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MEMORANDUM

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DATE: May 7, 1990

SUBJECT: Final Treatment Standards for K069 Nonwastewaters in the Calcium Sulfate/Sodium Subcategory and Wastewater Forms of K069

This memorandum presents the technical support and rationale for the development of treatment standards for K069 nonwastewaters in the Calcium Sulfate Subcategory and wastewater forms of K069.

INTRODUCTION

According to 40 CFR Part 261.32 (hazardous wastes from specific sources), waste code K069 is listed as emission control dust/sludge from secondary lead smelting. In the First Third Final Rule (53 FR 31165, August 17, 1988), EPA established a Calcium Sulfate Subcategory and a Noncalcium Sulfate Subcategory for K069 nonwastewaters. A final BDAT treatment standard of "no land disposal" based on total recycle for those K069 nonwastewaters in the Noncalcium Sulfate Subcategory was promulgated in 53 FR 31165 (Table 24). Treatment standards for K069 nonwastewaters in the Calcium Sulfate Subcategory and wastewater forms of K069 were not promulgated as part of the First Third rulemaking in order to allow the Agency time for additional data collection and analysis.

INDUSTRY AFFECTED

The Calcium Sulfate Subcategory of K069 nonwastewaters was defined by EPA in 53 FR 31165 to cover a single plant (Exide/GBC) which, to EPA's knowledge, is the only plant generating a K069 nonwastewater stream that cannot be directly recycled to recover lead. (Lead recovery is the treatment standard that was promulgated for the Noncalcium Sulfate Subcategory for nonwastewaters.) This stream is a dewatered venturi scrubber sludge resulting from the lime slurry scrubbing of residual gases from fabric filtration of secondary lead smelter offgases. The resulting wastewater after sludge dewatering is the "derived from" wastewater form of K069. This wastewater can also be generated as leachate from RCRA or CERCLA land disposal activities.

WASTE CHARACTERIZATION

A. **Wastewaters**. The only known characterization data for K069 wastewaters are available in an Office of Water, Effluent Guidelines Division, draft development document (USEPA 1977). These characterization data describe venturi scrubber water generated at the one secondary lead smelting plant. Table 1 presents the pertinent data on BDAT list metal constituents from this source.

The Agency believes that K069 wastewater represents a single treatability group based on its expected physical and chemical composition. Specifically, K069 wastewaters are expected to be similar in physical and chemical composition regardless of how they are produced. Hence, K069 wastewaters have not been subcategorized.

B. **Nonwastewaters**. Characterization data submitted by Exide/GBC in response to the First Third Proposed rulemaking for K069 waste are summarized in Table 2. These data cover the principal parameters characterizing the Calcium Sulfate Subcategory of K069 nonwastewaters.

Table 1 Venturi Scrubber Water Characterization Data at the Single Calcium Sulfate Subcategory Plant

Constituent	Scrubber water analyses (mg/l)
Arsenic	1.25
Cadmium	1.62
Lead	54
pH	1.5

Source: USEPA 1977.

Table 2 Summarized Characterization Data for the Calcium Sulfate Subcategory of K069 Nonwastewaters

Parameter	Value or range	·TCLP	EP mg/l	Comments
Metals content (Total analysis - wet basis), ppm				
Arsenic	494			
Barium	56			
Cadmium	13-130			
Total chromium	10			
Mercury	515			
Nickel	8			
Selenium	23-130			
Silver	3			
Copper	22			
Molybdenum	2			
Zinc	16			
Lead	650-3327			Too low to recycle to lead smelter for recovery of lead
TCLP leachate, test				
Cadmium		0.21-1.47		
Lead		0.66-0.72		
EP leachate, test				
Arsenic			<0.1-3.08	
Barium			<0.1-2.9	
Cadmium			0.1-13.7	
Total chromium			0.007-0.27	
Lead			0.085-24.3	
Mercury			<0.02-0.11	
Selenium			0.002-0.36	
Silver			0.01-0.07	
Other Parameters				
Percent solids	20-61			Typically around 40
pH (solids in water)	6-12			
Heating value	N/A			
Ignitability	N/A			Waste is not ignitable
Sulfate/sulfite content, %	31			
Oil and grease, %	<0.02			
Organics, ppm	<1			

Source. Morgan, Lewis, and Backius 1988.

APPLICABLE AND DEMONSTRATED TREATMENT TECHNOLOGIES

A. **Wastewaters**. For K069 wastewaters, the Agency believes that the applicable treatment technologies include chemical precipitation followed by settling and/or filtration. The Agency has identified these treatment technologies because they are designed to reduce the concentration of metals in wastewaters. In addition, the treatment system consisting of chemical precipitation followed by settling and/or filtration is an applicable technology for removal of both dissolved and suspended metals from K069 wastewaters. Other applicable technologies include ion exchange and physical treatment methods that remove suspended solids from wastewaters (such as clarification, flocculation, vacuum filtration, sludge thickening, and other similar technologies). Chemical precipitation, followed by settling, filtering, and dewatering of solids are widely practiced metals treatment technologies (USEPA 1986a). Physical separation methods such as clarification, flocculation, filtration, and sludge thickening are also demonstrated treatment technologies for removal of metals from wastewaters.

B. **Nonwastewaters**. Applicable treatment for the Calcium Sulfate Subcategory of K069 nonwastewater is stabilization to reduce the leachability of BDAT list metals.

