FINAL
BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT) BACKGROUND DOCUMENT FOR

K061 (ADDENDUM)

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1. INTRODUCTION AND SUMMARY

This background document presents the technical support and rationale for the promulgation of treatment standards for K061 wastewaters. Treatment standards for nonwastewater forms of K061 were promulgated in the First Third final rule (53 FR 31138, August 17, 1988). This background document is issued as an addendum to the August 1988 background document for K061 (USEPA 1988a), which accompanied the rulemaking for nonwastewater forms of K061. Treatment standards for wastewater forms of K061 were not promulgated as part of the First Third rulemaking in order to allow the Agency time for additional data collection and analysis. Information contained in the August 1988 background document is not repeated in this document.

In the Third Third proposed rule, the Agency proposed to amend the existing treatment standard for the high zinc subcategory of K061 nonwastewater to be "resmelting in a high temperature zinc metal recovery furnace." The Agency has decided not to amend the existing description of the treatment standard of "no land disposal based on high temperature metals recovery as a method of treatment." In addition, the Agency is extending the duration of the existing, interim treatment standards for another year. Further discussion of the rationale for the treatment standard for the high zinc subcategory of K061 nonwastewaters and extending the interim treatment standards is not provided here, but can be found in the preamble to the Third Third final rule.

This document presents information specific to the treatment of K061 wastewaters and the technologies that were evaluated in the determination of best demonstrated available technology (BDAT) for K061 wastewaters. The Agency is promulgating standards for the same four BDAT list metal constituents that are regulated in K061 nonwastewaters--cadmium,

chromium, lead, and nickel. For cadmium, chromium, and nickel, the standards are based on the transfer of treatment performance data from treatment of a similar metal-bearing wastewater (K062) using a treatment system consisting of hexavalent chromium reduction and chemical precipitation, followed by dewatering of the precipitate. For lead, the standards are based on the transfer of treatment performance data from a lead-bearing wastewater (D008) using a treatment system consisting of chemical precipitation, flocculation, clarification, filtration, and sludge thickening.

The treatment standards for K061 wastewaters are presented in Table 1-1.

Table 1-1. BDAT Treatment Standards for K061 Wastewaters

Constituent	Maximum for any single grab sample: Total concentration (mg/l)	Maximum for any single grab sample: TCLP (mg/l)
Cadmium	1.61	Not applicable
Chromium (total)	0.32	Not applicable
Lead	0.51	Not applicable
Nickel	0.44	Not applicable

2. INDUSTRY AFFECTED AND WASTE CHARACTERIZATION

2.1 Industry Affected

K061 waste is generated by the iron and steel industry and is defined as emission control dust/sludge from the primary production of steel in electric furnaces. The Agency has no new data that would change the description of the iron and steel industry contained in the August 1988 K061 background document (USEPA 1988a).

2.2 Waste Characterization

The August 1988 K061 background document contained waste characterization data for nonwastewater forms of K061. As defined by EPA, the wastewater form of K061 waste has less than 1 percent total suspended solids and less than 1 percent total organic carbon. K061 wastewaters can be generated from dewatering K061 sludges from electric furnace air pollution control scrubbers, leachates from mono-landfills, and CERCLA sites, as well as during corrective actions at RCRA facilities. Waste characterization data for wastewater forms of K061 are presented in Table 2-1 of this addendum. Three data points for untreated K061 wastewaters were collected by EPA's Office of Water for the Effluent Limitations Guidelines for the iron and steel industry (USEPA 1982). Four data points for K061 wastewaters were submitted by industry.

Table 2-1. K061 Wastewater Characterization Data

Constituent (mg/l)	Plant Identification						
	051[a]	052[a]	059A[a]	CBI[b]	CBI[b]	CBI[b]	CSC[c]
Antimony	0.67	-	-	-	-	-	-
Arsenic	1.23	-	-	0.014	0.021	0.006	<0.5
Barium	-	-	-	0.16	0.22	0.30	0.10
Cadmium	3.33	-	-	<0.16	<0.01	0.01	<0.03
Chromium	4.30	-	-	2.10	1.55	0.24	<0.05
Copper	1.33	-	-	-	-	-	-
Lead	23.3	-	-	9.82	86	17.8	23.7
Mercury	-	-	-	0.003	<0.09	0.002	<0.002
Nickel	0.043	-	-	-	-	-	-
Selenium	-	-	-	0.2	0.08	0.040	<0.5
Silver	0.063	-	-	0.06	0.03	<0.01	<0.05
Zinc	100	27	190	1.48	2.33	ND	-
pH	7.1-7.2	8.4-9.6	6.6-7.5	12.03	12.38	-	12.1
Suspended Solids (mg/l)	2843	883	6308	-	-	-	-

- = No data reported.
ND = Not detected.

