FINAL
BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT) BACKGROUND DOCUMENT FOR

P AND U THALLIUM WASTES

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TABLE OF CONTENTS

LIST OF TABLES

1. INTRODUCTION AND SUMMARY

Pursuant to section 3004(m) of the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments (HSWA) enacted on November 8, 1984, the Environmental Protection Agency (EPA) is promulgating treatment standards based on the best demonstrated available technology (BDAT) for U-code and P-code thallium wastes. These wastes are identified in 40 CFR 261.33 as follows:

P113 - Thallic oxide
P114 - Thallium (I) selenite
P115 - Thallium (I) sulfate
U214 - Thallium (I) acetate
U215 - Thallium (I) carbonate
U216 - Thallium (I) chlorate
U217 - Thallium (I) nitrate

These wastes are being regulated for the thallium constituent except for P114. P114 is being regulated for selenium but not regulated for thallium. Compliance with these treatment standards is a prrequisite for placement of these wastes in facilities designated as land disposal units according to 40 CFR Part 268. The effective date of the final promulgated treatment standards is August 8, 1990.

This background document presents the Agency's technical support and rationale for developing regulatory standards for these wastes. Sections 2 through 7 present waste-specific information for the thallium-containing wastes. Section 2 presents the number and location of facilities affected by the land disposal restrictions, the waste-generating process, and waste characterization data. Section 3 discusses the technologies used to treat the waste (or similar wastes), and Section 4 presents available performance data, including data on which

the treatment standards are based. Section 5 explains EPA's determination of BDAT, while Section 6 discusses the selection of constituents to be regulated. Treatment standards are determined in Section 7.

The BDAT program and promulgated methodology are more thoroughly described in two additional documents: Methodology for Developing BDAT Treatment Standards (USEPA 1989a) and Generic Quality Assurance Project Plan for Land Disposal Restrictions Program ("BDAT") (USEPA 1988b). The petition process to be followed in requesting a variance from the BDAT treatment standards is discussed in the methodology document.

The wastes generated from production and use of thallium compounds may be either wastewaters or nonwastewaters. A wastewater is defined by the Agency as containing less than 1 percent (weight basis) total suspended solids* and less than 1 percent (weight basis) total organic carbon (TOC). Wastes not meeting this definition must comply with the treatment standards for nonwastewaters.

The BDAT treatment standard for nonwastewater forms of P113, P115, U214, U215, U216, and U217 is thermal recovery or stabilization as a method of treatment. The Agency is setting a technology-based standard because the only thallium nonwastewater stabilization data available are inconclusive in setting a concentration-based standard. Some of the thallium stabilization data contained no untreated TCLP concentrations, and the data points differed by more than two orders of magnitude with no explanation given (HWTC 1989a). The Agency has, however, received data on thallium compounds that indicate that stabilization works for these

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* The term "total suspended solids" (TSS) clarifies EPA's previously used terminology of "total solids" and "filterable solids." Specifically, the quantity of total suspended solids is measured by Method 209C (Total Suspended Solids Dried at 103 to 105°C) in Standard Methods for the Examination of Water and Wastewater, 16th Edition (APHA, AWWA, and WPCF 1985).

wastes (HWTC 1989b). BDAT for nonwastewater forms of P114 is stabilization. Stabilization has been determined to represent BDAT for the selenium portion of thallium selenite (P114) nonwastewaters (USEPA 1990a). EPA is not regulating P114 nonwastewaters for thallium, but the Agency believes that treatment of P114 nonwastewaters for selenium will effectively reduce the concentration of thallium as well.

BDAT for the wastewater forms of P113, P115, U214, U215, U216, and U217 is chemical oxidation of thallium (I) compounds followed by chemical precipitation with hydroxide compounds, settling, and filtration. The treatment standard for these wastewaters is 0.14 mg/l, measured as total composition of a 24-hour composite sample.

The treatment standard for the selenium component of P114 is a concentration-based standard, with BDAT for removal of selenium being chemical treatment for selenium. The treatment removes only the selenium component. EPA has no data on the removal of thallium from P114 wastewaters. However, thallium is extremely insoluble at alkaline pHs (Mellor 1946). EPA believes BDAT subsequent to removal of selenium from P114 wastewaters is chemical precipitation at alkaline conditions. Therefore, BDAT for P114 wastewaters is chemical treatment for selenium removal followed by chemical precipitation at alkaline conditions. These treatment standards are summarized in Tables 1-1 and 1-2.