All of the applicable wastewater and nonwastewater treatment technologies are demonstrated because they are used on a full-scale commercial basis for treatment of metal bearing wastes. Metals precipitation, followed by settling, filtering, and dewatering of solids, and stabilization are widely practiced metals treatment technologies.

Additional information on technologies identified as applicable for K069 wastes can be found in the Treatment Technology Background Document (USEPA 1989)

PERFORMANCE DATA

This section discusses all available performance data associated with K069 nonwastewaters in the Calcium Sulfate Subcategory and wastewater forms of K069.

A. **Wastewaters**. The only treatability data relative to K069 wastewaters are from the Exide/GBC lead smelting plant. At this facility, K069 wastewater is sent to an onsite industrial wastewater treatment plant where it is lime-treated, clarified, and filtered in combination with other plant wastewaters. The treatability data for the combined wastewaters including waste code K069 have appeared in the previously referred to ELG document, and are presented in Table 3. Additional plant data (from the same ELG document) based on alkaline treatment (chemical precipitation) for lead and arsenic are shown in Table 4.

In addition, the Agency has 11 data sets for treatment of metal-bearing wastewaters by hexavalent chromium reduction, chemical precipitation, and dewatering of the precipitate. These data are presented in Tables 5 through 15. The metal bearing wastewaters included waste code K062, and these data were previously used in the development of treatment standards for K062 in the First Third Final Rule (USEPA 1988b). The Agency believes that these K062 data can be used to assess the performance of these technologies for K069 wastewaters, since the untreated K062 wastewaters contain much higher concentrations for most metals than K069 wastewaters are expected to contain. Accordingly, EPA is using these performance data for treatment by hexavalent chromium reduction, chemical precipitation, and dewatering of the precipitate to promulgate treatment standards for cadmium in K069 wastewaters.

Table 3 EPA-Collected Data on Alkaline Treatment (Chemical Precipitation) of Secondary Lead Smelter Wastewaters

Constituent	Influent concentration (mg/l)	Effluent concentration (mg/l)
Pb	76	0.41
As	0.024	0.03
Cd	0.83	0.005
pH	1.3	8.85

Source: USEPA 1977, Table VII-15, p. 187. Analyses are on composite samples of influent and effluent.

Table 4 Monthly Plant-Collected Effluent Data Following Alkaline Treatment (Chemical Precipitation) on BDAT Constituents

Year 1975	Selected Constituent Effluent Level (mg/l)				
	pH	Pb		As	
Month	Average	Average	Maximum	Average	Maximum
January	7.72	0.39	2.24	<0.004	0.037
February	7.33	0.37	1.63	<0.004	0.015
March	7.57	0.57	1.43	<0.009	0.033
April	8.14	0.35	0.88	<0.007	0.027
May	7.54	0.36	2.30	<0.004	0.026
June	8.03	0.104	0.32	0.003	0.008
July		-	-	-	-
August	8.31	<0.072	0.17	<0.002	0.002
September	7.94	0.16	0.74	0.003	0.019
October	7.93	0.228	2.65	0.003	0.007
November	8.12	0.155	0.81	0.004	0.027
December		-	-		-

Source: USEPA 1988.

The Agency has data indicating that K069 wastewaters may contain higher concentrations of lead than is typically found in K062 wastewaters. Therefore, the Agency evaluated available wastewater data for treatment of lead. The Agency evaluated the 15 data sets for treatment of D008 (lead) wastewaters from the foundry industry (Tischler/Kocurek - LD12-00027). These treatment performance data are presented in Tables 16 and 17. The D008 wastewaters are generated from the emission control scrubbers from the production of iron castings, and are treated by a system consisting of chemical precipitation, flocculation, clarification, filtration, and sludge thickening.

EPA evaluated the D008 data with respect to characteristics that affect treatment performance. Specifically, the D008 data were determined to be similar to K069 wastewaters in terms of the concentration of lead. In fact, the D008 had higher untreated lead concentrations than K069 wastewaters, (50-276 mg/l compared to 76 mg/l). Also, the D008 waste lead concentration was substantially reduced (from as high as 276 mg/l of lead in influent to as low as 0.17 mg/l of lead effluent) by the treatment system consisting of chemical precipitation, flocculation, clarification, filtration, and sludge thickening. The performance data for the D008 waste is shown in Table 16. Based on these D008 data, the Agency would expect that these D008 wastewaters would be more difficult to treat than K069 wastewaters. The Agency also believes that these two wastes probably have similar characteristics because both are emission control dust sludges from high temperature processes. Accordingly, the Agency is using D008 treatment data to assess the performance of lead in K069 wastewaters.

B. **Nonwastewaters**. Treatment performance data for the Calcium Sulfate Subcategory of K069 nonwastewaters specifically are not available. However, performance data are available from stabilization tests on F006 and K061 nonwastewaters, which are believed to be similar to K069 nonwastewater in the Calcium Sulfate Subcategory in that both F006 nonwastewaters and K061 nonwasterwaters contain similar metal constituents in higher concentrations than do K069 nonwastewaters. The data presented in Table 18 represent performance data developed from stabilization of F006 waste, while the data in Table 19 represent treatment of K061 wastes. These data were previously used in the development of treatment standards for F006 and K061 in the First Third Final Rule (USEPA 1988a,c).