[a] USEPA 1982.

[b] Industry-submitted data, generator is CBI.

[c] Industry-submitted data (Chaparral Steel Co./Steel Manufacturers Assoc. - LD12-00274).

3. APPLICABLE AND DEMONSTRATED TREATMENT TECHNOLOGIES

For K061 wastewaters, the Agency believes that the applicable treatment technologies include chemical precipitation, followed by settling, filtration, and dewatering of solids. The Agency has identified these treatment technologies because they are designed to reduce the concentration of metals in wastewaters. Other applicable technologies include physical treatment methods that remove suspended solids from wastewaters. These include clarification, flocculation, vacuum filtration, sludge thickening, and other similar technologies. In addition, available waste characterization data on K061 wastes indicate that hexavalent chromium may be present in K061 wastewaters (Lehigh University 1982). Chromium reduction may be needed to convert hexavalent chromium to trivalent chromium prior to metals precipitation.

All of the applicable treatment technologies are also demonstrated because they are used on a full-scale commercial basis for treatment of metal-bearing wastewaters. Hexavalent chromium reduction and 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. Regarding treatment of precipitated solids (K061 nonwastewaters), the Agency has previously promulgated treatment standards in the First Third final rule (USEPA 1988a).

4. PERFORMANCE DATA

The Agency has three data sets for treatment of K061 wastewaters collected by EPA's Office of Water, Effluent Guidelines Division (USEPA 1982). The three data sets were collected from different facilities treating K061 wastewaters by physical treatment methods. The treatment technologies consisted of clarification, thickening, and vacuum filtration (Plant 051); clarification, flocculation, lime neutralization, and vacuum filtration (Plant 052); and clarification and vacuum filtration (Plant 059A). These three treatment performance data sets for K061 wastewaters are presented in Tables 4-1 through 4-3 at the end of this section.

Also available are treatment performance data for metal-bearing wastewaters similar to K061 wastewaters. Specifically, the Agency has six data points for wastewaters from the emission control scrubber of an electric arc furnace. These data are from the treatment system consisting of clarification and vacuum dewatering of solids. They are presented in Table 4-4.

The Agency also has 11 data sets for treatment of metal-bearing wastewaters by hexavalent chromium reduction, chemical precipitation, and dewatering of the precipitate (USEPA 1986a). 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). These data are presented in Tables 4-5 through 4-15.

The Agency believes that the K062 data can be used to assess the performance of these technologies for K061 wastewaters. EPA compared the K062 wastewaters and K061 wastewaters with regard to characteristics that affect treatment performance. Included in this analysis were

concentrations of metals, oil and grease, and organic constituents. Of these characteristics, only metals concentration data were available for both wastes. The K062 wastewater composite, however, was very well characterized prior to treatment by hexavalent chromium reduction, chemical precipitation, and dewatering of the precipitate. Available data include concentrations of metals, organics, and oil and grease. These data show high levels of metals, suspended solids, dissolved solids, and measurable concentrations of oil and grease. In general, K061 wastewaters and K062 wastewaters contain similar metal constituents, but K062 has several BDAT list metals at higher concentrations. Also included in this analysis was consideration of (1) the effect on treatment performance of pH of the untreated wastewaters and (2) the settling characteristics of the precipitated solids. Available K061 wastewater characterization data generally show high pH levels, although different sources of K061 wastewaters are likely to have different pHs. The Agency believes that the addition of precipitating and other reagents can readily alter the pH of wastewaters for effective treatment by these technologies (Patterson 1985).