Table 1-1 BDAT Treatment Standards for P113, P115, U214, U215, U216, and U217 Nonwastewaters[a]

Waste code	Treatment standard
P113, P115, U214, U215, U216, U217	THERMAL RECOVERY OR STABILIZATION AS A METHOD OF TREATMENT

[a] Also see the Best Demonstrated Available Technology (BDAT) Background Document for K031, K084, K101, K102, Characteristic Arsenic Wastes (D004), Characteristic Selenium Wastes (D010), and P and U Wastes Containing Arsenic and Selenium Listing Constituents (USEPA 1990a) for selenium treatment standard for P114.

Table 1-2 BDAT Treatment Standards for P113, P115, U214, U215, U216, and U217 Wastewaters[a]

Regulated constituent	Maximum for any single 24-hour composite sample Total composition (mg/l)
Thallium	0.14

[a] Also see the Best Demonstrated Available Technology (BDAT) Background Document for K031, K084, K101, K102, Characteristic Arsenic Wastes (D004), Characteristic Selenium Wastes (D010), and P and U Wastes Containing Arsenic and Selenium Listing Constituents (USEPA 1990a) for selenium treatment standard for P114.

2. INDUSTRIES AFFECTED AND WASTE CHARACTERIZATION

Under 40 CFR 261.33, the thallium-containing hazardous wastes are specifically listed as follows:

P113 - Thallic oxide; Thallium (III) oxide
P114 - Thallium (I) selenite
P115 - Thallium (I) sulfate
U214 - Thallium (I) acetate
U215 - Thallium (I) carbonate
U216 - Thallium (I) chloride
U217 - Thallium (I) nitrate

The Agency has determined that these listed wastes represent a single treatability group based on their similar physical and chemical characteristics. They are all inorganic forms of thallium that generally ionize when dissolved in water. As described later in this section, EPA has examined the sources of the wastes, the specific similarities in the waste composition, applicable and demonstrated treatment technologies, and attainable treatment performance in order to support a simplified regulatory approach for these inorganic wastes.

2.1 Industry Affected and Process Description

According to the 1987 Minerals Yearbook (U.S. Bureau of Mines 1988), only 4,000 pounds of thallium compounds were consumed in the United States in 1987. Thallous bromide (thallium (I) bromide, TlBr) and thallous iodide (thallium (I) iodide, TlI) are used as infrared optical prism and window materials. The other thallium compounds are used primarily for research purposes.

Currently, there is only one manufacturer of thallium salts in the United States. The compounds presently made are listed in Table 2-1.

Other thallium compounds are either imported for use or sold from stockpiles of materials produced at earlier times.

Table 2-1 Current Manufacturer of Thallium Compounds

Plant	Location	Products	Wastes potentially generated
Harshaw Filtrol	Solon, Ohio	Thallium (I) bromide Thallium (I) chloride Thallium (I) iodide	U216

Source: SRI 1989.

The production process currently used to manufacture the three thallium salts is proprietary. However, in the past, all thallium compounds were generally made from thallic sulfate (thallium (III) sulfate, $Tl_2(SO_4)_3$), which had been recovered as a byproduct of the production of cadmium metal. Until about 10 years ago, thallic sulfate was sold primarily as a rodenticide. This use has largely disappeared, and the product has been replaced by other non-thallium-containing, nonpersistent pesticides.

2.2 Waste Characterization

The physical properties of thallium compounds are presented in Table 2-2 at the end of this section. A very limited amount of waste characterization information is available to characterize thallium wastes.

No waste generation was reported by the one facility manufacturing thallium salts (see Table 2-1). Wastes from that facility's processes

are discharged to a local publicly-owned treatment works (POTW) system (Versar 1989).

Waste composition data for waste from only one facility were reported in the 1986 National Survey of Hazardous Waste Generators (Generator Survey, USEPA 1986b). This waste contained 75 to 90 percent thallium, which is typical for a discarded laboratory chemical. (U- and P-code wastes are discarded, spilled, or off-specification chemicals.)

Table 2-3 lists the generators and the amounts of thallium wastes generated by each facility. According to the 1986 National Survey of Hazardous Waste Treatment, Storage, Disposal, and Recycling Facilities (TSDR Survey), only six facilities reported generating thallium wastes (USEPA 1986a). Table 2-4 shows the amounts of thallium wastes reportedly received by commercial waste treatment and disposal firms in 1986. Most of this quantity was reported to be obsolete thallic sulfate rodenticide.