DETERMINATION OF BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT) FOR K069

This section presents the rationale for the determination of best demonstrated available technology (BDAT) for K069 nonwastewaters in the Calcium Sulfate Subcategory and wastewater forms of K069.

The Agency examined all the available treatment performance data for the demonstrated technologies to determine which is best. For K069 wastewaters, the Agency has treatment performance data for one facility that treats K069 wastewaters using chemical precipitation. In addition, treatment performance data are available for metal-bearing wastewaters containing K062 waste, which the Agency has shown to be similar to K069 wastewaters (see section in Performance Data). Based on an evaluation of the untreated waste characteristics that affect treatment performance of these technologies, the Agency has determined that K062 wastewaters are more difficult to treat than K069 wastewaters for cadmium. Also available are treatment performance data for D008 wastewaters that are similar to K069 wastewaters with respect to lead concentrations. Based on an evaluation of these data (see section in Performance Data Base), the Agency has determined that for lead the D008 wastewater is more difficult to treat than K069 wastewaters.

Table 5 Treatment Performance Data for K062 EPA-Collected Data

Sample Set #1

Constituent	Untreated K062 waste (mg/l) Sample No. 801	Untreated K062 waste (mg/l) Sample No. 802	Untreated waste composite[a] (mg/l) Sample No. 805	Treated waste (wastewater) (mg/l) Sample No. 806
Arsenic	3	<1	<1	<0.1
Cadmium	<5	<5	13	<0.5
Chromium (hexavalent)	I	I	893	0.011
Chromium (total)	1800	7000	2581	0.12
Copper	865	306	138	0.21
Lead	<10	<10	64	<0.01
Nickel	3200	2600	471	0.33
Zinc	<2	<2	116	0.125

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a]The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1988b.

Table 6 Treatment Performance Data for K062 EPA-Collected Data

Sample Set #2

Constituent	Untreated K062 waste (mg/l) Sample No. 801	Untreated K062 waste (mg/l) Sample No. 802	Untreated waste composite[a] (mg/l) Sample No. 813	Treated waste (wastewater) (mg/l) Sample No. 814
Arsenic	3	<1	<1	<0.1
Cadmium	<5	<5	10	<0.5
Chromium (hexavalent)	I	I	807	0.12
Chromium (total)	1800	7000	2279	0.19
Copper	865	306	133	0.15
Lead	<10	<10	54	<0.01
Nickel	3200	2600	470	0.33
Zinc	<2	<2	4	0.115

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a]The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1988b.

Table 7 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #3

Constituent	Untreated K062 waste (mg/l) Sample No. 817	Untreated K062 waste (mg/l) Sample No. 802	Untreated waste composite[a] (mg/l) Sample No. 821	Treated waste (wastewater) (mg/l) Sample No. 822
Arsenic	3	<1	<1	<0.1
Cadmium	<5	<5	5	<0.5
Chromium (hexavalent)	I	I	775	I
Chromium (total)	1700	7000	1990	0.20
Copper	425	306	133	0.21
Lead	<10	<10	<10	<0.01
Nickel	100310	2600	16330	0.33
Zinc	7	<2	3.9	0.140

Design and Operating Data

	Design value	Operating value
pH	8-10	10

I = Color interference.

[a]The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1988b.

Table 8 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #4

Constituent	Untreated K062 waste (mg/l) Sample No. 827	Untreated K062 waste (mg/l) Sample No. 802	Untreated K062 waste (mg/l) Sample No. 817	Untreated waste composite[a] (mg/l) Sample No. 829	Treated waste (wastewater) (mg/l) Sample No. 830
Arsenic	2	<1	3	<1	<1
Cadmium	<5	<5	5	<5	<0.5
Chromium (hexavalent)	1	I	I	0.6	0.042
Chromium (total)	142	7000	1700	556	0.10
Copper	42	306	425	88	0.07
Lead	<10	<10	<10	<10	<0.01
Nickel	650	2600	41000	6610	0.33
Zinc	3	<2	7	84	1.62

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a]The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1988b.

Table 9 Treatment Performance Data for K062 EPA-Collected Data

Sample Set #5

Constituent	Untreated K062 waste (mg/l) Sample No. 801	Untreated K062 waste (mg/l) Sample No. 802	Untreated K062 waste (mg/l) Sample No. 817	Untreated waste composite[a] (mg/l) Sample No. 837	Treated waste (wastewater) (mg/l) Sample No. 838
Arsenic	3	<1	3	<1	<0.1
Cadmium	<5	<5	5	<5	<0.5
Chromium (hexavalent)	I	I	I	917	0.058
Chromium (total)	1800	7000	1700	2236	0.11
Copper	865	306	425	91	0.14
Lead	<10	<10	<10	18	0.01
Nickel	3200	2600	41000	1414	0.31
Zinc	<2	<2	7	71	0.125

Design and Operating Data

	Design value	Operating value
pH	8-10	8

I = Color interference.

[a]The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1988b.

