment standards for arsenic and selenium wastes, the Agency believes that it must consider not only the efficiency of removal of these metals from the wastewater, but also the physical and chemical state of the arsenic and the selenium that ends up in the wastewater treatment residues. Wastewater treatment for most metals is typically based on precipitation with anionic species such as hydroxide or sulfide.

Soluble arsenic species have been reported to be removed from wastewaters by using lime (calcium hydroxide) as a precipitant, resulting in arsenic precipitation as a calcium salt (calcium arsenate) rather than as a hydroxide as is typical for most other metals. Sulfide precipitation using sodium sulfide or hydrogen sulfide as reagents has also been reported as being partially effective for wastewaters containing arsenic in the form of arsenates, but relatively ineffective for arsenites. The removal of arsenic through the addition of a sulfide is believed to be the result of a chemical

reaction of the arsenate anions with the sulfide anions thereby converting the arsenate form to a relatively insoluble arsenic sulfide. While calcium arsenate is slightly soluble in water, arsenic sulfide is practically insoluble in water. Although lime may be effective in precipitating arsenic from wastewaters, sulfide precipitation should result in a precipitate that is less soluble in water than the calcium salt.

To further complicate matters, while arsenic sulfide is relatively insoluble in water under acid conditions, information indicates that the leachability (i.e., solubility) of the arsenic sulfide increases under alkaline conditions. Therefore, the decrease in solubility of arsenic sulfide versus the calcium arsenate must be balanced against the potential for leachability of the resulting wastewater treatment sludges during co-disposal with alkaline wastes or materials. This potential for increased leachability under these conditions is a legitimate concern, in that some operators of hazardous landfills co-dispose all "metal" wastes and it is typical practice to add excess lime to prevent migration of the other metals prior to disposal.

The Agency solicits comment on whether it should specify the use of sulfide as the precipitating reagent for all wastewaters containing arsenic as part of the treatment standard. In a similar manner, the Agency solicits comment on whether it should establish disposal requirements under 40 CFR parts 264 and 265 for all arsenic and selenium wastewaters that would require sulfide precipitation followed by segregation of the treatment residuals from alkaline materials (in either monofills or separate subcells within a landfill). Such a requirement would be a type of management standard designed to prevent co-disposal of incompatible wastes. By soliciting comment, EPA notes that these proposed requirements may be promulgated as additional requirements to meeting the proposed concentration-based standards.

Some arsenic and selenium wastewaters, such as those from wood preserving operations, may require more extensive treatment trains in order to treat hexavalent chromium, other metals, and organics which could possibly interfere with the treatment of the arsenic or selenium. A reduction step for hexavalent chromium and an oxidation step (with reagents such as hydrogen peroxide or hypochlorite) may be necessary to treat the organics. In addition, complexed organometallics which may be present will probably have to be oxidized or otherwise

removed prior to conversion of the metals to their proper valence state for further metal treatment by precipitation. However, the Agency currently lacks data that indicate that the proposed concentration-based standards cannot be achieved for these types of wastes and anticipates that pretreatment steps such as hexavalent chromium reduction and chemical oxidation of organics could remove these potential interferences. This is further supported by the fact that quantitative analytical methods for arsenic and selenium in waste samples include such pretreatment steps to remove the interferences during analysis. The Agency specifically solicits comments on the applicability of these and other pretreatment technologies for arsenic and selenium wastewaters and data that indicate the achievability of the concentration-based standards proposed in the following sections.

(a) *Proposed Standards for Arsenic-Containing Wastewaters.* The Agency has data on precipitation of arsenic from wastewaters identified as D004 from the veterinary pharmaceutical industry using lime followed by manganese sulfate and ferric in a three stage alkaline process. The Agency believes that these data represent a matrix that is very difficult to treat since it consists of a mixture of organic and inorganic compounds, including organo-arsenicals and inorganic arsenic compounds in concentrations up to 1,600 ppm. The data show that this three stage alkaline precipitation process provides effective treatment and removal of arsenic from these wastewaters because it reduces the concentration of arsenic in the wastewater to levels below the characteristic level of 5.0 mg/l. Therefore, the Agency is proposing two options for treatment standards for D004 wastewaters.

Based on these treatment data, the Agency is proposing a treatment standard of 0.79 mg/l arsenic for all D004 wastewaters. The Agency believes that these wastes represent the most difficult to treat wastewaters. As discussed in detail in section III.C. of today's preamble, the Agency has initially determined that it has the authority to establish treatment standards below the characteristic level for these wastes or at least to make failure to treat to the lower level a violation of section 3004(m). The Agency is also proposing a second option of limiting the treatment standard for D004 wastewaters to the characteristic level of 5.0 mg/l. The Agency specifically solicits comments on these two options.

The constituents for which P010, P011, and P012 wastes are listed are all inorganic forms of arsenic. The constituents for which P036, P038, and U136 wastes are listed are all organic forms of arsenic. K031 and K084 are typically generated as process wastes that contain mixtures of both organic and inorganic forms of arsenic. While all of these wastes are typically generated as nonwastewaters, the Agency expects that wastewater forms of these wastes may be generated from incidental spills or from the treatment process itself and thus would require treatment standards. The Agency expects that untreated wastewaters will be more dilute than the untreated D004 wastewaters that were used to develop the treatment standards, and thus would be expected to be less difficult to treat. Further, while K031, K084, P036, P038, and U136 wastes all contain organic forms of arsenic, the Agency believes that they can be chemically oxidized (using peroxides, permanganates, persulfates, or perchlorates) to destroy the organometallic bond prior to precipitation.

The Agency is proposing to transfer the D004 performance data and concentration-based treatment standard of 0.79 mg/l for K031, K084, P010, P011, P012, P036, P038, and U136 wastewaters. This is a reasonable approach given that: (1) The D004 wastewater that was tested by the Agency contained organo-arsenicals similar in structure to (or more complex than) those contained in K031, K084, P036, P038, and U136; (2) the D004 wastewater also contained inorganic arsenic compounds similar to those contained in K031, K084, P010, P011, and P012; (3) the untreated wastewater forms of these wastes are expected to be more dilute than the untreated D004 wastewater; and (4) the performance data demonstrate that the arsenic in the D004 wastewater can effectively be removed.

Additional wastewater treatment data primarily from the Agency's Office of Water have been recently analyzed for incorporation into the treatment standards for arsenic wastewaters. These data include the treatment of wastewaters that are not specifically listed as RCRA hazardous wastes, but do contain many of the corresponding U, P, and metal constituents. While these data were not available in time to incorporate into this discussion or into the background document for these wastes, these data are being placed in the administrative record for today's notice. Therefore, the Agency is not precluded from using these data in promulgating the standards for these

wastes. Further information on these data can be found in section III.A.1.h.(6.).

An alternative standard for arsenic based on these data are presented in section III.A.7. of today's notice for wastewater forms of multi-source leachate. This standard is based on single step chemical precipitation process. Thus, the Agency is proposing these standards as alternative standards for wastewaters for which concentration-based standards based on incinerator scrubber waters have been proposed in the following sections.

(b) *Proposed Standards for Selenium-Containing Wastewaters.* The Agency has no specific treatment data on RCRA hazardous wastewaters containing selenium. However, based on the similarities in chemical behavior of arsenic and selenium, the Agency is proposing to extrapolate the performance data for arsenic contained in D004 wastewaters to the selenium contained in D010 wastewaters and is thus proposing two options for treatment standards for D010 wastewaters.

Based on these treatment data, the Agency is proposing a treatment standard of 0.79 mg/l selenium for all D010 wastewaters. This is based on a level of treatment achieved for wastewaters that are representing the most difficult to treat. As discussed in detail in section III.C. of today's preamble, the Agency has initially determined that it has the authority to establish treatment standards below the characteristic level for these wastes or at least to make failure to treat to the lower level a violation of Section 3004(m). The Agency is also proposing a second option of limiting the treatment standard for D010 wastewaters to the characteristic level of 1.0 mg/l. The Agency solicits comments regarding the transfer of these performance data to D010 wastewaters and is specifically soliciting additional treatment data for wastewaters containing treatable levels of selenium that would classify the wastewaters as D010 prior to treatment.

Similar to the preceding discussion and the discussion for U and P arsenic wastewaters, the Agency is also proposing to transfer the D004 performance data for arsenic to the selenium in P103, P114, U204, and U205 wastewaters. Thus, the treatment standard for these wastewaters is proposed as 0.79 mg/l selenium.

Additional wastewater treatment data primarily from the Agency's Office of Water have been recently analyzed for incorporation into the treatment standards for selenium wastewaters. These data include the treatment of

wastewaters that are not specifically listed as RCRA hazardous wastes, but do contain many of the corresponding U, P, and metal constituents. While these data were not available in time to incorporate into this discussion or into the background document for these wastes, these data are being placed in the administrative record for today's notice. Therefore, the Agency is not precluded from using these data in promulgating the standards for these wastes. Further information on these data can be found in section III.A.1.h.(6.).

An alternative standard for selenium based on these data are presented in section III.A.7. of today's notice for wastewater forms of multi-source leachate. This standard is also based on single step chemical precipitation process. Thus, the Agency is proposing these standards as alternative standards for wastewaters for which concentration-based standards based on incinerator scrubber waters have been proposed in the following sections.

(2) *Identification of BDAT for Nonwastewaters.* The success of conventional stabilization processes for hazardous wastes containing metals is due partly to the ability of the alkaline cementitious reagents to chemically bind the cationic metal species. The Agency attempted pozzolanic stabilization of K031 nonwastewaters that contained relatively high concentrations of arsenic (133,000 ppm). The resultant data indicate that in some cases arsenic leachability from the treated residues was 10% higher than that from the untreated wastes. The increase in arsenic leachability after stabilization is probably due to the anionic character of the arsenic complexes that may be present in the waste, the inapplicability of stabilization processes to anionic metal species, and to the probable increase in solubility of some forms of arsenic at higher pH. This increase in leachability appears to indicate that the arsenic is not being chemically bound by the conventional stabilization reagents that were chosen for examination.

Some data indicate that cementitious or pozzolanic stabilization of wastes containing low concentrations of arsenic can be performed. These stabilization data using cement, lime, and other proprietary binder mixtures are inconclusive in demonstrating stabilization of arsenic. Although the amount of leachable arsenic is sometimes reduced, the results are not reproducible and, in some cases, can be attributed to dilution with the binders (high binder to waste ratios). While the

Agency has not fully investigated these potential problems in solidification for high concentrations of selenium, the Agency believes, based on selenium's chemical similarities to arsenic, that these same complications will occur.

Some data also indicate that asphalt stabilization of inorganic, low level arsenic waste can be performed, and may be especially appropriate for stabilizing arsenic in waste matrices containing other metals, because cementitious stabilization may increase the arsenic leachability. The two major concerns the Agency has regarding the application of this technology to arsenic and selenium wastes are: (1) the possibility that hazardous organic constituents (such as polynuclear aromatic hydrocarbons) that may be present in the asphalt itself will leach; and (2) the lack of performance data on this technology for arsenic and selenium wastes. An analysis of a TCLP extract from a sample of asphalt binder showed no sign of leaching organics, seemingly eliminating one of these concerns. Additional information regarding performance of this technology on arsenic and selenium wastes still remains necessary. The Agency therefore solicits comment and data on this technology.

No attempt was made by the Agency to differentiate between low level and high level arsenic or selenium wastes in the development of the proposed nonwastewater standards. The Agency does not have the data to properly make a distinction between a high level and a low level subgroup, or to determine applicable treatment for wastes in each subgroup. However, the Agency recognizes that a high level and a low level treatability group may exist and that treatment technologies for wastes in each group may be different. Therefore, the Agency is requesting data and comments identifying applicable treatment technologies for these potential subgroups. If no data is received, the standards proposed in today's rule will apply to all forms of nonwastewaters containing arsenic and selenium, regardless of the concentration of these metals in the waste.