2.3 Determination of Waste Treatability Groups

In some cases, wastes with different waste codes, produced in similar processes or in similar industries, can be treated to similar concentrations using the same technologies. In these instances, the Agency may combine the codes into a single treatability group.

Based on careful review of the generators of thallium wastes and available waste characterization data, the Agency has determined that thallium nonwastewaters constitute one treatability group.

Thallium nonwastewaters are expected to be similar in terms of the constituents that they contain, and all are inorganic thallium compounds. Thallium wastewaters are likewise expected to be similar in terms of the constituents that they contain, and all are inorganic thallium compounds. Therefore, thallium wastewaters constitute one treatability group.

None of the thallium wastes routinely generated are expected to contain organic constituents. P114 wastewaters and nonwastewaters contain selenium and are being regulated for selenium only and not thallium.

Table 2-2 Physical Properties of Thallium Compounds

		Melting point (°C)	Boiling point (°)	Solubility in H_2O
	Thallium, Tl	303.50	1457	Insoluble
P113	Thallic (III) oxide Tl_2O_3	717	875	Insoluble
P114	Thallium (I) selenite $Tl_2(SeO_3)_3$	---	---	---
P115	Thallium (I) sulfate, Tl_2SO_4	632	decomposes	4.87^{30} 19.14^{100}
U214	Thallium (I) acetate, $TlC_2H_2O_2$	131	-	Very soluble
U215	Thallium (I) carbonate, Tl_2CO_2	273	-	$4.03^{15.5}$ 27.2^{100}
U216	Thallium (I) chlorate, $TlClO_2$	-	-	2.0^{0} 57.31^{100}
U217	Thallium (I) nitrate, $TlNO_3$ (cubic crystalline structure)	206	430	9.55^{20} 4.13^{100}

Source: Weast 1989.

Table 2-3 Estimated Quantities of RCRA Thallium Wastes Generated in 1986

RCRA P or U waste	Thallium waste generator	Estimated quantity generated in 1986 (pounds)	Comments
P113	Aldrich Chemical Co.	9	1 gallon of waste reported (assume 9 lb/gal density); research quantity.
P113	Argonne National Lab.	270	30 gallons of waste reported (assume 9 lb/gal); research quantity.
P114	E.I. Du Pont Co.	1	Research quantity.
P115	Aldrich Chemical Co.	9	1 gallon of waste reported (assume 9 lb/gal); research quantity.
P115	E.I. Du Pont Co.	1	Research quantity.
P115	TRW Electronics & Defense	20	Actual thallium content not known; assume 1% of P115 in material.
P115	TRW Electronics & Defense	60	6,000 lb of electroplating waste mixture including D004, F007, P030, P038, P064, P106, and P115; assume only trace (0.1%) of P115 in the mixture.[a]
P115	USAF Norton AFB	810	90 gallons of waste reported (assume 9 lb/gal).
	Total P-code thallium waste generated	1,180	

Table 2-3 (continued)

RCRA P or U waste	Thallium waste generator	Estimated quantity generated in 1986 (pounds)	Comments
U214	Aldrich Chemical Co.	9	1 gallon of waste reported (assume 9 lb/gal); research quantity.
U215	Aldrich Chemical Co.	9	1 gallon of waste reported (assume 9 lb/gal); research quantity.
U215	E.I. Du Pont Co.	1	Research quantity.
U216	Aldrich Chemical Co.	9	1 gallon of waste reported (assume 9 lb/gal); research quantity.
U216	Argonne National Lab.	27	3 gallons of waste reported (assume 9 lb/gal); research quantity.
U217	Aldrich Chemical Co.	9	1 gallon of waste reported (assume 9 lb/gal); research quantity.
U217	American Cyanamid	10	110 gallons of waste reported as mixture of P001, U204, and U217 (assume 9 lb/gal and 1% U217).[a]
U217	E.I. Du Pont Co.	5	Research quantity.
	Total U-code thallium waste generated	79	
	Total P- and U-code thallium waste generated	1,259	

[a] Assumptions based on telephone conversations between Versar Inc. personnel and the generating plants.

Source: USEPA 1986a.