Also considered in the comparison of the treatability of K061 and K062 wastewaters were the settling characteristics of the precipitates. Specifically, the precipitate from the K062 treatment system is primarily a hydroxide while data on K061 indicate that the precipitated solids will be primarily in the oxide form. The Agency believes that differences in the settling characteristics of these two materials may exist. A well-designed and well-operated treatment system, however, should achieve similar or better performance on K061 solids than on K062 solids. Furthermore, the addition of flocculating/coagulating agents and the use of filtration may improve treatment of K061 wastewaters (Patterson 1985).

Based on information collected from the Generator survey (USEPA 1986b), K061 wastewaters generally have low concentrations of dissolved metals (i.e., less than 100 ppm), while K062 wastewaters generally

contain concentrations of dissolved metals as high as 5,000 ppm. For example, the Agency has waste characterization data showing that chromium is present in the untreated K062 wastewater composite at concentrations as high as 2,581 mg/l and in K061 wastewaters as high as 4.3 mg/l; cadmium is present in the K062 wastewater composite at concentrations as high as 23 mg/l and in K061 wastewaters as high as 3.33 mg/l; and nickel is present in the untreated K062 wastewater composite as high as 16,330 mg/l and in K061 wastewaters as high as 0.043 mg/l. EPA would therefore expect that the K062 wastewaters would be more difficult to treat effectively using the treatment system consisting of hexavalent chromium reduction, chemical precipitation, and dewatering of the precipitate. Accordingly, EPA is using these performance data for hexavalent chromium reduction, chemical precipitation, and dewatering of the precipitate to establish treatment standards for cadmium, chromium, and nickel in K061 wastewaters.

The Agency has data indicating that K061 wastewaters 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 identified two comments to the Third Third proposed rule containing lead (D008) wastewater treatment data including (1) data from the battery manufacturing/secondary smelter industries and (2) data from the foundry industry. The data submitted by the Battery Council International (LD12-00035/LD12-L0041) were evaluated and found to be insufficient for use in developing treatment standards for lead in K061 wastewaters (see Response to Comments Document for D008). The Agency evaluated the 15 data sets for treatment of D008 (lead) wastewaters from the foundry industry (Tischler/Kocurek - LD12-00027). 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. These treatment performance data are presented in Tables 4-16 and 4-17.

The Agency believes that these D008 wastewater treatment can be used to assess the performance of these technologies for lead in K061 wastewaters. EPA evaluated the D008 data with respect to characteristics that affect treatment performance. Specifically, the D008 wastewaters were determined to be similar to K061 wastewaters with respect to the concentration of lead. In fact, the D008 wastewaters had higher untreated lead concentrations than K061 wastewaters (50-276 mg/l compared to 9.82-86 mg/l), and could be substantially reduced by the treatment system consisting of chemical precipitation, flocculation, clarification, filtration, and sludge thickening. Therefore, the Agency would expect that these D008 wastewaters would be more difficult to treat effectively using that treatment system. The Agency believes that these two wastes would have similar characteristics because both are generated as an emission control dust/sludge from high temperature steel making/foundry operations. The Agency also believes that this D008 treatment system will achieve similar reductions in concentrations of metals in addition to lead. Accordingly, EPA is using these data to establish the treatment standard for lead in K061 wastewaters.

Table 4-1. Treatment Performance Data for K061 Wastewater by Clarification, Thickening, and Vacuum Filtration

Constituent	Untreated (mg/l)	Treated (mg/l)
Antimony	0.67	0.005
Arsenic	1.23	0.011
Cadmium	3.33	1.5
Chromium	4.30	0.55
Copper	1.33	0.080
Lead	23.3	1.5
Nickel	0.043	0
Silver	0.063	0
Zinc	100	31
pH	7.1-7.2	7.6
Suspended Solids	2843	86

Source: Plant 051-USEPA 1982.

Table 4-2. Treatment Performance Data for K061 Wastewater by Clarification, Flocculation, Lime Neutralization, and Vacuum Filtration

Constituent	Untreated (mg/l)	Treated (mg/l)
Antimony	-	-
Arsenic	-	-
Cadmium	-	-
Chromium	-	-
Copper	-	-
Lead	-	-
Nickel	-	-
Silver	-	-
Zinc	27	4.4
pH	8.4-9.6	8.5-9.5
Suspended Solids	883	15

- = Data not reported.
Source: Plant 052-USEPA 1982.