As an alternative to cementitious stabilization for arsenic and selenium wastes, the Agency has identified vitrification as a stabilization technology that is applicable to nonwastewaters. Vitrification is a technology that uses high temperatures (1200 °C to 1500 °C) generated by electrodes or direct flame to melt a mixture of glass formers and waste materials into a molten slag which then

cools and incorporates the metals and other materials into this glass/slag matrix. The waste materials are usually added after the glass is liquefied. This technology can be applied to wastes containing organic as well as inorganic forms of arsenic since it operates at temperatures that will destroy the organics present in the wastes. When the glass/slag matrix cools and solidifies, it forms a relatively impermeable mass. (See the Arsenic/Selenium Background Document for additional discussion of this technology).

Vitrification uses high operating temperatures that may cause the arsenic and selenium in the waste to volatilize. The glass melting furnaces, however, are designed so that any volatiles will condense in the cooler areas at the top of the furnace that falls back down into the molten glass, thus being further treated. Additional information indicates that precalcination of materials containing arsenate (ferric or calcium) at temperatures close to 400 °C has been found to reduce potential losses of arsenic due to vaporization during vitrification. After these arsenate materials have been calcined as a pretreatment step, they were dissolved in an iron silicate slag at temperatures up to 1290 °C without volatilization of arsenic oxides. Therefore, this appears to demonstrate that for certain arsenic wastes volatilization resulting from the vitrification treatment process should not be an air pollution problem. Vitrification has been used successfully by the nuclear industry for the disposal of low level radioactive waste containing metallic elements. The Agency is soliciting comments and data on this stabilization technique for arsenic and selenium wastes. Of particular interest is data for those wastes that are known to contain organo-complexes of these metals.

Arsenic and selenium are produced as a by-product of copper and gold mining operations. The Agency believes that for some wastes, recovery of arsenic and selenium is feasible using high temperature metal recovery technologies used by mining operations, provided the metal has been first chemically converted to an easily recoverable form. Information available to the Agency indicates that recovery of elemental selenium out of certain types of scrap material and other type of wastes is currently practiced in the United States. The Agency is requesting comments and data on the applicability of these, and any other, recovery technologies for wastes containing arsenic or selenium. While recovery options may be

preferable over vitrification or stabilization for some of these wastes, the choice of treatment options must be made by the generator or treater based on the ability of the particular recovery system to handle the waste.

(a) *Proposed Standards for Arsenic-Containing Nonwastewaters.* Data available to the Agency indicate that vitrification can incorporate arsenic in concentrations up to 23.5% into a glass/slag matrix with a maximum leachability of arsenic at 1.8 mg/l (using the EP toxicity protocol). In all, these data consist of 14 separate data points, with arsenic concentration in the untreated wastes ranging from 0.3% to 23.5% and leachate concentrations ranging from 0.007 mg/l to 1.8 mg/l. The Agency is specifying that the EP toxicity test be performed to measure compliance with today's proposed nonwastewater standards. The EP should be used rather than the TCLP because all of the performance data from vitrification upon which EPA is relying used the EP to evaluate the technology's performance. However, a facility is not precluded from demonstrating the statistical equivalency of the TCLP to EP test for these wastes. The Agency views the continued use of the EP test as a measure of compliance with treatment standards as unfortunate. We strongly encourage the submission of TCLP performance data for arsenic that will eliminate the need for a separate analytical protocol for this metal. In addition, as noted in other rulemakings, EPA views the TCLP as the most appropriate protocol for measuring the effectiveness of stabilization as BDAT).

All of these data indicate that the vitrification can achieve stabilization of arsenic to leachate levels below the characteristic level (5.0 mg/l). However, using the analytical recovery data transferred from the Agency's analysis of K102 incinerator ash (which had the appearance of a slag) and a variability factor of 2.8, a concentration-based treatment standard for arsenic of 5.6 mg/l in the leachate (measured by the EP toxicity test) was calculated.

The Agency is also proposing to transfer the concentration-based treatment standard of 5.6 mg/l arsenic to K031, K084, P010, P011, P012, P036, P038, and U136 nonwastewaters. We believe that the performance of the vitrification technology, and analytic variability of treatment residues, also will not change for different arsenic-containing wastes. Thus, we think this transfer is legitimate.

(b) *Proposed Standards for Selenium-Containing Nonwastewaters.* The

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Agency has no treatment data on D010 nonwastewaters. However, based on the similarities in chemical behavior of arsenic and selenium, the Agency is extrapolating the performance data for vitrification of arsenic to D010 nonwastewaters and thus is proposing the same concentration-based standard, 5.6 mg/l selenium as measured in the leachate generated by the EP toxicity test. In a similar manner, the Agency is proposing to transfer this concentration-based treatment standard of 5.6 mg/l selenium to P103, P114, U204, and U205 nonwastewaters. The Agency solicits comment on the transfer of these performance data to D010 nonwastewaters, and requests data on any treatment or recovery technologies applicable to these nonwastewaters.

Because this treatment standard (5.6 mg/l) is above the level of leachable selenium that defines the waste as D010 (1.0 mg/l), D010 wastes that are generated at a level between 5.6 mg/l and 1.0 mg/l are considered to meet the treatment standard, but are still considered hazardous wastes and, therefore, must be land disposed in a subtitle C facility.

(3) *Revisions to K101 and K102 Treatment Standards.* In the First Third final rule (53 FR 31170, August 17, 1989), the Agency established two subcategories of K101 and K102 nonwastewaters based on the concentration of arsenic in the waste. A low arsenic subcategory was established for waste containing less than 1% arsenic and a high arsenic subcategory for waste containing 1% or greater. EPA believed this distinction establishing a subcategory for high arsenic K101 and K102 nonwastewaters was necessary to ensure that facilities did not burn arsenic-containing wastes that could potentially create a significant risk due to stack emissions of arsenic.

Treatment standards for the organics contained in these wastes were developed based on incineration of K101 and K102 nonwastewaters in the low arsenic subcategory. The corresponding nonwastewater standards included the regulation of certain metals based on stabilization. However, EPA did not establish a nonwastewater treatment standard for arsenic because the data did not indicate treatment for the arsenic.

In today's notice the Agency is proposing to change the nonwastewater standards for K101 and K102 promulgated in the First Third final rule by eliminating the low and high level arsenic subcategories and by replacing

the existing standards with a concentration-based treatment standard for arsenic of 5.6 mg/l (measured in the EP extract) based on the performance of vitrification. The Agency believes that the organic constituents present in these wastes (for which treatment standards were based upon incineration) will be destroyed by the high temperatures at which vitrification operates (temperatures comparable to incineration). Therefore, the Agency is proposing to remove the organic standards for K101 and K102 nonwastewaters. In addition, EPA is proposing to eliminate the existing metal standards for nonwastewaters because they were based on performance of a different stabilization technology.

The Agency is also proposing new wastewater treatment standards for K101 and K102 in today's rule. Standards for K101 and K102 wastewaters were promulgated in the First Third rule (53 FR 31170, August 17, 1988) and were applicable to all forms of K101 and K102 wastewaters (i.e., they did not distinguish between high arsenic or low arsenic subcategories). These promulgated standards were based on the same D004 wastewater treatment data used in today's proposal to establish arsenic standards for other K, U, and P wastes. In the process of reevaluating the D004 wastewater treatment data for today's proposed rule, however, EPA discovered an error in the calculation of the promulgated K101 and K102 wastewater standards for the metal constituents. The Agency is proposing today to correct this error by amending the wastewater standards for the metal constituents (arsenic, cadmium, lead, and mercury) in K101 and K102. Therefore, a new treatment standard of 0.79 mg/l for arsenic, 0.24 mg/l for cadmium, 0.17 mg/l for lead, and 0.82 mg/l for mercury is being proposed. These proposed standards are based on the same D004 data but using a different data set than that used for the development of the promulgated standards. Since there was no error in the calculation of the promulgated standards for the organic constituents, the Agency is not proposing to change the standards for the organics present in K101 and K102 wastewaters. The promulgated standards for the organics are being presented for convenience of the reader and are not being reconsidered. Therefore, no comment on this subject will be accepted.

BDAT TREATMENT STANDARDS FOR D004, K031, K084, P010, P011, P012, P036, P038, AND U136

[Wastewaters]

Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
Arsenic.....	0.79

BDAT TREATMENT STANDARDS FOR D004, K031, K084, P010, P011, P012, P036, P038, AND U136

[Nonwastewaters]

Regulated constituent	Maximum for any single grab sample, EP leachate (mg/l)
Arsenic.....	5.6

BDAT TREATMENT STANDARDS FOR D010, P103, P114, U204 and U205

[Wastewaters]

Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
Selenium.....	0.79

BDAT TREATMENT STANDARDS FOR D010, P103, P114, U204 and U205

[Nonwastewaters]

Regulated constituent	Maximum for any single grab sample, EP leachate (mg/l)
Selenium.....	5.6

BDAT TREATMENT STANDARDS FOR K101

[Wastewaters]

Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
Ortho-nitroaniline.....	0.27
Arsenic.....	0.79
Cadmium.....	0.24
Lead.....	0.17
Mercury.....	0.082

BDAT TREATMENT STANDARDS FOR
K102

[Wastewaters]

Regulated constituent	Maximum for any single grab sample, total Composition (mg/l)
Ortho-nitrophenol.....	0.028
Arsenic.....	0.79
Cadmium.....	0.24
Lead.....	0.17
Mercury.....	0.082

BDAT TREATMENT STANDARDS FOR
K101 AND K102

[Nonwastewaters*]

Regulated constituent	Maximum for any single grab sample, EP leachate (mg/l)
Arsenic.....	5.6

* This proposes to remove subcategories based on high and low arsenic content

c. Barium. The Agency has identified two hazardous wastes that potentially contain high levels of barium. These include P013 (barium cyanide) and D005 (EP toxic for barium; 100 mg/l barium as measured in an EP leachate). Treatment standards for cyanides contained in P013 wastes were promulgated with the Final Rule for second Third Wastes (54 FR 26614 (June 23, 1989)). At the same time, treatment standards for barium in P013 wastewaters were not promulgated based on the lack of treatment data. Today's notice proposes treatment standards for P013 wastewaters and all D005 wastes.

According to the periodic chart of elements, barium is a group II element that has chemical properties similar to magnesium and calcium. In aqueous conditions it typically exists as a divalent, cationic species. This behavior is important, in that selection and performance of treatment technologies for barium is somewhat similar to most other metals based on this cationic behavior in aqueous conditions. However, due to differences in solubilities of certain salts of barium compared to other metals, treatment technologies for both wastewaters and nonwastewaters containing barium are slightly different compared to wastes containing only other metal constituents.

The treatment standards presented in today's preamble for all barium wastes are based on a limited amount of treatment data. In this notice, the Agency is soliciting data on the characterization and treatment of all

wastes containing barium. Copies of any additional data pertaining to these proposed treatment standards that may be submitted during the public comment period, can be specifically requested in writing by identifying the request for data as "Additional data on treatment of barium—Section III.A.5.c.". See section III.A.1.i. of today's preamble for additional information on procedures for requesting additional data on specific standards.

(1) Identification of BDAT for Wastewaters. When evaluating treatment technologies to establish wastewater treatment standards for barium wastes, the Agency believes that it must consider not only the efficiency of removal of barium from the wastewater, but also the physical and chemical state of the precipitated barium salts that end up in the wastewater treatment residues.

While some data indicate that barium can be removed from wastewaters by using lime (calcium hydroxide) or caustic (sodium hydroxide) as a precipitating reagent (resulting in precipitation of the barium as a hydroxide salt (barium hydroxide)), barium is typically precipitated as a sulfate salt (barium sulfate) using sodium sulfate, ferric sulfate, or aluminum sulfate as a precipitating reagent. Most other cationic metals are typically removed from wastewaters based on precipitation as hydroxides or sulfides. While barium hydroxide is slightly soluble in water, barium sulfate is practically insoluble in water. Although lime or caustic may be effective in precipitating barium from wastewaters, sulfate precipitation should result in a precipitate that is less soluble in water than the hydroxide salt.