Table 10 Treatment Performance Data for K062 EPA-Collected Data

Sample Set #6

Constituent	Untreated K062 waste (mg/l) Sample No. 801	Untreated K062 waste (mg/l) Sample No. 802	Untreated waste composite[a] (mg/l) Sample No. 845	Treated waste (wastewater) (mg/l) Sample No. 846
Arsenic	3	<1	<1	<0.1
Cadmium	<5	<5	<5	<0.5
Chromium (hexavalent)	I	I	734	I
Chromium (total)	1800	7000	2548	0.10
Copper	865	306	149	0.12
Lead	<10	<10	<10	<0.01
Nickel	3200	2600	588	0.33
Zinc	<2	<2	4	0.095

Design and Operating Data

	Design value	Operating value
pH	8-10	8

I = Color interference.

[a]The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1988b.

Table 11 Treatment Performance Data for K062 EPA-Collected Data

Sample Set #7

Constituent	Untreated K062 waste (mg/l) Sample No. 801	Untreated K062 waste (mg/l) Sample No. 802	Untreated waste composite[a] (mg/l) Sample No. 853	Treated waste (wastewater) (mg/l) Sample No. 854
Arsenic	3	<1	<1	<0.1
Cadmium	<5	<5	10	<0.5
Chromium (hexavalent)	I	I	769	0.12
Chromium (total)	1800	7000	2314	0.12
Copper	865	306	72	0.16
Lead	<10	<10	108	<0.01
Nickel	3200	2600	426	0.40
Zinc	<2	<2	171	0.115

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a]The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1988b.

Table 12 Treatment Performance Data for K062 EPA-Collected Data

Sample Set #8

Constituent	Untreated K062 waste (mg/l) Sample No. 859	Untreated K062 waste (mg/l) Sample No. 801	Untreated waste composite[a] (mg/l) Sample No. 861	Treated waste (wastewater) (mg/l) Sample No. 862
Arsenic	<1	3	<1	<0.1
Cadmium	<5	<5	<5	<0.5
Chromium (hexavalent)	0.220	I	0.13	<0.01
Chromium (total)	15	1800	831	0.15
Copper	151	865	217	0.16
Lead	<10	<10	212	<0.01
Nickel	90	3200	669	0.36
Zinc	7	9	151	0.13

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a]The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1988b.

Table 13 Treatment Performance Data for K062 EPA-Collected Data

Sample Set #9

Constituent	Untreated K062 waste (mg/l) Sample No. 867	Untreated K062 waste (mg/l) Sample No. 801	Untreated K062 waste (mg/l) Sample No. 802	Untreated waste composite[a] (mg/l) Sample No. 869	Treated waste (wastewater) (mg/l) Sample No. 870
Arsenic	<0.1	3	<1	<1	<0.1
Cadmium	<0.5	<5	<5	<5	<0.5
Chromium (hexavalent)	0.079	I	I	0.07	0.041
Chromium (total)	6	1800	7000	939	0.10
Copper	5	865	306	225	0.08
Lead	<1	<10	<10	<10	<0.01
Nickel	4	3200	2600	940	0.33
Zinc	0.4	<2	<2	5	0.06

Design and Operating Data

	Design value	Operating value
pH	8-10	10

I = Color interference.

[a]The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1988b.

Table 14 Treatment Performance Data for K062 EPA-Collected Data

Sample Set #10

Constituent	Untreated K062 waste (mg/l) Sample No. 801	Untreated waste composite[a] (mg/l) Sample No. 885	Treated waste (wastewater) (mg/l) Sample No. 862
Arsenic	<3	<1	<0.10
Cadmium	<5	<5	<0.5
Chromium (hexavalent)	I	0.08	0.106
Chromium (total)	1800	395	0.12
Copper	865	191	0.14
Lead	<10	<10	<0.01
Nickel	3200	712	0.33
Zinc	<2	5	0.070

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a]The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1988b.

Table 15 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #11

Constituent	Untreated K062 waste (mg/l) Sample No. 801	Untreated K062 waste (mg/l) Sample No. 859	Untreated waste composite[a] (mg/l) Sample No. 893	Treated waste (wastewater) (mg/l) Sample No. 894
Arsenic	3	<1	<1	<0.10
Cadmium	<5	<5	23	<5
Chromium (hexavalent)	I	0.220	0.30	<0.01
Chromium (total)	1800	15	617	0.18
Copper	865	151	137	0.24
Lead	<10	<10	136	<0.01
Nickel	3200	90	382	0.39
Zinc	<2	7	135	0.100

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a]The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1988b.

Table 16 Treatment Performance Data for D008 Wastewater

Sample set no.	Influent concentration (mg/l)	Effluent concentration (mg/l)[1]
1	66.7	0.17
2	91.7	0.25
3	83.3	0.25
4	276.0	0.33
5	50.0	0.17
6	50.0	0.25
7	58.3	0.33
8	58.3	0.33
9	134.0	0.33
10	200.0	0.25
11	100.0	0.33
12	116.0	0.25
13	91.7	0.33
14	100.0	0.42
15	116.0	0.33

[1] Recovery data 115 percent and 112 percent. Analytical recovery data show two recovery values, 115 & 112 percent. Because both values exceeded 100%, the effluent data were not corrected to lower values, but are considered at the uncorrected level. (See Methodology Document - May 89).