Table 2-4 Estimated Quantities of RCRA Thallium Wastes Received by TSDR Facilities in 1986

RCRA P or U waste	Thallium waste handler	Estimated quantity handled in 1986 (pounds)	Comments
P116	Casmalia Resources	40,000	This material consists of obsolete rodenticides (mixtures of thallium sulfate and inert materials) that are being phased out by suppliers of these materials and thus would not be a continuing source of this waste.[a]
P216	Appropriate Technologies II	10	None.
	Total P-code thallium waste handled	40,010	
U214	ThermalKem	45	5 gallons of waste reported (assume 9 lb/gal).
U214	Earth Industrial Waste	2	None.
	Total U-code thallium waste handled	47	
	Total P-code and U-code thallium waste handled	40,057	

[a] This information is based on a telephone conversation between Versar Inc. and Casmalia Resources.

Source: USEPA 1986a.

3. APPLICABLE AND DEMONSTRATED TREATMENT TECHNOLOGIES

This section identifies the treatment technologies that are applicable to the two thallium treatability groups. It also discusses which of the applicable technologies can be considered demonstrated for the purpose of establishing BDAT.

To be applicable, a technology must be theoretically usable to treat the waste in question or to treat a waste that is similar in terms of the parameters that affect treatment selection. To be demonstrated, the technology must be in full-scale operation for the treatment of the waste in question or a similar waste. Technologies available only at pilot- and bench-scale operations are not considered demonstrated technologies.

3.1 Applicable Treatment Technologies

Initial data gathering on the treatment of thallium-containing wastes included review of the technical literature and contacts with industry representatives. As a result of these efforts, EPA identified four technologies as applicable for treatment of these wastes. These four technologies (two for nonwastewater wastes and two for wastewaters) are discussed briefly below. Further discussion of each of these technologies is found in the Treatment Technology Background Document (USEPA 1989b).

3.1.1 Applicable Treatment Technologies for Nonwastewaters

(1) Thermal recovery. Thermal recovery technologies are applicable to the recovery of thallium from wastes. In high-temperature metals recovery, the waste is heated in a reducing atmosphere to vaporize the metal. Thallium has a boiling point of 1457°C. The vaporized metal usually reacts with air to form an oxide, which is recovered from the airstream exiting the high-temperature recovery unit.

(2) Stabilization. Thallium salts--for example, thallic oxide (Tl_2O_3), thallic hydroxide ($Tl(OH)_3$) wastes (such as wastewater treatment sludges generated from chemical precipitation treatment of thallium-containing wastewaters), and thallic selenite--may be treated by stabilization. Other thallium salts, such as thallium trioxide, thallium sulfate, and thallium acetate, have been successfully treated by stabilization (HWTC 1989a, 1989b). Stabilization involves mixing the insoluble thallium compounds with lime, fly ash, concrete, cement, other pozzolanic materials, and water. Chemical reactions occur in the mixed materials, which then cure into a hard, concrete-like mass.

(Note: Chemical precipitation and chemical oxidation are also applicable to nonwastewaters. However, these are primarily wastewater treatment technologies and will be discussed in section 3.1.2. To use these technologies for treatment of many nonwastewaters, the waste must first be either dissolved or suspended in water.)

3.1.2 Applicable Treatment Technologies for Wastewaters

(1) Chemical precipitation. Chemical precipitation is a technology used for treatment of dissolved metals in wastewaters. Chemicals are added to the waste solution that result in the formation of insoluble compounds that can be physically separated by technologies such as sedimentation and filtration. Chemical precipitation of thallium by the addition of lime or caustic to an aqueous solution or suspension converts all soluble thallic salts present into highly insoluble thallic hydroxide ($Tl(OH)_3$).

(2) Chemical oxidation. Thallium in wastewaters occurs in two oxidation states: monovalent thallous (or thallium (I)) salts and trivalent thallic (or thallium (III)) salts. Typically, thallous compounds are much more soluble than thallic compounds; thus thallium is more easily removed from wastewaters when it is in the thallic form. Thallous salts may be oxidized to thallic compounds by aqueous chemical

oxidation processes using a variety of oxidizing agents. Chemical oxidation processes are aqueous treatment processes that are usually used to destroy organic or oxidizable inorganic constituents in wastewaters. These processes can also be used, however, to convert a metal from a low oxidation state to a higher oxidation state. Hydrogen peroxide, potassium permanganate, and sodium hypochlorite all oxidize thallous salts to thallic compounds by this reaction (Mellor 1946).

3.2 Demonstrated Treatment Technologies

3.2.1 Demonstrated Treatment Technologies for Nonwastewaters

Thermal recovery, stabilization, chemical oxidation, and chemical precipitation are all full-scale, well-demonstrated technologies that have been used for management of a wide variety of BDAT list metal-containing wastes including thallium. Use of chemical oxidation or precipitation for treatment of many nonwastewaters requires that the waste first be dissolved or suspended in water. This would be necessary for chemical oxidation and chemical precipitation pretreatment before stabilization.