To further complicate matters, the resultant nonwastewater treatment residues containing barium sulfate salts may not be effectively stabilized by conventional stabilization reagents. This is primarily due to the anticipated presence of excess soluble sulfate (used as the precipitating reagent) which is known to interfere with the cementitious reactions. (Note: Conventional stabilization processes are typically applied to wastes containing primarily metal hydroxide salts). Therefore, in development of the appropriate BDAT treatment standards for wastewaters containing barium, the decrease in solubility of the resultant nonwastewaters containing barium sulfate (versus the more soluble barium hydroxide) must be balanced against the potential difficulty in conventional stabilization processes for the barium sulfate nonwastewaters. However, there

are stabilization reagents (such as certain types of Portland cements) that have been developed that are specifically designed to handle materials containing high sulfates.

Due to a well established chemical relationship known as the "common ion effect" and due to the relatively higher solubility of barium hydroxide (compared to barium sulfate), there exists a reasonable potential for an increase in leachability of the resulting wastewater treatment sludges (either the barium hydroxide or the barium sulfate) during co-disposal with alkaline wastes or materials. This potential for increased leachability under these conditions is a legitimate concern, in that some operators of hazardous landfills co-dispose all "metal" wastes and it is typical practice to add excess lime to prevent migration of the other metals prior to disposal.

Thus, EPA solicits comments on whether it should (as part of the treatment standard) specify the use of sulfate as the precipitating reagent for all wastewaters containing barium. In a similar manner, the Agency solicits comment on whether it should establish disposal requirements under 40 CFR Parts 264 and 265 for all barium wastewaters that would include sulfate precipitation followed by segregation of the treatment residuals from alkaline materials (i.e., in either monofills or separate subcells within a landfill). EPA notes that these proposed requirements may then be promulgated as additional requirements to meeting the proposed concentration-based standards.

Additional information indicates that barium could be precipitated as barium carbonate at pH 10–10.5, with lime used for pH adjustment, as an alternative treatment technology for barium wastewaters. Ion exchange also has been reported as achieving extremely high removal efficiencies. The Agency, however, lacks data to support these treatment technologies as being BDAT for D005 wastes.

For some barium wastewaters, more extensive treatment trains may be necessary in order to treat hexavalent chromium, other metals, and organics which could possibly interfere with the treatment of the barium. A reduction step for hexavalent chromium and an oxidation step (with reagents such as hydrogen peroxide or hypochlorite) may be necessary to treat the organics. However, the Agency currently lacks data indicating that the proposed concentration-based standards cannot be achieved for these type of wastes, and anticipates that pretreatment steps such as hexavalent chromium reduction

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and chemical oxidation of organics could remove these potential interferences. The Agency specifically solicits comments on the applicability of these and other pretreatment technologies for barium wastewaters, as well as data indicating the achievability of the concentration-based standards proposed in the following sections.

The Agency has very little data on precipitation of barium from RCRA hazardous wastewaters identified as P013 or D005. However, the Agency's Office of Water does have data from its analysis of various treated wastewaters under the Agency's Effluent Guidelines Program. In the absence of treatment data specific to P013 or D005 wastewaters, the Agency believes that these data from the Effluent Guidelines Program can be transferred to develop treatment standards for P013 and D005 wastewaters.

Based on these treatment data, the Agency is proposing a treatment standard of 1.15 mg/l barium for all D005 wastewaters. As discussed in detail in section III.C. of today's preamble, the Agency has initially determined that it has the authority to establish treatment standards below the characteristic level for these wastes or at least to make failure to treat to the lower level a violation of Section 3004(m). The Agency is also soliciting comments on an option of limiting the treatment standard for D005 wastewaters to the characteristic level of 100 mg/l.

Based on Effluent Guidelines data, the Agency is also proposing a treatment standard for barium in P013 wastewaters of 1.15 mg/l barium. While P013 wastes (barium cyanide), are typically generated as nonwastewaters, the Agency expects that wastewater forms of these wastes may be generated from incidental spills or from the treatment process itself and thus would require treatment standards. The Agency expects that untreated wastewaters will be relatively dilute, and thus would not expect to be difficult to treat. The Agency points out that it is not reopening the promulgated treatment standards for cyanides in P013 for comment.

(2) *Identification of BDAT for Nonwastewaters.* For nonwastewater forms of P013 and D005, which primarily consist of inorganic barium salts other than hydroxides or sulfates, the Agency believes that the barium can be dissolved and reprecipitated as the sulfate or carbonate in order to generate a treatment residual meeting the characteristic level. In addition, barium may be able to be leached from these wastes by concentrated strong acid

solutions, with the acid leachate subsequently neutralized and treated by sulfate or carbonate precipitation. The Agency is proposing a required method as the treatment standard for these barium wastes. D005 nonwastewaters must be treated by acid or water leaching followed by chemical precipitation as sulfate or carbonate followed by stabilization.

For D005 wastes that are generated containing high levels of organics the Agency believes that these wastes can be incinerated prior to stabilization of the ash. The Agency is soliciting information on whether these wastes actually exist, the concentration of barium and organics within these wastes, and treatment data for these wastes. If the Agency finds that these wastes do exist and treatment data is submitted, the Agency may define these wastes as a separate treatability group based on the level of organics and barium and promulgate the resultant concentration-based standards based on these data. However, information is submitted that these wastes exist but no treatment data are submitted from which concentration-based standards can be developed, the Agency may promulgate "Incineration Followed by Stabilization as a Method of Treatment" for these wastes.

BDAT TREATMENT STANDARDS FOR D005 AND P013

[Nonwastewaters]

Acid or water leaching followed by chemical precipitation as sulfate or carbonate or stabilization as methods of treatment

BDAT TREATMENT STANDARDS FOR D005 AND P013

[Wastewaters]

Regulated constituent	Maximum for any 24 hour composite sample
	Total composition (mg/l)
Barium.....	1.15

d. Cadmium. The criterion for classifying a solid waste as a D006 hazardous waste is the presence of cadmium in a concentration exceeding 1.0 mg/l, as measured in an EP leachate. On July 8, 1987, a 100 mg/l statutory prohibition level went into effect for liquid hazardous wastes containing cadmium (see the California list final rule, 52 FR 25760). The Agency received

data during the comment period for the California list rule (that it presented in a subsequent Notice of Data Availability) indicating that the full range of California list wastes containing cadmium, except those containing high levels of oil and grease, could be treated to a concentration level of 1.0 mg/l through precipitation of wastewaters and stabilization of nonwastewaters. The 1.0 mg/l level was not promulgated at that time, but EPA has used the data received in response to both the California list proposal and the Notice of Data Availability, along with other waste specific data, to develop today's proposed treatment standards.

Based on information from the 1986 Bureau of Mines report on the production of cadmium and cadmium salts, cadmium is typically extracted from sulfide minerals bearing zinc, lead, and copper. Cadmium is used primarily in electroplating and in the production of nickel/cadmium rechargeable batteries (as well as other types of batteries), pigments, and plastics. Other uses of cadmium include television picture tube and fluorescent light phosphors, catalysts for primary ester and alcohol production, nuclear reactor controls, fire detection alloys, alloys and solders, and copper hardening agents.

The treatment standards presented in today's preamble for all cadmium wastes are based on a limited amount of treatment data. In this notice, the Agency is soliciting data on the characterization and treatment of all wastes containing cadmium. Copies of any additional data pertaining to these proposed treatment standards submitted during the public comment period can be requested in writing by identifying the request for data as "Additional data on treatment of cadmium—Section III.A.5.d.". See section III.A.1.i. of today's preamble for information on procedures for requesting additional data on specific standards.

Treatment data indicate that cadmium follows treatment patterns of most other metallic waste in that conventional metal hydroxide or sulfide precipitation and stabilization appear effective for cadmium-bearing wastes. Based on all available waste characterization and treatment data, the Agency is proposing to group all D006 wastes into one of three treatability groups: (1) Wastewaters, (2) nonwastewaters, and (c) cadmium-containing batteries. The Agency is requesting data that will assist in further categorizing D006 wastes into these (and any other) treatability groups.

(1) *Identification of BDAT for Wastewaters.* This treatability group

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encompasses the largest volume of cadmium wastes, which are generated primarily as electroplating rinsewaters. The technologies typically used for treating these wastewaters include chemical precipitation (as a hydroxide, carbonate, phosphate, sulfide, or ferrous sulfate coprecipitant), ion exchange, activated carbon adsorption, and evaporative and electrolytic recovery.

The Agency has very little data on precipitation of cadmium from RCRA hazardous wastewaters identified as D006. However, the Agency's Office of Water does have data from its analysis of various treated wastewaters under the Agency's Effluent Guidelines Program. In the absence of treatment data specific to D006 wastewaters, the Agency believes that these data from the Effluent Guidelines Program can be transferred to develop treatment standards for D006 wastewaters. The data show that the treatment provided by these industries can reduce the concentration of cadmium in the wastewater to levels below the characteristic level of 1.0 mg/l. Therefore, the Agency is proposing a concentration based treatment standard for D006 wastewaters based on the performance of precipitation in treating cadmium wastewaters.

Based on these treatment data, the Agency is proposing a treatment standard of 0.20 mg/l cadmium for all D006 wastewaters. As discussed in detail in section III.C. of today's preamble, the Agency has initially determined that it has the authority to establish treatment standards below the characteristic level for these wastes or at least to make failure to treat to the lower level a violation of section 3004 (m). The use of other technologies to achieve this concentration-based treatment standard is not prohibited by today's rule.

(2) *Identification of BDAT for Nonwastewaters.* Wastes which are comprised of concentrated cadmium metal, such as the residuals from the recovery of K061 (electric arc furnace dust containing cadmium) and zinc mining wastes, are amenable to recovery, direct reuse, or stabilization.

The Agency has data on the stabilization of nonwastewaters indicating that cadmium can be effectively stabilized to levels below the characteristic level. For example, the Agency has data on the stabilization of K061 (electric arc furnace dust containing cadmium primarily in the form of cadmium oxides) nonwastewaters indicating that cadmium can be stabilized to a level of 0.14 mg/l using TCLP extraction (53 FR 31164). Furthermore, the Agency has

data indicating that stabilized cadmium in F006 (wastewater treatment sludges containing primarily cadmium in the form of cadmium hydroxides) can achieve a TCLP extract level of 0.066 mg/l (53 FR 31153). Based on these available data, the Agency believes that all cadmium nonwastewaters can either be stabilized such that the technologies reduce the leachability and total composition of cadmium in D006 nonwastewaters to below the characteristic level.

As discussed in detail in section III.C. of today's preamble, the Agency has initially determined that it may have the authority to establish treatment standards below the characteristic level for these wastes or at least to make failure to treat to the lower level a violation of section 3004 (m). The Agency is proposing two options for the development of treatment standards for D006 nonwastewaters.

The first option is to propose a concentration-based treatment standard for D006 nonwastewaters of 0.14 mg/l based on a transfer of K061 data. The Agency believes that this transfer is technically feasible due to fact that K061 wastes probably contain cadmium oxides which appear to be slightly more difficult to stabilize than the cadmium hydroxide found in a F006 wastes. Waste K061 is also a particularly difficult matrix to stabilize (see e.g., Comments of Steel Bar Mills Association and other steel producers) in the First Third rulemaking. The second option is to propose a method of treatment of stabilization or metals recovery. The Agency is soliciting comments on the concentration of cadmium that can be recovered and whether the Agency can identify a concentration of cadmium in nonwastewaters that is not amenable to metals recovery.