Source: Tischler/Kocurek (LD12-00027)

Table 17 Design and Operating Data for D008 Wastewater Treatment Performance Data

Sample set no.	TSS (mg/l)	Flow (GPM)	pH[1]	pH[2]
1	<4	1300	8.9	8.8
2	<4	1285	9.2	9.2
3	<4	1291	9.2	9.3
4	<4	1274	9.0	9.2
5	<4	1296	9.1	9.2
6	<4	1285	8.8	8.8
7	<4	1305	9.1	9.2
8	<4	1295	9.2	9.3
9	<4	1285	9.1	9.2
10	<4	1290	9.2	9.2
11	<4	1250	8.7	8.5
12	<4	1250	8.6	8.6
13	4	1300	8.8	8.8
14	5	1262	9.2	9.1
15	6	1307	9.4	9.2

<u>Chemical addition</u>:

Cationic polymer 1.5 ppm
Anionic polymer 0.5 ppm
16 percent high magnesium lime 4.26 GPM

[1] pH of recycle to clarifier.
[2] pH in clarifier.

Source: Tischler/Kocurek (LD12-00027)

Table 18 Treatment Performance Data for Stabilization of F006 Nonwastewater[a]

Source	Mix ratio[b]	Metal concentrations (ppm)							
		Barium	Cadmium	Chromium	Copper	Lead	Nickel	Silver	Zinc
Unknown									
Unstabilized									
As received	-	-	-	-	-	-	435	-	1560
TCLP	-	-	-	-	-	-	0.71	-	0.16
Stabilized									
TCLP	0.2	-	-	-	-	-	0.05	-	0.03
Auto part manufacturing									
Unstabilized									
As received	-	-	31.3	755	7030	409	989	6.62	4020
TCLP	-	-	2.21	0.76	638	10.7	22.7	0.14	219
Stabilized									
TCLP	0.5	-	0.01	0.45	0.27	0.39	0.03	0.06	0.01
Aircraft overhauling									
Unstabilized									
As received	-	85.5	67.3	716	-	-	259	-	631
TCLP	-	1.41	1.13	0.43	-	-	1.1	-	5.41
Stabilized									
TCLP	0.2	0.34	0.06	0.09	-	-	0.27	-	0.03
Zinc plating									
Unstabilized									
As received	-	17.2	1.30	-	1510	-	37	9.05	90,200
TCLP	-	0.84	0.22	-	4.6	-	0.52	0.16	2050
Stabilized									
TCLP	0.5	0.25	0.01	-	0.21	-	0.02	0.05	0.04
Unknown									
Unstabilized									
As received	-	14.3	720	12,200	160	-	701	-	25,900
TCLP	-	0.38	23.6	25.3	1.14	-	9.78	-	867
Stabilized									
TCLP	0.5	0.21	0.01	0.44	0.31	-	0.04	-	0.03

Table 18 (continued)

Source	Mix ratio[a]	Metal concentrations (ppm)							
		Barium	Cadmium	Chromium	Copper	Lead	Nickel	Silver	Zinc
Small engine manufacturing									
Unstabilized									
As received	-	-	7.28	3100	1220	113	19,400	4.08	27,800
TCLP	-	-	0.3	38.7	31.7	3.37	730	0.12	1200
Stabilized									
TCLP	0.5	-	0.01	0.89	0.31	0.39	0.06	0.06	0.040
Circuit board manufacturing									
Unstabilized									
As received	-	-	5.39	42,900	10,600	156	13,000	-	120
TCLP	-	-	0.60	360	8.69	1.0	152	-	0.62
Stabilized									
TCLP	0.5	-	0.01	1.41	0.45	0.41	0.11	-	0.020
Unknown									
Unstabilized									
As received	-	15.3	5.81	-	17,600	169	23,700	8.11	15,700
TCLP	-	0.53	0.18	-	483	4.22	644	0.31	650
Stabilized									
TCLP	0.5	0.294	0.01	-	0.35	0.40	0.04	0.06	0.020
Unknown									
Unstabilized									
As received	-	19.2	-	-	27,400	24,500	5,730	-	322
TCLP	-	0.28	-	-	16.9	50.2	16.1	-	1.29
Stabilized									
TCLP	0.5	0.087	-	-	0.50	0.29	<0.02	-	<0.01

[a]Adjusted analytical results (referred to as accuracy-corrected concentrations) used for comparing the performance of one technology to that of another and for calculating treatment standards for those constituents to be regulated.

[b] $\text{Mix ratio} = \frac{\text{weight of reagent}}{\text{weight of waste}}$

Source: USEPA 1988a.

Table 19 Summary of Treatment Performance Data for Stabilization of K061 Nonwastewater Using a Lime/Flyash Binder (EPA Collected Data)

Constituents	Untreated waste Total (ppm)	Untreated waste TCLP (mg/l)	Treated waste TCLP (mg/l)
Antimony	294	0.040	<0.050
Arsenic	36	<0.010	<0.010
Barium	238	0.733	0.431 - 0.500
Beryllium	0.15	<0.001	<0.001
Cadmium	481	12.8	0.033 - 0.073
Chromium	1,370	<0.007	0.053 - 0.093
Copper	2,240	0.066	<0.004 - 0.015
Lead	20,300	45.1	0.066 - 0.150
Mercury	3.8	0.0026	0.0016 - 0.0018
Nickel	243	0.027	<0.012
Selenium	<5.0	<0.050	<0.025
Silver	59	0.021	<0.003
Thallium	<1.0	0.038	0.011 - 0.014
Vanadium	25	<0.006	0.080 - 0.089
Zinc	244,000	445	0.179 - 0.592
Oil and grease	282		
Sulfates	8,440		
Chlorides	19,300		
TOC	4,430		

Source: USEPA 1988c.