Table 4-3. Treatment Performance Data for K061 Wastewater by Clarification and Vacuum Filtration

Constituent	Untreated (mg/l)	Treated (mg/l)
Antimony	-	-
Arsenic	-	-
Cadmium	-	-
Chromium	-	-
Copper	-	-
Lead	-	-
Nickel	-	-
Silver	-	-
Zinc	190	38
pH	6.6-7.5	7.1-7.9
Suspended Solids	6308	38

- = Data not reported.
Source: Plant 059A-USEPA 1982.

Table 4-4. Treatment Performance Data for Wastewater from Electric Arc Furnace Emission Control Scrubber (Lone Star Steel) (Treated Effluent)[a]

Sample No.	Cadmium	Chromium	Lead	Nickel	pH
1	0.04	0.40	2.6	0.05	9.1
2	0.05	0.51	2.6	0.05	9.7
3	0.07	0.50	3.0	0.05	9.7
4	0.18	0.23	1.8	<0.03	8.7
5	0.03	0.28	2.6	<0.03	9.7
6	0.06	0.04	2.9	<0.03	10.0

[a] Treated effluent from treatment system consisting of clarification and vacuum dewatering of solids.

Source: Lone Star Steel (LD 12-L0044).

Table 4-5 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 and other non-K062 waste streams.

Source: USEPA 1988b.

Table 4-6 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 and other non-K062 waste streams.

Source: USEPA 1988b.

Table 4-7 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 and other non-K062 waste streams.

Source: USEPA 1988b.

Table 4-8 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 and other non-K062 waste streams.

Source: USEPA 1988b.

Table 4-9 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 and other non-K062 waste streams.

Source: USEPA 1988b.

Table 4-10 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 and other non-K062 waste streams.

Source: USEPA 1988b.

Table 4-11 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 and other non-K062 waste streams.

Source: USEPA 1988b.

Table 4-12 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 and other non-K062 waste streams.

Source: USEPA 1988b.

Table 4-13 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 and other non-K062 waste streams.

Source: USEPA 1988b.

Table 4-14 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 and other non-K062 waste streams.

Source: USEPA 1988b.

Table 4-15 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 and other non-K062 waste streams.

Source: USEPA 1988b.

Table 4-16 Treatment Performance Data for D008 (EP Toxic for Lead) Wastewater

Sample set no.	Influent concentration (mg/l)	Effluent concentration (mg/l)[a]
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

[a] Recovery data 115 percent and 112 percent.

Source: Tischler/Kocurek (LD12-00027).

Table 4-17 Design and Operating Data for D008 Wastewater Treatment Performance Data

Sample set no.	TSS (mg/l)	Flow (GPM)	pH[a]	pH[b]
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

Chemical addition:

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

[a] pH in recycle clarifier.
[b] pH in dissolved metals clarifier.

Source: Tischler/Kocurek (LD12-00027).

5. DETERMINATION OF BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT)

This section presents the rationale for the determination of best demonstrated available technology (BDAT) for K061 wastewaters. The Agency examined all the available treatment performance data for the demonstrated technologies to determine which is best. The Agency has treatment performance data for three facilities that treat K061 wastewaters using physical separation methods. In addition, treatment performance data are available for systems treating metal-bearing wastewaters that are similar to K061 wastewaters. 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 K061 wastewaters for cadmium, chromium, and nickel. Also available are treatment performance data for D008 wastewaters that are similar to K061 wastewaters with respect to lead concentrations. Based on an evaluation of these data, the Agency has determined that for lead the D008 wastewater is more difficult to treat than K061 wastewaters.

As stated previously, the Agency has three data sets for treatment of K061 wastewaters using a physical separation treatment process. Of these three data sets, two (Plants 052 and 059A) are not usable by the BDAT program to assess the performance of the technologies because chemical analysis is provided only for zinc. Therefore, these two data sets were not used in the comparison of the technologies. The remaining data set (Plant 051) for physical treatment consisting of clarification, thickening, and vacuum filtration was compared to the other available treatment data. The six data points submitted by Lone Star Steel (LD12-L0044) were evaluated for use in determining the best demonstrated available technology for K061 wastewaters. The data submitted consist of effluent data for cadmium, chromium, lead, and nickel from a treatment

system consisting of clarification and vacuum dewatering of solids. These data were determined to be insufficient to evaluate the treatment system because only effluent data were supplied. Because of the absence of influent waste characterization data, the Agency could not evaluate properly the effectiveness of the treatment system.