(3) *Identification of BDAT for Cadmium-Containing Batteries.* Nickel/cadmium rechargeable batteries are widely used in many household electronic products and are also used industrially in railroad signaling, diesel locomotive starting, commercial and jet aircraft starting, satellites, missile guidance systems, television and camera lighting, portable hospital equipment, computer memories, pinball machines, and gasoline pumps. Variations of this battery are the silver/cadmium cell and the mercury/cadmium battery, which are more costly and limited in their use.

Because the Agency does not have adequate data to establish a concentration-based standard, the Agency is proposing a treatment standard for cadmium-containing

batteries expressed as "Recovery as a Method of Treatment". The Bureau of Mines has conducted studies on pyrometallurgical techniques for recycling nickel/cadmium batteries. Data indicates that cadmium-containing batteries may be recycled through the use of smelting technologies. More information on this data can be found in the background document for cadmium wastes. EPA is specifically requesting data on the recovery of cadmium-containing batteries.

BDAT TREATMENT STANDARDS FOR D006

[Wastewaters]

Regulated constituent	Maximum for any 24 hour composite sample
	Total Composition (mg/l)
Cadmium.....	0.20

BDAT TREATMENT STANDARDS FOR D006

[Nonwastewaters]

Regulated constituent	Maximum for any single grab sample
	TCLP (mg/l)
Cadmium.....	0.14

BDAT TREATMENT STANDARDS FOR D006

[Cadmium Batteries]

Thermal recovery as a method of treatment

e. Chromium. U032 (calcium chromate) and D007 (EP toxic for chromium; 5.0 mg/l) are two of the many RCRA hazardous wastes that are listed for their chromium content. Typically, these wastes contain chromium as trivalent or hexavalent cations. Primarily in untreated wastewaters, chromium is present in its hexavalent state and is reduced by treatment to the trivalent state. The Agency is proposing to regulate chromium in wastes as "total" chromium rather than distinguishing between these two valence states. This is primarily because of the difficulty in analyzing treatment residues for hexavalent chromium. (Note: Concentrations of trivalent chromium are determined by subtracting the concentration of hexavalent

chromium from total chromium concentrations).

The Agency has data treatment of chromium in wastewaters such as K062 wastes that contain significant concentrations of chromium and other metals. These data on K062 wastes indicated treatment of up to 7,000 ppm of total chromium. This is similar to waste characterization data on other wastewaters (such as those generated in battery manufacturing) indicating concentrations of up to 10,000 ppm of total chromium in untreated waste. The data for treatment of nonwastewaters (sludges or solids) indicate that high levels of chromium in hydroxide sludges, incinerator ash, and in furnace dust, can be treated by conventional stabilization processes to below the characteristic level for D007.

(1) *Identification of BDAT for D007 Wastewaters.* Treatment data available to the Agency indicate that chemical reduction processes can convert a significant range of concentrations of hexavalent chromium in wastes to chromium in the trivalent state using chemical reducing agents such as sulfur dioxide, sodium bisulfite, metabisulfite, hydrosulfite, or ferrous sulfate. The trivalent chromium is then removed, usually by hydroxide precipitation. The Agency has treatment data on chromium reduction followed by precipitation and sludge dewatering for K062 wastes. The Agency believes that K062 would be similar or more difficult to treat than D007 wastes because of the high concentration of chromium and other metals in K062 wastes. Therefore, the Agency is transferring the performance data for K062 to D007 wastewaters and is proposing a treatment standard of 0.32 mg/l. The Agency is soliciting additional treatment performance data, including data on ion exchange processes which can remove hexavalent chromium directly from wastewaters.

(2) *Identification of BDAT for D007 Nonwastewaters.* Treatment data available to the Agency indicate that D007 nonwastewaters can be treated by stabilization provided the chromium has been reduced to the trivalent state. The Agency has performance data from the stabilization of F006 wastes that contain high concentrations of chromium. The data indicates that total chromium can be stabilized to 5.2 mg/l as analyzed by the TCLP analysis. For the K062 nonwastewaters, the concentration of total chromium in the nonwastewaters did not need to be stabilized. The reason was during the precipitation step, the treater added lime such that it reduced the mobility of chromium and other metals that were present in the wastes.

This information justifies that fact that chromium wastes can be easily stabilized.

Therefore, the Agency has two sets of treatment data for chromium containing nonwastewaters. The Agency believes that the F006 wastes could have contained hexavalent chromium as opposed to trivalent chromium. The reason for this is that the Agency believes that a F006 wastes is generated from the treatment of electroplating rinsewaters by alkaline chlorination treatment rather than a chromium reduction treatment. An alkaline chlorination process would not reduce the hexavalent chromium to trivalent. Therefore the Agency is proposing a treatment standard for D007 nonwastewaters of 0.094 mg/l based on an analysis of TCLP extracts and based on the performance of chromium reduction followed by lime and sulfide precipitation and dewatering for K062 wastes. The Agency is soliciting comments and treatment data from industry on whether this treatment standard is achievable for all D007 nonwastewaters. If comments indicate that the standard is not achievable, the Agency may promulgate the 5.2 mg/l treatment standard based on a transfer of the performance of stabilization for the F006 wastes.

(3) *Identification of BDAT for Calcium Chromate.* In today's proposed rule, the Agency is proposing wastewater and nonwastewater concentration-based treatment standards for chromium in this waste (U 032). BDAT for wastewaters and nonwastewaters are based on a transfer of the treatment performance of chemical reduction followed by lime/sulfide precipitation and filtration for K062 wastes.

The Agency believes that the transfer of the performance data for the treatment of K062 to calcium chromate wastewaters is technically feasible due to the high concentration of chromium in K062 wastewater.

BDAT TREATMENT STANDARDS FOR D007 AND U032

[Nonwastewaters]

Regulated constituent	Maximum for any single grab sample
	TCLP (mg/l)
Chromium (Total).....	0.094

BDAT TREATMENT STANDARDS FOR D007 AND U032

[Wastewaters]

Regulated constituent	Maximum for any single grab sample
	Total composition (mg/l)
Chromium (Total).....	0.32

f. Lead

- D008—EP toxic for lead
- P110—Tetraethyl lead
- U144—Lead acetate
- U145—Lead phosphate
- U146—Lead subacetate

Lead appears in Group IV of the periodic table. Lead, as a metal, is used as an industrial raw material in the manufacture of batteries, pigments, leaded glass, fuels, photographic materials, matches, explosives, and in electroplating baths. Lead is also used in the iron and steel industry and in the mining industry. Typically the lead in the D008 nonwastewaters may appear as lead in its elemental form (i.e., solid lead) or as chemical salts. In aqueous solutions (such as wastewaters), lead can easily be precipitated by adding lime, carbonate, or sulfides. This behavior is important, in that selection and performance of treatment technologies for lead is somewhat similar to other metals, based on this cationic behavior in aqueous conditions. Lead salts typically contain lead in the divalent state and are mostly insoluble in water. The nitrate, $Pb(NO_3)_2$, and the acetate, $Pb(C_2H_3O_2)_2$, are the only common soluble salts. The solubility of these two salts form the basis for certain analytical determinations of lead concentrations in some particular matrices.

The treatment standards presented in today's preamble for all lead wastes are based on a limited amount of treatment data. In this notice, the Agency is soliciting data on the characterization and treatment of all wastes containing lead. Copies of any additional data pertaining to these proposed treatment standards that may be submitted during the public comment period can be requested in writing by identifying the request for data as "Additional data on treatment of lead—Section III.A.5.e.". See Section III.A.1.i. of today's preamble for information on procedures for requesting additional data on specific standards.

(1) *Treatment Standards for Wastewaters.* When evaluating

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treatment technologies to establish wastewater treatment standards for lead wastes, the Agency believes that it must consider not only the efficiency of removal of lead from the wastewater, but also the chemical state of the precipitated lead salts that end up in the wastewater treatment residuals.

Most of the data indicates that lead oxides can be removed from wastewaters by using carbonate or hydroxide as precipitating reagent. In most precipitation treatment systems, two factors influence lead removal. These are lead solubility and lead precipitate settleability. Lead oxides are more insoluble in carbonate rather than lead hydroxide. (Note: Lead hydroxide is actually amphoteric and will become more soluble as the pH moves beyond optimum insolubility.) This suggests that a method of treatment for lead in wastewaters should be precipitation with carbonate, followed by sludge dewatering. The Agency is requesting comments on the approach of specifying a precipitant with the method of treatment.

The Agency has data on the treatment of wastewaters containing lead by precipitation with lime and sulfide filtration, and settling for K062 and D008 mixed wastes. The Agency believes that these data represent a matrix that is very difficult to treat since it consists of other dissolved metals in concentrations up to 7,000 ppm. While the lead concentration in K062 waste ranged up to only 200 ppm, treatment by precipitation acts to concentrate the lead in the sludge. K062 wastewaters were treated by chemical reduction, followed by precipitation with lime and sulfide and sludge dewatering. The sludge generated from this process contained leachable lead concentrations of less than 0.10 mg/l, indicating that the sludge did not need further treatment. The wastewater residual from this treatment contained lead concentrations of less than 0.01 mg/l. These data indicate that the performance of precipitation with lime and sulfide can achieve concentration levels lower than the EP toxic concentration for lead (i.e., 5 mg/l).

Therefore, the Agency is proposing two options for treatment standards for D008 wastewaters. The first option is a treatment standard of 0.04 mg/l lead for all D008 wastewaters. As discussed in detail in section III.C. of today's preamble, the Agency has initially determined that it has the authority to establish treatment standards below the characteristic level for these wastes or at least to make failure to treat to the lower level a violation of Section 3004

(m). However, the Agency is proposing a second option of limiting the treatment standards for D008 wastewaters to the characteristic level of 5.0 mg/l. The Agency specifically solicits comments on these two options. The Agency also solicits comment on use of the standards developed for the secondary and primary lead industries as part of the Agency's effluent limitations guidelines program.

The constituents for which U144, U145, and U146 wastes are listed are all soluble salt forms of lead. The constituents for which P110, U144, and U146 are listed are organic forms of lead. While all of these wastes are typically generated as nonwastewaters, the Agency expects that wastewater forms of these wastes may be generated from incidental spills or from a treatment process itself, and thus would require treatment standards. The Agency expects that untreated wastewaters will be more dilute than the untreated K062 wastewaters that were used to develop the treatment standards, and thus would be expected to be less difficult to treat.

Given that: (1) U144, U145, and U146 are all soluble lead compounds, (2) untreated K062 wastewaters are expected to be more difficult to treat than untreated P110, U144, U145, and U146 wastewaters, and (3) the performance data demonstrate that the lead in K062 wastewaters can effectively be removed, EPA is proposing to transfer K062 performance data and concentration-based treatment standard of 0.04 mg/l for P110, U144, U145, and U146 wastewaters.

(2) *Treatment Standards for Nonwastewaters Containing Lead.* The Agency has identified many types of D008 nonwastewaters that are different, and can be classified as those wastes that can be stabilized, recycled, and incinerated. The Agency has proposed a cut-off concentration of 2.5% total lead as a means of distinguishing between those essentially inorganic nonwastewaters containing recyclable levels of lead and those which can be effectively stabilized. This cut-off level has been proposed based on a limited amount of data from both recycling and stabilization of wastes containing lead.

(a) *Standards for Wastes in the Low Lead Subcategory.* For D008 nonwastewaters, the Agency has identified two sets of stabilization data on electroplating wastewater treatment sludges (F006) and wastewater treatment sludges from explosives manufacturing (K046). Data on electroplating nonwastewaters indicate that wastes with total lead

concentration of 24,500 can be reduced to lead concentrations of 0.51 ppm using the TCLP extract test. At the same time, the Agency has treatment data for K046 wastes that contain total lead concentrations of 1,000 ppm with reductions to 0.18 ppm of leachable lead. Both of these data sets for diverse waste types indicate that conventional stabilization processes can reduce the leachability of lead to concentrations lower than the EP levels.