Treatment performance data are not available for the Calcium Sulfate Subcategory of K069 nonwastewaters specifically. However, performance data are available from stabilization tests on F006 and K061 nonwastewaters and can be used for treatment of K069 nonwastewater because both F006 and K061 nonwastewater contain similar metal constituents in higher concentrations than do K069 nonwastewaters.

A. Wastewaters. Based on the comparison of metal concentrations in the untreated wastes (i.e., as high as 13 mg/l of cadmium (Table 5) and 212 mg/l lead (Table 12) in untreated K062 wastewaters compared to as high as 1.62 mg/l cadmium (Table 1), and 76 mg/l lead (Table 3) in untreated K069 waste), the Agency has determined that K062 wastewaters are more difficult to treat than K069 wastewater for cadmium.

Available treatment performance data presented in Tables 5 through 15 for treatment of K062 wastewaters by chromium reduction, chemical precipitation, and filtration show that this treatment is effective. Cadmium was reduced from as high as 13 mg/l to <0.5 mg/l; and lead was reduced from as high as 212 mg/l to <0.01 mg/l. These data collected from this treatment train for K062 wastewaters were obtained from a well-designed and well-operated system and therefore can be used to compare treatment performance of demonstrated technologies. Based on the evaluation of the available treatment performance data and other information, the Agency believes that the treatment train consisting of hexavalent chromium reduction, chemical precipitation and settling, and/or filtration represents BDAT for cadmium in K069 wastewaters.

Even though K062 data could be used to evaluate treatment of lead in K069 wastewaters, the treatment data for K062 wastewaters, however, were not used because during the Third Third comment period, EPA received D008 (lead) wastewater data (Tischler/Kocurek-LD12-00027) showing higher lead concentration in untreated D008 waste than in both K062 and K069. These data are shown on Table 16. D008 treatment data (15 data sets) showed treatment was possible to 0.17-0.42 mg/l for lead. Since D008 wastewater data have higher untreated lead concentration than both K069 and K062 wastewaters (i.e., D008 should be more difficult to treat than either K062 or K069), EPA is using these data to calculate the treatment standard for lead (See Table 21). The D008 data were collected from a well-designed and well-operated treatment system consisting of chemical precipitation, flocculation, clarification, filtration, and sludge thickening. Also submitted for D008 treatment were effluent values without the corresponding untreated data. These data could not be used in EPA's evaluation of the treatment system. However, they are presented in Appendix A.

The Agency believes that the D008 wastewater treatment data for chemical precipitation, flocculation, clarification, filtration, and sludge thickening represents BDAT for lead in K069 wastewaters. The treatment performance data demonstrate substantial reduction of the concentration of lead in wastewaters, from levels as high as 276 mg/l to as low as 0.17 mg/l (see Table 16). Therefore, the Agency is transferring the D008 wastewater treatment performance data for lead to K069 wastewaters, with the above-mentioned treatment train representing BDAT for lead in K069 wastewaters.

For cadmium, in K069 wastewater the treatment standard is based on the performance of chemical precipitation for K062 wastewaters. For lead, in K069 wastewaters the treatment standard is also based on the performance of chemical precipitation, but in D008 wastewaters. As noted above, the Agency believes that D008 wastewaters better represent lead treatment in K069 wastewaters. Since both the K062 and D008 treatment trains use the same technology (i.e., chemical precipitation) as a method of removing metals from wastewater, EPA believes that the use of K062 wastewater data for cadmium regulation in K069 wastewater is compatible with the use of D008 wastewater data for lead regulation in K069 wastewater.

Based on the evaluation of the available treatment performance data and other information, the Agency has determined that the treatment train consisting of hexavalent chromium reduction, chemical precipitation, filtration, clarification and sludge dewatering is BDAT for K069 wastewaters for treating both cadmium and lead.

B. **Nonwastewaters**. EPA compared the F006 and K061 wastes to determine which would be more representative of K069 nonwastewaters in the Calcium Sulfate Subcategory. Included in this analysis were waste parameters that affect the stabilization treatment such as concentrations of metals, sulfide levels, and waste generation information. In general, both K061 nonwastewaters and F006 nonwastewaters contain similar metal constituents in higher concentrations than do K069 nonwastewaters. The sulfate levels in both K061 and F006 are insignificant compared to the high sulfate level in K069. The industrial process by which the K061 nonwastewater sludge is generated more closely resembles the process that generates the K069 nonwastewater (both are emission control dust sludges). Based on this analysis, EPA considers the K061 nonwastewaters more representative than F006 nonwastewaters of K069 nonwastewaters in the Calcium Sulfate Subcategory.

The data on generation of the K069 wastes in the Calcium Sulfate Subcategory indicate that during the generation of this waste, excess lime is added to the K069 as it is being generated. This excess lime is expected to act as a stabilizing agent, with the resulting waste exhibiting a lower leachability than would be expected from a waste that was generated without the addition of excess lime. Conversely, characterization data of this waste indicate a high level of sulfates in the waste, which affects treatment performance of some solidification processes. Regardless of the high level of sulfates, the Agency believes that substantial treatment levels is achievable simply by the current practice of addition of excess lime during generation. Therefore, EPA believes that the data on stabilization of K061 can be used to establish treatment performance standards for K069 nonwastewaters in the Calcium Sulfate Subcategory.