Available treatment performance data presented in Tables 4-5 through 4-15 for treatment of K062 wastewaters by hexavalent chromium reduction, chemical precipitation, and dewatering of the precipitate show that treatment levels are substantial. Total chromium was reduced from 2,581 mg/l to 0.12 mg/l; cadmium from 13 mg/l to <0.5 mg/l; and nickel from 471 mg/l to 0.33 mg/l. The data collected from this treatment train for K062 waste- waters were obtained from a well-designed and well-operated system and therefore may be used to compare the treatment performance of demonstrated technologies. However, these data for K062 wastewaters were not used to evaluate treatment of lead because the Agency received K061 wastewater data that contain higher concentrations of lead than were present in the K062 wastewaters tested. Therefore, the Agency evaluated other sources of treatment data for lead-bearing wastewaters. The D008 wastewater treatment data were identified as suitable for characterizing treatment performance for lead. The D008 data were collected from a well-designed and well-operated treatment system consisting of chemical precipitation, flocculation, clarification, filtration, and sludge thickening, a system essentially identical to and certainly compatible with that used for K062 treatment. 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.

Based on the evaluation of these treatment performance data, the Agency believes that the K062 treatment system consisting of hexavalent chromium reduction, chemical precipitation, and dewatering of the precipitate represents treatment by BDAT for cadmium, chromium, and

nickel. First, the physical separation system treating K061 wastewaters was not considered to be well-designed because it is designed to remove particulates, not dissolved metals in solution, especially hexavalent chromium. Hexavalent chromium reduction and chemical precipitation steps are included in the K062 treatment train to remove metals from solution. Second, the level of treatment performance achieved by the K062 treatment train is more substantial because it reduces BDAT list metal constituents from much higher concentrations in the untreated waste to levels below those achieved by the K061 physical separation system. Therefore, the Agency is transferring the treatment performance data from this treatment train for K062 wastewaters to K061 wastewaters for cadmium, chromium, and nickel. The Agency has no evidence to suggest that any further precipitation process would significantly improve the performance. Therefore, the treatment train consisting of hexavalent chromium reduction, chemical precipitation, and dewatering of the precipitate represents BDAT for cadmium, chromium, and nickel in K061 wastewaters.

The Agency believes that the D008 wastewater treatment data for chemical precipitation, flocculation, clarification, filtration, and sludge thickening represents BDAT for lead in K061 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. Therefore, the Agency is transferring the D008 treatment performance data to lead for K061 wastewaters, with the above-mentioned treatment train representing BDAT for lead in K061 wastewaters.

6. SELECTION OF REGULATED CONSTITUENTS

The Agency presented its selection of regulated constituents for K061 nonwastewaters in Section 6 of the K061 background document (USEPA 1988a). These regulated constituents are cadmium, chromium (total), lead, and nickel.

The Agency has no data that would lead it to believe that other constituents may warrant regulation for K061 wastewaters. An evaluation of the available waste characterization data for K061 wastewaters and nonwastewaters (USEPA 1988a) indicates that cadmium, chromium, lead, and nickel are present in the waste at the highest concentrations with the exception of zinc.* Although available waste characteristic data for K061 wastewaters, presented in Table 2-1, show low concentrations of nickel, the Agency would expect concentrations of nickel to be significant in wastes from specialty and stainless steel production. For this reason, nickel has been included as a regulated constituent for both nonwastewater and wastewater forms of K061. Other BDAT list metal constituents that may be present are not regulated since they are also expected to be treated by a well-designed and well-operated treatment system. Analytical methods to determine the concentration of BDAT list metal constituents in K061 wastewaters can be found in USEPA 1986c.

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* Zinc is no longer a BDAT list metal. It appears in 40 CFR 261 Appendix VIII only as the cyanide compound zinc cyanide, which is listed because of its cyanide, not its zinc content.