Therefore, using the treatment data for F006 wastes, the Agency is proposing a treatment standard of 0.51 mg/l leachable lead for D008 wastes that can be effectively stabilized. In order to define this subcategory, the Agency examined the available data and determined that total concentrations of lead up to 2.5 percent can be effectively stabilized. The Agency is proposing this level as a cut-off for those D008 nonwastewaters that can be stabilized. Based on this 2.5% level, the Agency is identifying these wastes that can be stabilized as wastes in the D008 Low Lead Subcategory. The Agency believes that these data for F006 and K046 represent the treatment of wastes that are more difficult to stabilize (due to the presence of organo-lead initiating compounds and residuals organics in the K046 wastes, and high dissolved metals and oil and grease in the F006 wastes).

As discussed in detail in section III.C. of today's preamble, the Agency has initially determined that it has the authority to establish treatment standards below the characteristic level for these wastes or at least to make failure to treat to the lower level a violation of section 3004 (m). However, the Agency is proposing a second option of limiting the treatment standard for these D008 nonwastewater treatment sludges to the characteristic level. The Agency is soliciting comments on this approach and on the definition of stabilized D008 nonwastewaters based on a 2.5 percent cutoff concentration of lead.

(b) *Standards for High Lead Subcategory.* In determining which D008 lead wastes are amenable to thermal recovery, the Agency has data that indicate that wastes containing concentrations of lead as low as 5 percent can be recovered.

(Note: This 5% level correlates well with the proposed cut-off level of 2.5% based on the performance of stabilization.)

Thus, the Agency is defining wastes in the High Lead Subcategory as those wastes containing greater than or equal to 2.5% lead (based on an analysis of total lead concentration in the waste).

The Agency has identified some particular D008 wastes which appear to have good recovery potential, such as lead acid batteries, lead dross, and electric arc furnace dust.

Data available to the Agency indicates that lead can be recovered from electric arc furnace dust (K061) by high temperature metals recovery. Some K061 wastes contained total lead concentrations up to 14 percent, and were reduced to leachate levels well below the characteristic level of 5.0 mg/l. Based on these data, the Agency believes that residues from thermal recovery of D008 wastes containing high levels of lead will no longer leach lead above the EP toxic level. (See also the discussion on recovery of lead acid batteries and the solicitation of comments and data below.) Therefore, the Agency is proposing a treatment standard of "Thermal Recovery as a Method of Treatment" for wastes in the High Lead Subcategory.

(c) Standards for Lead Acid Batteries Subcategory. Currently, the Agency does not have waste characterization and treatment data from the recycling of lead acid batteries (i.e., influent lead concentrations and total and leachable residual data). Therefore, the Agency is soliciting recovery data of lead from secondary smelting operations. In particular, the Agency is interested in the minimum concentration of lead that can be recovered from other D008 wastes, the resultant waste characteristics associated with the slag (assuming that the slag is either a D008 waste, or comes from smelting a waste that is not indigenous to the industrial furnace), and any treatment data on the slag.

As a result, the Agency is proposing treatment standards for non-indigenous recyclable D008 wastes (identified as the D008 High Lead Subcategory) based on the performance of the high temperature metals recycling of K061 wastes that contain significant concentrations of lead. (Residues from recycling indigenous D008 materials would be subject to the D008 standard if such residues exhibit EP toxicity for lead, and their subcategory would be determined at the time of their generation.)

Incidentally, the Agency notes in response to inquiries from the affected industries that lead acid batteries themselves, when stored before land disposal, are not considered to be land disposed. This is because the battery is considered to be a container (see 40 CFR

264.314(d)(3)). Battery storage, however, typically is subject to the subpart J storage standards (relating to secure storage, secondary containment in some instances, and other requirements).

For the lead acid batteries treatability group, the Agency is proposing metals recovery as a method of treatment. The Agency believes that most of the treaters for lead acid batteries are using a recovery process. These standards only apply for lead acid batteries that are identified as RCRA hazardous wastes and that are not elsewhere excluded from regulation under the land disposal restrictions of 40 CFR 268 or exempted under other EPA regulations (see 40 CFR 266.80).

(d) Standards for P110, U144, and U146 Nonwastewaters. The Agency has determined that some nonwastewater forms of lead wastes including P110, U144, U146, and some D008 wastes, would need to be incinerated prior to stabilization due to the presence of high concentrations of organics in order to achieve a treatment standard based on stabilization. This is primarily because the organics typically interfere with conventional stabilization processes (particularly at concentrations exceeding 1% TOC). The Agency has data on the incineration of organic wastes containing up to 1,000 mg/kg lead (such as K048/K051 and K087 wastes) followed by stabilization of the ash. These data indicate that the proposed standard (i.e. 0.51 mg/1 leachable lead) for D008 nonwastewaters in the Low Lead Subcategory based on stabilization can be achieved for wastes that also contain significant concentrations of organics, provided the organics are destroyed by pretreatment. The Agency is therefore proposing that this standard is applicable to those U and P lead wastes that are organo-lead compounds, i.e., P110, U144, and U146. This is further supported by the fact that the lead contained in the K048-K052 petroleum refinery wastes that were incinerated, probably was present as tetraethyl lead thus supporting the extrapolation to P110, off-specification tetraethyl lead. Lead acetate (U144) and lead subacetate (U146) are anticipated to be less difficult (or at least of similar difficulty) to treat than tetraethyl lead.

(e) Standards for Radioactive Lead Solids Subcategory. The Agency is also proposing treatment standards for radioactive lead solids. These lead solids include, but are not limited to, all forms of lead shielding, lead "pigs", and other elemental forms of lead. These

lead solids do not include treatment residuals such as hydroxide sludges, other wastewater treatment residuals, or incinerator ashes that can undergo conventional pozzolanic stabilization, nor do they include organo-lead materials that can be incinerated and then stabilized as ash. These wastes are different than the other D008 nonwastewaters containing high levels of lead, because of their radioactivity.

EPA does not believe that metal recovery (i.e., smelting) is an available technology for radioactive solids. Any lead recovery would be radioactive, and thus unusable. If the radioactive lead was smelted along with normal lead, the entire mass recovered would be unusable.

However, conventional stabilization technologies generally should not be impacted by the presence of radioactive versus nonradioactive lead. As a result, the Agency is not subcategorizing wastewater treatment residues and incinerator ash containing radioactive lead or other metals except for purposes of determining availability of treatment capacity (i.e., stabilization processes for radioactive materials should employ special safety precautions due to the radioactivity). Therefore, the Agency has developed a separate treatability group and BDAT for the specified radioactive lead solids.

For these radioactive lead solids, the Agency is proposing a treatment standard of "Surface Deactivation or Removal of Radioactive Lead Portions Followed by Encapsulation; or Direct Encapsulation as Methods of Treatment". The Agency believes that most radioactive lead results from the use of the elemental lead (a solid) either directly or indirectly as a shield from radioactivity. Typically, the radioactivity penetrates slowly into one side of the lead (shield), thus providing the necessary protection. Therefore, depending upon the thickness of the lead shield the radioactive portion of the lead may be able to be shaved off from the nonradioactive portion. The remaining nonradioactive lead would then be subject to the treatment standard for High Lead wastes, "Thermal Recovery as a Method of Treatment". The radioactive portion (or in some cases the entire shield or solid) would then be either macro- or micro-encapsulated into a protective material that would prevent the lead from leaching in the disposal environment.

**BDAT TREATMENT STANDARDS FOR
D008, P110, U144, U145, U146**
[Wastewaters]

Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
Lead.....	0.040

**BDAT TREATMENT STANDARDS FOR
P110, U144, U145, AND U146**
[Nonwastewaters]

Regulated constituent	Maximum for any single grab sample, TCLP (mg/l)
Lead.....	0.51

**BDAT TREATMENT STANDARDS FOR D008
LOW LEAD SUBCATEGORY—LESS THAN
2.5%**
[Nonwastewaters]

Regulated constituent	Maximum for any single grab sample, TCLP (mg/l)
Lead.....	0.51

**BDAT TREATMENT STANDARDS FOR D008
HIGH LEAD SUBCATEGORY GREATER
THAN OR EQUAL TO 2.5% LEAD**
[Nonwastewaters]

Thermal recovery as a method of treatment

**BDAT TREATMENT STANDARDS FOR D008
[Lead Acid Batteries*]**

Thermal recovery as a method of treatment

*This standard only applies to lead acid batteries that are identified as RCRA hazardous wastes and that are not excluded elsewhere from regulation under the land disposal restrictions of 40 CFR 268 or exempted under other EPA regulations (see 40 CFR 266.80).

**BDAT TREATMENT STANDARDS FOR D008
[Radioactive Lead Solids*]**

Surface deactivation or removal of radioactive lead portions followed by encapsulation; or direct encapsulation of radioactive lead solids as methods of treatment

*These lead solids include, but are not limited to, all forms of lead shielding, lead "pigs", and other elemental forms of lead. These lead solids do not include treatment residuals such as hydroxide sludges, other wastewater treatment residuals, or incinerator ashes that can undergo conventional pozzolanic stabilization, nor do they include organo-lead materials that can be incinerated and then stabilized as ash.

g. Mercury.

- D009—EP toxic for mercury
- K071—Brine purification muds from the mercury cell process in chlorine production, where separately prepurified brine is not used
- K106—Wastewater treatment sludges from the mercury cell process in chlorine production
- P065—Mercury fulminate
- P092—Phenylmercury acetate
- U151—Mercury

These six wastes are grouped together because they contain mercury as the primary hazardous constituent. The Agency is grouping these wastes together in order to simplify the explanation of the chemistry of mercury and the operational treatment principles of technologies for treating the related mercury wastes.

(1) *Review of Applicable Technologies for Nonwastewaters—(a) Thermal Recovery Processes.* Based on the available treatment data from thermal recovery processes for K071, K106, and for cinnabar ores, EPA is proposing thermal recovery as part of the treatment standards for many of the nonwastewater forms of these six mercury wastes. EPA has examined data on the mercury content of residues from roasting/retorting of K071 and K106 wastes, and believes that it shows substantial reductions in mercury mobility. The data indicated that mercury can be recovered from these wastes such that the residues contain less than 16 mg/kg of total mercury.

In addition, EPA believes the thermal processing of cinnabar ores simulates the roasting/retorting of mercury sulfide containing wastes. These additional data indicates that the thermal processing of cinnabar ores yields a calcinated residue containing 100 mg/kg total mercury, and none of treated residues exceed EP toxicity Levels for mercury. As a result, EPA is proposing to use the lowest concentration based number achieved by these two sets of thermal recovery data, i.e., the 16 mg/kg, to reflect the level of mercury amenable to recovery.

It is not clear from the available data whether organo-mercury wastes (like P065 and P092) can be retorted directly, or if the organic fraction must be destroyed first. Consequently, for certain organo-mercury wastes, EPA is proposing an initial treatment step to destroy the organics followed by thermal recovery of mercury if the incineration residues contain sufficient mercury to be amenable to recovery.

The Agency is aware of other thermal processes, such as scrap metal distillation incorporating steam stripping and vacuum distillation, that are used

for recovery of mercury from debris and equipment. However, the Agency has no particular data from these processes for use in the development of treatment standards. Therefore, the Agency is soliciting data and information on these technologies.

(b) *Acid Leaching.* The promulgated treatment standards for K071 nonwastewaters in the First Third rule based on the performance of a treatment process involving acid leaching to solubilize and extract the mercury contained in the K071 brine sludge and later convert the mercury to a relatively insoluble mercury sulfide sludge. (See further discussion of proposed rule for K071 in 53 FR 11758–11759 (April 8, 1988) and final rule in 53 FR 31166–31167 (August 17, 1988).) The Agency is using these data and promulgated standards for transfer to wastes that contain less than 16 mg/kg total mercury as generated (i.e., wastes with insufficient mercury to warrant recovery). Residues from this acid leaching process must be evaluated for mercury content to determine whether they must undergo thermal recovery.