Available treatment performance data presented in Table 19 for stabilization of K061 nonwastewater using a lime/flyash binder show that this treatment is effective. Stabilization technology adopted as BDAT for the Low Zinc Subcategory of K061 nonwastewater was able to produce TCLP leachate levels of 0.066 to 0.150 mg/l lead and 0.033 to 0.073 mg/l cadmium from a K061 nonwastewater containing 20,300 ppm lead and 481 ppm cadmium. Based on this analysis and other data and information explained in the K061 Background Document (USEPA 1988a), the Agency maintains that stabilization using a lime/flyash binder represents BDAT for K069 nonwastewaters in the Calcium Sulfate Subcategory.

SELECTION OF REGULATED CONSTITUENTS

A. **Wastewaters.** The BDAT list metals found in treatable concentrations in the untreated K069 wastewater (see Table 1) are lead and cadmium. Arsenic was also present in low concentrations, but is expected to be treated and controlled along with the lead and cadmium. Based on these findings, the regulated constituents for which EPA is promulgating standards are lead and cadmium.

B. **Nonwastewaters.** Leachate data for K069 nonwastewaters in the Calcium Sulfate Subcategory (see Table 2) show that lead and cadmium are present at treatable concentrations, and that while other metal constituents are present at lower concentrations. The Agency does not expect the presence of other BDAT metals at treatable levels. Furthermore, other BDAT list metal constituents that are not regulated are expected to be treated by a well-designed and well-operated treatment system. Based on these findings, the regulated constituents are lead and cadmium.

CALCULATION OF BDAT TREATMENT STANDARDS

This section presents the treatment standards for the regulated constituents described previously. A description of the rationale and procedures for calculating treatment standards is presented in the K062 wastewater background document (1988b) and K061 nonwastewater background document (1988a) and D008 (Final Background Document (USEPA, 1990). The BDAT treatment standards presented in this section (1) are reflective of treatment performance data from a well-designed and well-operated treatment system, (2) account for analytical limitations, and (3) have been adjusted for variability caused by treatment, sampling, and analytical techniques and procedures.

A. Wastewaters. Treatment Standards for Cadmium: EPA compared the K062 wastewaters with the K069 waste stream shown in Table 1 with regard to concentrations of metals. In general, both K069 wastewaters and K062 wastewaters contain similar metal constituents, but cadmium in K062 wastewaters had higher concentrations than cadmium in K069 wastewaters. Therefore, for cadmium, EPA would expect that the K062 wastewaters would be more difficult to treat effectively by the selected BDAT treatment system consisting of chemical precipitation, settling, and/or filtration.

Based on the available data relative to waste characteristics, the Agency has no reason to believe that for cadmium the treatment levels achieved for K062 wastewaters cannot be achieved for K069 wastewaters

Accordingly, EPA is using these performance data for chemical precipitation, and settling and/or filtration to establish treatment standards for cadmium in K069 wastewaters. Therefore, the Agency is transferring the treatment performance data from this treatment train for cadmium in K062 wastewaters to K069 wastewaters.

The 11 data sets for treatment of K062 wastewaters by chemical precipitation and dewatering of the precipitate were determined to represent treatment by a well-designed and well-operated treatment system (USEPA 1988b). One data set for cadmium was deleted (Sample Set #11) because of an artificially high detection limit of 5 mg/l for cadmium, deviating from the other 10 data points, which had detection limits of 0.5 mg/l.

Treatment Standards for Lead: The 15 data sets for treatment of lead in D008 wastewaters by chemical precipitation, flocculation, clarification, filtration, and sludge thickening were determined to represent treatment by a well-designed and well-operated system. (See Table 16 and 17). The 15 effluent treatment points for lead were corrected for analytical recovery by multiplying the data by the appropriate correction factor. The correction factor was calculated from the recovery data submitted with the data for the treatment tests (Tischler/Kocurek, 1989). Both of the recovery figures (115 and 112 percent) were greater than 100 percent. Therefore, a correction factor of 1.00 is used and the corrected values equal the original data values (see Methodology Document, May 89). The corrected values for the two regulated constituents in the K069 wastewaters are presented in Table 20.

An arithmetic average of accuracy-corrected concentration levels for each regulated constituent and a variability factor for each regulated constituent were then calculated. The treatment standard for each regulated constituent was calculated by multiplying the average accuracy-corrected data by the appropriate variability factor. The calculation of the treatment standards for K069 wastewaters is presented in Table 21.

Table 22 presents the specific BDAT treatment standards for K069 wastewater. For the BDAT list metal constituents, treatment standards in the wastewater reflect the total constituent concentration. The units for the total constituent concentration are mg/l (parts per million on a weight-by-volume basis) for the wastewater. If the concentrations of the regulated constituents in the K069, as generated, are lower than or equal to those of the BDAT treatment standards, then treatment is not necessary as a prerequisite to land disposal.

B. **Nonwastewaters**. Specifically, EPA believes that the data on stabilization of K061 waste can be used to assess treatment performance for cadmium and lead in K069 nonwastewaters.