7. CALCULATION OF BDAT TREATMENT STANDARDS

This section presents the calculation of treatment standards for the regulated constituents described in Section 6. The BDAT treatment standards for K061 wastewaters (1) reflect treatment performance data from a well-designed and well-operated treatment system, (2) account for analytical limitations, and (3) have been adjusted for variability resulting from treatment, sampling, and analytical techniques and procedures.

The 11 data sets for treatment of K062 wastewaters by hexavalent chromium reduction, 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 (Sample Set #11) for cadmium was deleted because of an artificially high detection limit of 5 ppm, which deviated from the other 10 data points having detection limits of 0.5. The remaining analytical data sets for this treatment system (for cadmium, chromium, and nickel) were corrected for analytical recovery by multiplying the data by their respective correction factors.

The correction factors were obtained by dividing 100 by the corresponding percent recovery of the regulated constituents. The percent recovery values for the regulated constituents were transferred from the Onsite Engineering Report for Horsehead Resource Development Co., Inc. for K061 (USEPA 1987), since recovery values were not available for the treatment data on K062. An expanded description of the rationale for this transfer of recovery data is presented in the K062 nonwastewater background document (USEPA 1988b). The matrix spike recovery data used for these data are presented in Table 7-1.

The 15 data sets for treatment of D008 wastewaters by chemical precipitation, flocculation, clarification, filtration, and sludge thickening were determined to represent treatment by a well-designed and well-operated system. 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. The corrected values for all four regulated constitutents in the K061 wastewaters are presented in Table 7-2.

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 K061 wastewaters is presented in Table 7-3.

Table 7-4 presents the treatment standards for K061 wastewaters.

Table 7-1 Matrix Spike Recovery of TCLP Extract of Treated K061 Waste and Accuracy Correction Factors for High Temperature Metals Recovery

		Sample				Sample duplicate	
BDAT constituent	Original sample (μg/l	Spike added (μg/l	Spike result (μg/l)	Percent recovery[a]	Spike result (μg/l)	Percent recovery[a]	Correction factor
Cadmium	4.2	25	26	87	27	91	1.15
Chromium	<4.0	50	35	70	34	68	1.47
Nickel	203	1,000	1,140	94	1,128	93	1.08

[a] Percent Recovery = [(Spike Result - Original Amount)/Spike Added] x 100.

Source: USEPA 1987.

Table 7-2 Calculation of Corrected Values for Regulated Constituents for Treated Wastewater

Constituent	Treated waste (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
Chromium (total)	0.12	68[a]	1.47	0.1764
	0.12			0.1764
	0.20			0.294
	0.10			0.147
	0.11			0.162
	0.10			0.147
	0.12			0.1764
	0.15			0.2205
	0.10			0.147
	0.12			0.1764
	0.18			0.2646
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

Table 7-2 (continued)

Constituent	Treated waste (mg/l)	Percent recovery	Correction factor	Corrected value (mg/l)
Nickel	0.33	93[a]	1.075	0.35
	0.33			0.35
	0.33			0.35
	0.33			0.35
	0.31			0.33
	0.33			0.35
	0.40			0.43
	0.36			0.39
	0.33			0.35
	0.33			0.35
	0.39			0.42

[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.

Table 7-3 Calculation of the Treatment Standards for the Regulated Constituents for 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			
Chromium (total)	0.1765	0.1898	1.69	0.32
	0.1765			
	0.2941			
	0.1471			
	0.1618			
	0.1471			
	0.1765			
	0.2206			
	0.1471			
	0.1765			
	0.2647			
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			

Table 7-3 (continued)

Regulated constituent	Conc.	Mean	VF	Treatment standard total concentration (mg/l)
Nickel	0.3548	0.3685	1.20	0.44
	0.3548			
	0.3548			
	0.3548			
	0.3333			
	0.3548			
	0.4301			
	0.3871			
	0.3548			
	0.3548			
	0.4194			

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

Table 7-4 BDAT Treatment Standards for K061 Wastewaters

Constituent	Maximum for any single grab sample Total concentration (mg/l)	TCLP (mg/l)
Cadmium	1.61	Not applicable
Chromium (total)	0.32	Not applicable
Lead	0.51	Not applicable
Nickel	0.44	Not applicable

8. REFERENCES

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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)