(c) *Stabilization.* Existing stabilization data for K106 nonwastewaters containing over 2% total mercury (by weight) indicate that the overall leachability of mercury from the K106 wastes actually increases with the addition of the alkaline stabilization reagents. Thus, conventional cementitious and pozzolanic stabilization processes (all of which involve alkaline materials) are not considered BDAT for wastes containing concentrations above 2% total mercury.

No data have been received on K106 stabilization using proprietary binders such as asphalts, silicates, or sulfide. While some vendors have expressed their interest in submitting data to EPA, these data have not been submitted at the time of this rule. If these data become available, anyone interested in reviewing performance data for the stabilization of K106 wastes (mercury sulfides), must request such data following the procedures described in section III.A.1.i. of today's preamble. This request should be identified as "III.A.5.g. Stabilization of Mercury Wastes".

(d) *Incineration.* EPA has information from a few facilities that indicate routine incineration of some wastes containing organo-metallics. EPA believes that these include organo-mercury wastes such as spent organo-mercury catalysts, organo-mercurials in lab packs, and paint sludges containing mercury. Thus, incineration is considered to be demonstrated to treat a

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vast array of mercury-containing wastes. The mercury from these wastes is not destroyed by the incineration process but rather accumulates as inorganic mercury compounds in the ash, the scrubber water, and the wastewater treatment sludges from the treatment of the scrubber waters. Thus, the Agency is specifying further treatment of incineration residues in order to reduce the mobility or concentration of mercury to levels that more fully minimize threats to human health and the environment.

(2) *Complications of Co-disposal with Alkaline Materials.* Mercury sulfide is relatively insoluble in water under acid conditions. However, the information on the attempted pozzolanic stabilization of K106 (which is primarily mercury sulfide) indicates that the leachability (i.e., solubility) of the mercury increases under alkaline conditions. Therefore, the low solubility of mercury sulfide must be balanced against the potential for leachability of the resulting wastewater treatment sludges during co-disposal with alkaline wastes or materials. This potential for increased leachability under these conditions is a legitimate concern, in that some operators of hazardous landfills co-dispose all "metal" wastes and it is typical practice to add excess lime to prevent migration of the other metals prior to disposal.

The Agency solicits comment on whether it should establish disposal requirements under 40 CFR parts 264 and 265 for all mercury sulfide wastewater treatment residuals in the Low Mercury Subcategory which would require segregation of the treatment residuals from alkaline materials (in either monofills or separate subcells within a landfill). Such a requirement would be a type of management standard designed to prevent co-disposal of incompatible wastes. By soliciting comment, EPA notes that these proposed requirements may be promulgated as additional requirements to meeting the proposed concentration-based TCLP standards.

The Agency also solicits comment on an alternative of simply classifying D009, K071, K106, P065, P092, and U151 nonwastewaters in the Low Mercury Subcategory as "incompatible" with alkaline wastes like hydroxide sludges. The basis would be the increased potential for leachability of the mercury when exposed to alkaline pH.

(3) *Standards for All Wastewaters.* The Agency has identified ion exchange, carbon disulfide sorption, chemical oxidation/reduction, chemical precipitation, or combinations of these technologies as applicable technologies to treat inorganic mercury wastewaters.

Chemical oxidation/reduction processes typically alter the chemical valence of mercury species for subsequent precipitation or removal by ion exchange or carbon disulfide sorption.

While ion exchange and carbon disulfide sorption may be used directly on a mercury-containing wastewater, all of the mercury must be in the proper valence state. Typically these two removal technologies are used primarily as polishing steps after precipitation. Several facilities are believed to be treating mercury wastewaters with ion exchange or carbon disulfide sorption. However, the Agency lacks sufficient wastewater treatment data based on the use of these two technologies.

The Agency has data on precipitation of mercury from wastewaters identified as K071 from the chlor-alkali industry using sulfide as the precipitant. The Agency believes that these data represent a matrix that is difficult to treat since it consists of a mixture of different forms of inorganic mercury. The data show that this precipitation process provides effective treatment and removal of mercury from these wastewaters because it reduces the concentration of mercury in the wastewater to levels below the characteristic level of 0.2 mg/l.

Based on these treatment data, the Agency is proposing a treatment standard of 0.030 mg/l mercury for all D009 wastewaters. The Agency believes that these wastes represent the most difficult to treat wastewaters. As discussed in detail in section III.C. of today's preamble, the Agency has initially determined that it has the authority to establish treatment standards below the characteristic level for these wastes or at least to make failure to treat to the lower level a violation of section 3004(m). The Agency is also proposing a second option of limiting the treatment standard for D009 wastewaters to the characteristic level of 0.2 mg/l. The Agency specifically solicits comments on these two options.

The Agency is also proposing to transfer these performance data and standards to K106, P065, P092, and U151 wastewaters. EPA is soliciting and data on the achievability of these standards for all mercury wastewaters. In particular, the Agency solicits data characterizing the untreated and treated mercury-contaminated wastewaters that are routinely generated, information pertinent to the design and operation of their wastewater treatment technologies, and information pertinent to the manufacturing processes generating these mercury-bearing wastewaters.

Some mercury-containing wastewaters may require more extensive treatment trains in order to treat hexavalent chromium, other metals, and organics which could possibly interfere with the treatment of the mercury. A reduction step for hexavalent chromium and an oxidation step (with reagents such as hydrogen peroxide or hypochlorite) may be necessary to treat the organics. In addition, complexed organometallics which may be present will probably have to be oxidized or otherwise removed prior to conversion of the mercury to their proper valence state for further metal treatment by precipitation. However, the Agency currently lacks reliable data that indicate that the proposed concentration-based standards cannot be achieved for these types of wastes. Nevertheless, EPA anticipates that pretreatment steps such as hexavalent chromium reduction and chemical oxidation of organics may be necessary and these pretreatment steps could remove these potential interferences. This is further supported by the fact that quantitative analytical methods for mercury in waste samples include such pretreatment steps to remove the interferences during analysis. The Agency specifically solicits comments on the applicability of these and other pretreatment technologies for mercury-containing wastewaters and data that indicate the achievability of the proposed wastewater standard.

(4) *Standards for K106 and U151 Nonwastewaters.* The Agency previously proposed treatment standards for K106 wastes based on retorting in the First Third proposed rule (53 FR 17578, May 17, 1988). The proposed standards, however, were not promulgated because, at that time, there was insufficient information to support the transfer from the retorting of mercury sulfide ores or other mercury wastes that the Agency believed were similar to the K106 wastes (53 FR 31173-31174, August 17, 1988). The Agency has since collected performance data on the thermal processing of cinnabar ores that the Agency believes simulates the roasting/retorting of mercury sulfide containing wastes: (See section III.A.5.g.(1)(a.) above).

The Agency is proposing to establish a High Mercury Subcategory and a Low Mercury Subcategory for K106 and U151 nonwastewaters based on a cut-off of 16 mg/kg. For wastes in the High Mercury Subcategory (i.e., containing greater than or equal to 16 mg/kg total mercury) the Agency is proposing a treatment standard of "Roasting or Retorting as a

Method of Treatment". Since it is likely that K106 and U151 wastes will be considered indigenous to the thermal recovery processes, the residues from these processes would no longer be considered K106 or U151. However, if these wastes are EP toxic for mercury (D009) they must then comply with the appropriate standards for D009 wastes (i.e., High or Low Mercury Subcategory) presented below.

For K106 and U151 nonwastewaters in the Low Mercury Subcategory (i.e., less than 16 mg/kg total mercury) the Agency is proposing a treatment standard of 0.025 mg/l mercury measured in a TCLP leachate based on the transfer of performance of acid leaching data for K071 nonwastewaters. (See section III.A.5.g.(1.) above.) Residues from this acid leaching process must be evaluated for mercury content to determine whether they must undergo thermal recovery. K106 and U151 nonwastewaters that contain less than 16 mg/kg total mercury and that also leach less than 0.025 mg/l mercury (as measured in the TCLP extract) are considered to have met the BDAT and can be land disposed.

(5) *Proposed Revisions of K071 Nonwastewaters.* The Agency promulgated treatment standards for K071 nonwastewaters with the First Third Final Rule based on the performance of a treatment process involving an acid leaching to solubilize and extract the mercury contained in the K071 brine sludge and later convert the mercury to a relatively insoluble mercury sulfide sludge. (See further discussion of proposed rule for K071 in 53 FR 11758-11759 (April 8, 1988) and final rule in 53 FR 31166-31167 (August 17, 1988).)

The Agency is proposing to create a new subcategory identified as K071 High Mercury Subcategory and is thus proposing to partially replace the K071 nonwastewater treatment standard previously promulgated. Thus, for K071 nonwastewaters in the High Mercury Subcategory (i.e., greater than or equal to 16 mg/kg total mercury) the Agency is proposing a treatment standard of "Roasting or Retorting as a Method of Treatment". (See also discussion for K106 and U151.) The Agency is also proposing to create a new subcategory identified as Low Mercury Subcategory, i.e., less than 16 mg/kg total mercury, for K071 nonwastewaters and is retaining the promulgated standard (0.025 mg/l mercury based on analysis of a TCLP extract) for these wastes.

(6) *Standards for P065 and P092 Nonwastewaters.* Mercury fulminate (P065) and phenylmercury acetate (P092) are mercury compounds containing

carbon. The Agency has determined that incineration represents part of the BDAT for P065 and P092 nonwastewaters. This is because incineration is demonstrated for destruction of carbon-metal bonds in organo-metallics, and may be necessary to make mercury available for recovery. (See discussion of incineration in section III.A.5.g.(1.) (a.) and (c.) above.) Also, the Agency notes that available information for P065 indicates that mercury fulminate can be destroyed in an incinerator designed to destroy explosive wastes. (Detailed information on the treatment methods identified for mercury fulminate can be found in the Department of the Army Technical Manual, TM-9-1300-214, Military Explosive, September 1984).

Incineration of P065 and P092 will not destroy mercury, which will end up in the residues. The residues therefore must be treated further. This is reflected in the proposed standard for these wastes: "Incineration followed by roasting or retorting of incinerator nonwastewater residues (ash and wastewater treatment sludges from the treatment of incinerator scrubber waters) provided such residues exceed 16 mg/kg total mercury; and scrubber waters from incineration must comply with the 0.030 mg/l wastewater standard" for D009, K106, P065, P092, and U151 wastewaters.

In other words, residues from incinerating these wastes (including wastewater treatment sludges from the treatment of scrubber waters) require further treatment for mercury. For nonwastewaters, if the residues contain sufficient mercury to warrant recovery (16 mg/kg total mercury) they would have to be roasted or retorted. If not, they would have to meet the standard for low mercury wastes. Scrubber waters would be required to meet the same standard applicable to all wastewaters within the mercury treatability group. Thus, for these wastes, incineration serves as a type of pretreatment, and nonwastewaters from incineration are then evaluated to determine if they are in the High or Low Mercury Subcategory, and the appropriate treatment standard for mercury applies.

(7) *Standards for D009 Nonwastewaters.* Treatment standards for D009 nonwastewaters in the High Mercury Subcategory are being proposed based on a combination of the standard for K106 and that for P065 and P092. The main reason for this is that D009 wastes may be contaminated with organics or other organo-mercury constituents (along with inorganic mercury). EPA is thus proposing a standard for D009 nonwastewaters in

the High Mercury Subcategory of "Roasting or retorting as a method of treatment; or incineration followed by roasting or retorting of incinerator nonwastewater residues (ash and wastewater treatment sludges from the treatment of incinerator scrubber waters) provided such residues exceed 16 mg/kg total mercury". As a result, if the organic content is too high for the retorting or roasting, incineration would be required as a pretreatment step. The Agency considered proposing a subcategory of organic-mercury wastes; however, the Agency had no means of establishing a definition for these wastes. Thus, the Agency is soliciting data and comment that would assist the Agency in subdividing this standard according to the organic content.