The Agency considered the K069 treatment sludge data submitted to the Agency in response to the Third Third Proposed Rule. No treated (stabilized) data was provided to the Agency for evaluation. The K069 treatment sludge data submitted to the Agency lacked EPA's protocol for proper evaluation, i.e., lacked paired influent (untreated) effluent (treated) data to determine treatability and therefore, the data was not used in the development of treated standards for K069 nonwastewaters.

Congress has mandated Land Ban Restriction standards be based on BDAT for treatment of waste. Since the BDAT technologies can significantly reduce the lead and cadmium levels, lead and cadmium treatment standards will be developed.

Since the process by which the K069 nonwastewater sludge is generated closely resembles the process that generates the K061 nonwastewater (both are emission control dust/sludges), the Agency has no reason to believe that the treatment levels achieved for cadmium and lead in K061 cannot also be achieved for K069. Accordingly, EPA is using K061 performance data to establish treatment standards for cadmium and lead in the Calcium Sulfate Subcategory of K069 nonwastewaters.

The data presented for stabilization of K061 nonwastewaters (see Table 19) have been evaluated by EPA to ensure that any data representing poor design and poor operation were deleted and that all data were adjusted for analytical accuracy. As a result, the data for K061 stabilization were determined to represent treatment by a well-designed and well-operated treatment system.

Table 23 presents the specific BDAT treatment standards for K069 nonwastewater. For the BDAT list metal constituents, treatment standards in nonwastewater reflect the concentration of constituents in the leachate from the Toxicity Characteristic Leaching Procedure (TCLP). The units for the leachate concentration are mg/l (parts per million on a weight-by-volume basis). If the concentrations of the regulated constituents in the K069, as determined in the leachate analytical process, are lower than or equal to the concentration required in the BDAT treatment standards, then treatment is not a prerequisite to land disposal.

Table 20 Calculation of Corrected Values for Regulated Constituents for Treated Wastewater

Constituent	Treated waste[d] (mg/l)	Percent recovery	Correction factor	Corrected value (mg/l)
Cadmium	<0.5	87[a]	1.15	<0.575
	<0.5			<0.575
	<0.5			<0.575
	<0.5			<0.575
	<0.5			<0.575
	<0.5			<0.575
	<0.5			<0.575
	<0.5			<0.575
	<0.5			<0.575
	<0.5			<0.575
Lead	0.17	115[b]	1.00[c]	0.17
	0.25			0.25
	0.25			0.25
	0.33			0.33
	0.17			0.17
	0.25			0.25
	0.33			0.33
	0.33			0.33
	0.33			0.33
	0.25			0.25
	0.33			0.33
	0.25			0.25
	0.33			0.33
	0.42			0.42
	0.33			0.33

[a] The percent recovery has been taken from Table 7-14 of the Onsite Engineering Report for Horsehead Resource Development Co., Inc. for K061 (USEPA 1987).

[b] The percent recovery for lead is from the D008 data submitted by Tischler/Kocurek (LD12-00027).

[c] For recoveries greater than 100, a correction factor of 1.00 is used and the corrected values equal the uncorrected data.

[d] Data for cadmium from USEPA 1988b. Data for lead from Tischler/Kocurek LD12-00027.

Table 21 Calculation of the Treatment Standards for the Regulated Constituents - Treated Wastewater

Regulated constituent	Conc.	Mean	VF	Treatment standard total concentration (mg/l)
Cadmium	<0.575	0.575	2.8[a]	1.61
	<0.575			
	<0.575			
	<0.575			
	<0.575			
	<0.575			
	<0.575			
	<0.575			
	<0.575			
	<0.575			
Lead	0.17	0.288	1.76	0.51
	0.25			
	0.25			
	0.33			
	0.17			
	0.25			
	0.33			
	0.33			
	0.33			
	0.25			
	0.33			
	0.25			
	0.33			
	0.42			
	0.33			

[a] For cases in which all values are at or below the detection limit, the variability factor is taken as 2.8.

Table 22 BDAT Treatment Standards for K069 Wastes
(Wastewaters)

Regulated constituent	Maximum for any Single grab sample Total composition (mg/l)
Cadmium	1.61
Lead	0.51

Table 23 BDAT Treatment Standards for K069
Calcium Sulfate Subcategory
(Nonwastewaters)

Regulated constituent	Maximum for any Single grab sample TCLP (mg/l)
Cadmium	0.14
Lead	0.24

Table 24 BDAT Treatment Standards for K069
Non-Calcium Subcategory
(Nonwastewaters)
(Revised From No Land Disposal)

RECYCLING (LEAD) AS A METHOD OF TREATMENT

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APPENDIX A

Appendix A

Tischler/Kocurek Effluent Data

Date	Lead (mg/l)	Date	Lead (mg/l)
11/88	2.0	6/89	0.4
	0.1		0.3
	0.3		0.4
	0.1		0.4
	0.1		
		7/89	0.2
12/88	0.2		<0.001
	0.2		
1/89	0.3	8/89	0.2
	0.7		0.2
	0.2		0.6
	0.2		0.4
	0.4		
		9/89	0.3
2/89	0.4		0.4
	0.4		0.4
	0.2		
		10/89	0.3
	0.6		0.4
	0.3		0.2
	0.4		0.4
			0.2
4/89	0.2		
	0.3	11/89	0.1
	0.3		0.2
	0.3		0.2
5/89	0.3		
	0.2		
	0.1		
	0.4		
	0.3		

Reference: Tischler/Kocurek (LD12-00027)