3.2.2 Demonstrated Treatment Technologies for Wastewaters

Chemical oxidation and chemical precipitation are full-scale, demonstrated wastewater treatment methods used for removal of BDAT list metal ions from wastewaters. These technologies are therefore demonstrated for thallium wastewaters.

4. PERFORMANCE DATA

EPA has limited treatment data on nonwastewater forms of thallium wastes and no treatment data on wastewater forms. Where sufficient data are not available on the treatment of the specific wastes of concern, as is the case with thallium wastes, the Agency may elect to transfer data on the treatment of a similar waste or wastes, using a demonstrated technology. To transfer data from another waste category, EPA must find that the wastes covered by this background document are no more difficult to treat (based on the waste characteristics that affect performance of the demonstrated treatment technology) than the treated wastes from which performance data are being transferred.

Table 2-4 lists the quantities of thallium wastes received by TSDR facilities in 1986. The facility receiving most of the waste, Casmalia Resources, is a hazardous waste landfill. It did not treat the waste prior to disposal. The other facilities received very small quantities of thallium wastes and mixed them with other wastes prior to treatment. As a result, limited treatment data on thallium nonwastewaters are available.

The Agency has extensive data on stabilization as applied to nonwastewater forms of other BDAT list metal-containing wastes. Additionally, EPA received data on the stabilization of thallium as part of the comments in response to the proposed rule on thallium. Data were received on thallium stabilization using proprietary reagents (HWTC 1989a, 1989b). Some of the thallium stabilization data contained no untreated TCLP concentrations, and the data points differed by more than two orders of magnitude with no explanation given. The Agency has, however, received data on thallium compounds that indicate that stabilization works for these wastes.

Wastewater treatment data, primarily from EPA's Office of Water, were analyzed for the development of concentration-based treatment standards for thallium-containing wastewaters (see Table 4-1). Further information on these data, including the sources of the data and the treatment technologies used, can be found in the Preamble to the Third Third Land Disposal Restrictions Final Rule and in the Best Demonstrated Available Technology (BDAT) Background Document for Wastewaters Containing BDAT List Constituents (USEPA 1989c). Data on treatment of other BDAT metal-containing wastewaters by chemical precipitation and chemical oxidation can be found in the effluent guidelines background document for the Inorganic Chemicals Industry (USEPA 1982).

Table 4-1 Performance Data for Thallium Wastewaters

Technology	Technology size	Average effluent concentration (ppb)
Lime precipitation and sedimentation	Full	500.00
Lime precipitation and sedimentation and filtration	Full	340.00

Source: USEPA 1989c.

5. DETERMINATION OF BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT)

The Agency examined all available performance data from applicable, demonstrated technologies to determine (using statistical techniques) whether one or more of the technologies performs significantly better than the others. The technology that performs best on a particular waste or waste treatability group is then evaluated to determine whether it is "available." To be available the technology must (1) be commercially available to any generator and (2) provide substantial treatment of the waste, as determined through evaluation of accuracy-adjusted data. In determining whether treatment is substantial, EPA may consider data on the performance of a waste similar to the waste in question provided that the similar waste is at least as difficult to treat. If the best technology is not available, the next best technology is evaluated, and so on until BDAT is determined. The most desirable waste management technology is one that results in no residual streams or a residual stream with no hazardous properties. No such technologies, however, have been identified for thallium wastes.

The best technology identified for thallium nonwastewaters is the treatment train consisting of chemical oxidation to the thallium (III) state followed by chemical precipitation and stabilization. There are significant differences between the solubilities of thallous (thallium (I)) and thallic (thallium (III)) salts. Thallous hydroxide is very soluble, and thallic hydroxide is very insoluble. Therefore, conversion to the thallic state is desirable before stabilization. This treatment train may necessitate dissolving or slurrying the waste with water prior to chemical treatment. In the next step, all thallium compounds are converted to the thallium (III) oxidation state and precipitated as insoluble thallic hydroxide. The nonwastewater treatment sludge residual thus generated is then stabilized to reduce the leachability of thallium

even further. These technologies are commercially available and are expected to result in significant reduction of thallium in a leachate. Therefore, the Agency has determined that this approach is BDAT for thallium nonwastewaters.