(8) *Standards for Radioactive Wastes Containing Mercury.* Information provided recently to EPA by the United States Department of Energy (DOE) indicates the generation of two particular mixed radioactive/hazardous wastes that contain mercury. This information also suggests that the BDAT technologies and standards proposed for the corresponding nonradioactive wastes may not be applicable. The Agency, therefore, has developed alternative treatment standards for these wastes which are presented in the following section.

(a) *Elemental Mercury.* Elemental mercury is typically found in vacuum pumps and related manometers. In the nuclear industry, this form of mercury has been contaminated with radioactive tritium (a radio-isotope of hydrogen). These wastes are often identified as D009 or U151. The treatment standard proposed for the nonradioactive wastes of this type is "Roasting or Retorting as a Method of Treatment". However, the Agency has no data or information that would indicate that these processes would be able to separate the mercury from the radioactive material (i.e., tritium) resulting in a reusable mercury. Thus, the Agency believes that these processes would not necessarily be applicable to these wastes and therefore developed a proposed standard based on the following information.

As a result of the high vapor pressure associated with elemental mercury in the liquid form, the predominant safety concern with the mercury in these wastes is from air emissions. One method that has been developed to handle spills of nonradioactive liquid mercury involves the application of elemental zinc powder to areas that have been contaminated with the mercury (the visible droplets of liquid mercury are physically collected in a

separate step before application of the zinc). The zinc is dampened with dilute sulfuric acid (5-10%) until a paste is formed. This paste is then collected for disposal. The mercury forms an amalgam with the zinc providing a significant reduction in air emissions of mercury. (EPA prefers this procedure over the conventional spill cleanup procedures involving addition of calcium polysulfide or flowers of sulfur because use of zinc results in lower air emissions of mercury.)

The Agency currently has no information on whether this procedure will reduce the overall leachability of mercury. However, the Agency has determined that this procedure does provide significant treatment due to the decrease in air emissions, the change in mobility from liquid mercury to a paste-like solid, and the potential reduction in leachability due to the amalgamation with the zinc. Based on this information, the general lack of treatment data, the lack of alternative technologies, and the unique handling problems associated with the radioactivity, the Agency is proposing a treatment standard for D009 and U151 elemental mercury wastes contaminated with radioactive materials of "Amalgamation with Zinc as a Method of Treatment". Roasting, retorting or other recovery process are not precluded from use by this standard as long as all residuals from these recovery processes comply with the amalgamation treatment standard prior to land disposal.

(b) *Hydraulic Oil Contaminated with Mercury.* The DOE also indicated the generation of a hydraulic oil that is contaminated with mercury and tritium. EPA is assuming that the hydraulic oil referred to by DOE is organic and can be incinerated. EPA has determined that the technologies applicable to nonradioactive mercury wastes that contain high levels of organics are incineration followed by roasting or retorting of all of the inorganic residues and wastewater treatment for the scrubber waters. (See the exact proposed standards for P065 and P092 nonwastewaters above.)

The Agency is proposing to modify this standard for this type of radioactive mercury waste by removing the requirement to recover mercury from the inorganic residues. Because the Agency is uncertain that roasting or retorting will be able to recover a reusable mercury (i.e., nonradioactive) from these residues, the Agency is proposing a treatment standard of "Incineration as a Method of Treatment with incinerator residues meeting the following: (1) Ash and wastewater treatment sludges from

the treatment of scrubber waters must comply with a TCLP concentration of 0.025 mg/l; and (2) Scrubber waters must comply with a total concentration of 0.030 mg/l wastewater standard" for D009 Hydraulic Oil Contaminated with Radioactive Materials.

BDAT TREATMENT STANDARDS FOR D009, K106, P065, P092, AND U151

[Wastewaters]

Regulated constituent	Maximum for any single grab sample
	Total composition (mg/l)
Mercury.....	0.030

BDAT TREATMENT STANDARDS FOR K106 AND U151

[Nonwastewaters]

[High Mercury Subcategory—Greater than or equal to 16 mg/kg total mercury]

Roasting or Retorting as a Method of Treatment

BDAT TREATMENT STANDARDS FOR K106 AND U151

[Nonwastewaters]

[Low Mercury Subcategory—Less than 16 mg/kg total mercury]

Regulated constituent	Maximum for any single grab sample
	TCLP (mg/l)
Mercury.....	0.025

BDAT TREATMENT STANDARDS FOR K071*

[Nonwastewaters]

[High Mercury Subcategory—Greater than or equal to 16 mg/kg total mercury]

Roasting or Retorting as a Method of Treatment

* This standard creates a new subcategory identified as K071 High Mercury Subcategory and would replace the K071 nonwastewater treatment standard promulgated August 17, 1988 (53 FR 31167) for wastes that would now fall into this new subcategory.

BDAT TREATMENT STANDARDS FOR K071*

[Nonwastewaters]

[Low Mercury Subcategory—Less than 16 mg/kg total mercury]

Regulated constituent	Maximum for any single grab sample
	TCLP (mg/l)
Mercury.....	0.025

* This standard is the same as the standard for K071 nonwastewaters promulgated August 17, 1988 (53 FR 31167), but now would only be applicable to the new subcategory identified as the K071 Low Mercury Subcategory.

BDAT TREATMENT STANDARDS FOR P064 AND P092

[Nonwastewaters]

Incineration Followed by Roasting or Retorting of Incinerator Nonwastewater Residues (Ash and Wastewater Treatment Sludges from Treatment of the Incinerator Scrubber Waters) Provided Such Residues Exceed 16 mg/kg Total Mercury; and Scrubber Waters from Incineration Must Comply With the 0.030 mg/l Wastewater Standard

BDAT TREATMENT STANDARDS FOR D009

[Nonwastewaters]

[High Mercury Subcategory—Greater than or equal to 16 mg/kg total mercury]

Roasting or Retorting as a Method of Treatment; or Incineration Followed by Roasting or Retorting of Incinerator Nonwastewater Residues (Ash and Wastewater Treatment Sludges from Treatment of the Incinerator Scrubber Waters) Provided Such Residues Exceed 16 mg/kg Total Mercury

BDAT TREATMENT STANDARDS FOR D009

[Nonwastewaters]

[Low Mercury Subcategory—Less than 16 mg/kg total mercury]

Regulated constituent	Maximum for any single grab sample
	TCLP (mg/l)
Mercury.....	0.025

BDAT TREATMENT STANDARDS FOR D009 AND U151 ELEMENTAL MERCURY CONTAMINATED WITH RADIOACTIVE MATERIALS

Amalgamation with Zinc as a Method of Treatment

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**BDAT TREATMENT STANDARDS FOR D009
HYDRAULIC OIL CONTAMINATED WITH
MERCURY AND RADIOACTIVE MATERI-
ALS**

Incineration as a Method of Treatment with Incinerator Residues Meeting the Following: (1) Ash and Wastewater Treatment Sludges from Treatment of the Incinerator Scrubber Waters Must Comply with a TCLP Concentration of 0.025 mg/l; and (2) Scrubber Waters must Comply with a Total Concentration of 0.030 mg/l Wastewater Standard)

h. Silver. The Agency has identified three hazardous wastes that potentially contain high levels of silver. These include P099 (potassium silver cyanide), P104 (silver cyanide), and D011 (EP toxic for silver; 5.0 mg/l silver as measured in an-EP leachate). Treatment standards for cyanides contained in P099 and P104 wastes were promulgated with the Final Rule for Second Third Wastes (54 FR 26614 (June 23, 1989)). At the same time, treatment standards for silver in P099 and P104 wastewaters were not promulgated based on the lack of treatment data. Today's notice proposes treatment standards for P099 and P104 wastewaters and all D011 wastes.

Silver is part of the Group I elements and has chemical properties similar to lead and mercury. In aqueous conditions silver typically exists as a monovalent, cationic species. This behavior is important, in that selection and performance of treatment technologies for silver is somewhat similar to most other metals based on this cationic behavior in aqueous conditions.

However, due to differences in solubilities of certain salts of silver compared to other metals, treatment technologies for both wastewaters and nonwastewaters containing silver are slightly different compared to wastes containing only other metal constituents.

The treatment standards presented in today's preamble for all silver wastes are based on a limited amount of treatment data. In this notice, the Agency is soliciting data on the characterization and treatment of all wastes containing silver. Copies of any additional data pertaining to these proposed treatment standards that may be submitted during the public comment period, can be specifically requested in writing by identifying the request for data as "additional data on treatment of silver—section III.A.5.h.". See section III.A.1.i. of today's preamble for additional information on procedures for requesting additional data on specific standards.

(1) *Identification of BDAT for Wastewaters.* When evaluating

treatment technologies to establish wastewater treatment standards for silver wastes, the Agency believes that it must consider not only the efficiency of removal of silver from the wastewater, but also the physical and chemical state of the precipitated silver salts that end up in the wastewater treatment residues.

Some data indicate that silver can be removed from wastewaters by using lime (calcium hydroxide) or caustic (sodium hydroxide) as a precipitating reagent (resulting in precipitation of the silver as a hydroxide salt (silver hydroxide)). However, silver is typically precipitated as a chloride salt (silver chloride) using a soluble chloride salt as a precipitating reagent. Most other cationic metals are typically removed from wastewaters based on precipitation as hydroxides, carbonates or sulfides. While silver hydroxide is slightly soluble in water, silver chloride is relatively insoluble in water. Although lime or caustic may be effective in precipitating silver from wastewaters, chloride precipitation should result in a precipitate that is less soluble in water than the hydroxide salt.

Due to the relatively higher solubility of silver hydroxide (compared to silver chloride), there exists a reasonable potential for an increase in leachability of silver from the resulting wastewater treatment sludge containing silver as a chloride during co-disposal with alkaline wastes or materials. This potential for increased leachability under these conditions is a legitimate concern, in that some operators of hazardous landfills co-dispose all "metal" wastes and it is typical practice to add excess lime to prevent migration of the other metals prior to disposal.

Thus, EPA solicits comments on whether it should (as part of the treatment standard) specify the use of chloride as the precipitating reagent for all wastewaters containing silver. In a similar manner, the Agency solicits comment on whether it should establish disposal requirements under 40 CFR parts 264 and 265 for all silver wastewaters that would include chloride precipitation followed by segregation of the treatment residuals from alkaline materials (i.e., in either monofills or separate subcells within a landfill). In doing so, EPA notes these proposed requirements may then be promulgated as additional requirements to meeting the proposed concentration-based standards.

The Agency has information that sulfide has been used to precipitate silver contained in photoprocessing wastewaters. Also, ion exchange of

silver has been reported as achieving extremely high removal efficiencies. The Agency is soliciting data on the efficiency of these treatment technologies for D011 wastes.

For some silver wastewaters more extensive treatment trains may be necessary in order to treat hexavalent chromium, other metals, and organics which could possibly interfere with the treatment of the silver. A reduction step for hexavalent chromium and an oxidation step (with reagents such as hydrogen peroxide or hypochlorite) may be necessary to treat the organics. However, the Agency currently lacks data that indicate that the proposed concentration-based standards cannot be achieved for these type of wastes and anticipates that pretreatment steps such as hexavalent chromium reduction and chemical oxidation of organics could remove these potential interferences. The Agency specifically solicits comments on the applicability of these and other pretreatment technologies for silver wastewaters and data that indicate the achievability of the concentration-based standards proposed in the following sections.

The Agency has very little data on precipitation of silver from RCRA hazardous wastewaters identified as P099, P104, or D011. However, the Agency's does have data from its analysis of various treated wastewaters under the Agency's Effluent Guideline Program. In the absence of treatment data specific to P099, P104, or D011 wastewaters, the Agency believes that these data from the Effluent Guidelines Program can be transferred to develop treatment standards for P099, P104, or D011 wastewaters. The data show that the treatment provided by these industries can reduce the concentration of silver in the wastewater of levels below the characteristic level of 5.0 mg/l.

Therefore, the Agency is proposing two options for treatment standards for D011 wastewaters. Based on these treatment data, the Agency is proposing a treatment standard of 0.29 mg/l silver for all D011 wastewaters as one option. As discussed in detail in section III.C. of today's preamble, the Agency has initially determined that it has the authority to establish treatment standards below the characteristic level for these wastes or at least to make failure to treat to the lower level a violation of section 3004(m). The Agency is also proposing a second option of limiting the treatment standard for D011 wastewaters to the characteristic level of 5.0 mg/l. The Agency specifically solicits comments on these two options.

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Based on this same data, the Agency is also proposing a treatment standard for silver in P099 and P104 wastewaters of 0.29 mg/l of silver. While P099 (potassium silver cyanide) and P104 (silver cyanide) wastes are typically generated as nonwastewaters, the Agency expects that wastewater forms of these wastes may be generated from incidental spills or from the treatment process itself and thus would require treatment standards. The Agency expects that untreated wastewaters will be relatively dilute, and thus would not be expected to be difficult to treat. The Agency points out that it is not reopening the promulgated treatment standards for cyanides in P099 and P104 for comment.

(2) *Identification of BDAT for Nonwastewaters.* The Agency is proposing several options for treatment standards for D011 nonwastewaters. These options are based on the inherent economic value of silver and the general lack of treatment data for wastes containing various levels of silver.

For nonwastewater forms of D011, the Agency believes that the silver can be dissolved or leached using an appropriate media (each chemical form of silver may require a different dissolving media) and either reprecipitated as the chloride or hydroxide or better yet, recovered for its inherent economic value through processes involving electro-deposition or electro-winning. As an example, while silver chloride is generally insoluble in dilute acids, it is considerably soluble in strong ammonia (NH₄OH) and could theoretically be leached by ammonia and recovered. The Agency believes that due to the relatively high economic value of silver, an economic incentive already exists for most generators to investigate all recovery options as well as source reduction techniques to prevent generation. The Agency is thus proposing one option for D011 nonwastewaters treatment standards as "Recovery as a Method of Treatment".

However, the Agency does not think that at very low concentrations (i.e., just above the EP level) and low waste volumes, recovery may not be a viable alternative for D011 wastes. Therefore, the Agency investigated the availability of stabilization data for wastes containing silver. Treatment standards for silver in nonwastewater forms of P099 and P104 were promulgated in the Second Third Rule (53 FR 26615, (June, 23, 1989)). These standards were transferred from stabilization data for F006 nonwastewaters. However, these data represent the stabilization of a

waste that originally contained low concentrations of silver. The Agency received no comments disputing the achievability of the silver standards for P099 and P104 wastes, even though the Agency anticipates that these wastes could contain reasonably high levels of silver. As a result, the Agency is proposing the same concentration-based standards for silver in D011 nonwastewaters. However, the Agency is concerned about the validity of the transfer of these standards to D011 wastes that contain high levels of silver, and is thus proposing "Recovery or Stabilization as Methods of Treatment".

EPA is currently unaware of any silver wastes contaminated with high levels of organics being generated on a routine basis. If these wastes do exist, the Agency believes that these wastes can be incinerated prior to stabilization of the ash. The Agency is soliciting information on whether these wastes actually exist, the concentration of silver and organics within these wastes, and treatment data for these wastes. If the Agency finds that these wastes do exist and treatment data is submitted, the Agency may define these wastes as a separate treatability group based on the level of organics and silver and promulgate the resultant concentration-based standards based on these data. However, information is submitted that these wastes exist but no treatment data are submitted from which concentration-based standards can be developed, the Agency may promulgate "Incineration Followed by Stabilization as a Method of Treatment" for these wastes.

BDAT TREATMENT STANDARDS FOR D011, P099, AND P104

[Wastewaters]

Regulated constituent	Maximum for any 24 hour composite sample, total composition (mg/l)
Silver	0.29

BDAT TREATMENT STANDARDS FOR D011

[Nonwastewaters]

Regulated constituent	Maximum for any single grab sample, TCLP (mg/l)
Silver	0.072

i. Thallium

- P113—Thallic oxide
- P114—Thallium selenite
- P115—Thallium (I) sulfate
- U214—Thallium (I) acetate

- U215—Thallium (I) carbonate
- U216—Thallium (I) chloride
- U217—Thallium (I) nitrate

In today's notice, the Agency is proposing wastewater and nonwastewater treatment standards for P113, P114, P115, U214, U215, U216, and U217 thallium wastes. The Agency has been able to identify only one manufacturer of Thallium wastes. (In fact, the Bureau of Mines estimates the production of thallium as only 4,000 pounds per year.) Most of thallium compounds are used in research, in the electrical industry for the production of thallium activated sodium iodide crystals, in the glass industry as low melting alloys, and as catalysts in the organic chemical industry.

(1) *Wastewaters.* The Agency has reviewed characterization data from the Generator Survey and the TSDR Survey for thallium wastewaters. Based on the information from these surveys, most thallium wastewaters are characterized as metallic acidic liquids. There may be other metals such as lead, nickel, and zinc present within the wastes. The concentration of thallium in these wastes range from 0.1–10 ppm.

The Agency has information indicating that thallic hydroxide compounds are very insoluble. The Agency is proposing to use this information to extrapolate treatment standards to these thallium wastes. The Agency believes that because thallic hydroxide is so insoluble, if these thallium wastes are treated by chemical oxidation followed by chemical precipitation with hydroxide reagents, settling and filtration, most of the thallic compounds will precipitate out in the sludge. Therefore, BDAT for thallium wastewaters is chemical oxidation followed by chemical precipitation with hydroxide reagents, settling and filtering. The treatment standard being proposed today is based on the detection limit of thallium in wastewaters.

As an alternative, the Agency has recently analyzed additional wastewater treatment data primarily from the Agency's Office of Water for incorporation into the treatment standards for many of the U and P wastes in this section. These data include the treatment of wastewaters that are not specifically listed as U or P wastewaters, but do contain many metal constituents. While these data were not available in time to incorporate into this discussion or into the background document for these wastes, these data are being placed in the administrative record for today's notice. Therefore, the Agency is not precluded from using

these data in promulgating the standards for these wastes. Further information on these data can be found in section III.A.1.h.(6.). The resultant alternative standard calculated for thallium in wastewaters is 1.400 mg/l.

(2) *Nonwastewaters.* The Agency is proposing several options for treatment standards for P113, P114, P115, U214, U215, U216, and U217 nonwastewaters. These options are based on the inherent economic value of thallium and the general lack of treatment data for wastes containing various levels of thallium.

Based on information from the Generator Survey, most of the thallium nonwastewaters are characterized as inorganic salts used as research chemicals, off-specification, or out-dated materials. Because of the insolubility of thallic hydroxide compounds and the information that suggest that these thallium compounds are mostly inorganic, the Agency believes that P113, P114, P115, U214, U215, U216, and U217 nonwastewaters are also primarily inorganic and therefore can be stabilized. Thus, the Agency is proposing that stabilization is also BDAT for the nonwastewaters. In addition, the Agency believes that due to the relatively high economic value of thallium, an economic incentive already exists for most generators to investigate all recovery options as well as source reduction techniques to prevent generation. However, the Agency does not think that at very low concentrations and low waste volumes, recovery may not be a viable alternative for thallium wastes. The Agency is thus proposing for a nonwastewater treatment standard of "Recovery or Stabilization as a Method of Treatment" for P113, P114, P115, U214, U215, U216, and U217.

The Agency is also soliciting comments on the regulation of P114 (thallium selenite). In section III.A.5.b. of today's rule, the Agency is proposing a concentration-based treatment standard for D010 nonwastewaters based on vitrification data for arsenic. Thus, the Agency is proposing "Vitrification or Stabilization as a Method of Treatment" for P114 nonwastewaters and is soliciting comments on whether vitrification is necessary to immobilize both thallium and selenium. The Agency is soliciting comments on potential cut-off levels for thallium wastes that can be recovered versus those that can be stabilized and any stabilization data on wastes containing thallium.

BDAT TREATMENT STANDARDS FOR P113, P114*, P115, U214, U215, U216, AND U217

[Wastewaters]	
Regulated constituent	Maximum for any single grab sample, total composition (mg/l)
Thallium	0.14

*Treatment standards for selenium in P114 wastewaters are presented in section III.A.5.b.

BDAT TREATMENT STANDARDS FOR P113, P115, U214, U215, U216, AND U217

[Nonwastewaters]	
Recovery or stabilization as a method of treatment	

BDAT TREATMENT STANDARDS FOR P114
[Nonwastewaters]

Vitrification or stabilization as a method of treatment	
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j. Vanadium.

P119—Ammonium vanadate
P120—Vanadium pentoxide

Vanadium compounds are used primarily as alloying materials in iron and steel production or as catalysts in several chemical manufacturing processes such as adipic acid, sulfuric acid, synthetic rubber, and crude oil. Most of the vanadium produced in the United States comes from mined ores or recovery processes. Vanadium is recovered from mining ores by calcining and leaching of the calcined material. Recovery processes usually recover the vanadium in its pentoxide state. Vanadium is recovered in uranium production via liquid/liquid extraction; and the product is usually in the form of ammonium metavanadate.

The Agency believes that these wastes comprise one treatability group because they are produced from the same mined ores and are used as catalysts in similar industries. Vanadium wastes such as P119 and P120, can be generated as a fly ash or slag from the iron and steel industry or as a spent catalyst from the chemical manufacturing process. Based on information from the Generators Survey, these wastes could be classified as inorganic solids, organic liquids, or used bags or drums.

(1) *Wastewaters.* The Agency believes that P119 and P120 wastewaters could

be generated from recovery or incineration of the nonwastewater forms of P119 and P120, and as leachate from landfill closure operations. A review of the literature indicates that vanadium compounds can be treated with ferric sulfate. By treating with ferric sulfate, the vanadium is removed from the wastewaters and ferric metavanadate, which is relatively insoluble, remains in the filter cake.

The Agency has recently analyzed additional wastewater treatment data primarily from the Agency's Office of Water for incorporation into the treatment standards for many of the metal wastes in this section. These data include the treatment of wastewaters that are not specifically listed as P119 or P120 wastewaters, but do contain many metal constituents. While these data were not available in time to incorporate into this discussion or into the background document for these wastes, these data are being placed in the administrative record for today's notice. Therefore, the Agency is not precluded from using these data in promulgating the standards for these wastes. Further information on these data can be found in section III.A.1.h.(6.). The resultant alternative standard calculated for vanadium in wastewaters is 0.042 mg/l.

(2) *Nonwastewaters.* The Agency believes that P119 and P120 nonwastewaters can be generated as spent catalysts from chemical production or as fly ash from the iron and steel industry. The Agency has information indicating that nonwastewaters containing greater than seven percent of vanadium can be recovered. The Agency is proposing a treatment standard for P119 and P120 nonwastewaters of "Thermal Recovery as a Method of Treatment" based on the following: (1) P119 and P120 are generated primarily as off-spec products and would probably contain greater than seven percent vanadium due to their elemental composition, thus making them technically viable to recovery; (2) Due to these high levels of vanadium, P119 and P120 contain an inherent high economic value that acts as an incentive for most generators to investigate all recovery options as well as source reduction techniques to prevent generation; and (3) The Agency has no other treatment data for nonwastewaters containing vanadium.

However, the Agency does not think that at very low concentrations and low waste volumes, recovery may not be a viable alternative for vanadium wastes. Because these vanadium compounds are inorganic, the Agency believes that P119

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