Thermal recovery can be used to recover cadmium and zinc because they have low melting and boiling points. Thallium can also be recovered using thermal recovery because it has low melting and boiling points; therefore, thermal recovery is BDAT for thallium nonwastewaters.

For wastewaters, chemical oxidation of thallium (I) to thallium (III) followed by chemical precipitation of thallium by conventional hydroxide precipitating agents (e.g., lime or sodium hydroxide) will reduce significantly the concentration of thallium in wastewaters. Chemical oxidation and chemical precipitation are commercially available and are expected to provide significant treatment of thallium. These technologies represent BDAT for thallium wastewaters.

BDAT for P114 nonwastewaters is stabilization. Stabilization is the treatment used as BDAT for regulating the selenium content of P114 nonwastewaters (USEPA 1990a). EPA is not regulating P114 nonwastewaters for thallium, but the Agency believes that treatment of P114 nonwastewaters for selenium will effectively reduce the concentration of thallium as well. The treatment standard for the selenium component of P114 wastewaters is a concentration-based standard with BDAT for removal of selenium being chemical treatment for selenium. The treatment removes only the selenium component. EPA has no data on the removal of thallium from P114 wastewaters. However, thallium is extremely insoluble at alkaline pHs (Mellor 1986). EPA believes the BDAT subsequent to removal of selenium from P114 wastewaters is chemical precipitation at alkaline conditions. BDAT for P114 wastewaters is chemical treatment for selenium removal followed by chemical precipitation at alkaline conditions.

6. SELECTION OF REGULATED CONSTITUENTS

EPA is promulgating treatment standards for thallium in both wastewaters and nonwastewaters for all the P- and U-code thallium wastes covered by this background document except P114 wastes. Thallium is the only Appendix VIII constituent for which these wastes are listed (except for P114, which is discussed below) and is the only BDAT list constituent that will be found in these wastes on a regular basis (unless these wastes are mixed with other listed hazardous wastes, in which case other treatment standards will also apply).

P114 contains both thallium and selenium as BDAT list constituents. This waste is being regulated only as a selenium-containing waste and is not being regulated for thallium. Treatment standards for selenium in P114 are discussed in the best demonstrated available technology (BDAT) background document for arsenic and selenium (USEPA 1990a), which is also being developed for this rulemaking.

7. CALCULATION OF BDAT TREATMENT STANDARDS

The treatment standard for nonwastewater forms of P113, P115, U214, U215, U216, and U217 is thermal recovery or stabilization as a method of treatment. These treatment standards for nonwastewaters are presented in Table 7-1.

The treatment standard for P113, P115, U214, U215, U216, and U217 wastewaters is 0.14 mg/l, measured as total composition of a 24-hour composite sample. The thallium wastewater data were from the EPA's Office of Water. The Office of Water data, the only data available, were based on 24-hour composite samples. Further information on these data can be found in the Preamble to the Third Third Land Disposal Restrictions Final Rule and in the Best Demonstrated Available Technology (BDAT) Background Document for Wastewaters Containing BDAT List Constituents (USEPA 1989c). The wastewater treatment standards are presented in Table 7-2.

The treatment standard for thallium wastewaters was calculated using a mean of 0.034 and a variability factor of 4.1.

Treatment standard = mean x variability factor

TS = 4.1 x 0.034 = 0.14 mg/l

Table 7-1 BDAT Treatment Standards for P113, P115, U214, U215, U216, and U217 Nonwastewaters[a]

Waste code	Treatment standard
P113, P115, U214, U215, U216, U217	THERMAL RECOVERY OR STABILIZATION AS A METHOD OF TREATMENT

[a] Also see the Best Demonstrated Available Technology (BDAT) Background Document for K031, K084, K101, K102, Characteristic Arsenic Wastes (D004), Characteristic Selenium Wastes (D010), and P and U Wastes Containing Arsenic and Selenium Listing Constituents (USEPA 1990a) for selenium treatment standard for P114.

Table 7-2 BDAT Treatment Standards for P113, P115, U214, U215, U216, and U217 Wastewaters[a]

Regulated constituent	Maximum for any single 24-hour composite sample Total composition (mg/l)
Thallium	0.14

[a] Also see the Best Demonstrated Available Technology (BDAT) Background Document for K031, K084, K101, K102, Characteristic Arsenic Wastes (D004), Characteristic Selenium Wastes (D010), and P and U Wastes Containing Arsenic and Selenium Listing Constituents (USEPA 1990a) for selenium treatment standard for P114.

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