SODIUM PHOSPHATE LISTING BACKGROUND DOCUMENT
FOR
THE INORGANIC CHEMICAL LISTING DETERMINATION

This Document Contains No Confidential Business Information

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1. SECTOR OVERVIEW

1.1 SECTOR DEFINITION, FACILITY NAMES AND LOCATIONS

Currently two manufacturing companies at four locations in the United States produce sodium phosphate from wet process phosphoric acid. **Table 1.1** presents the name and location of these producers.[1] **Figure 1.1** shows the geographical location of facilities presented in Table 1.1. The numbers on the map correspond to the facility number in Table 1.1.

Table 1.1 Sodium Phosphate Producers

Facility Name	Facility Location
1. Rhodia Inc. - Waterway	Chicago, IL
2. Rhodia Inc. - Chicago Heights	Chicago Heights, IL
3. Solutia Inc. - Augusta	Augusta, GA
4. Solutia Inc. - Carondelet	St. Louis, MO

1.2 PRODUCTS, PRODUCT USAGE AND MARKETS

Sodium phosphate is the general chemical name for a wide variety of salts produced from the reaction of phosphoric acid with sodium hydroxide or sodium carbonate. These salts can be divided into two classes: orthophosphates and complex phosphates.[2]

Chemical analysis predicts three salts resulting from the successive neutralization of the acidic protons of the phosphate group with sodium hydroxide or sodium carbonate. These salts are: monosodium dihydrogen phosphate (H_2NaPO_4), disodium monohydrogen phosphate or sodium orthophosphate (HNa_2PO_4), and trisodium phosphate (Na_3PO_4). Each of these salts is produced commercially in the anhydrous state, although disodium monohydrogen phosphate and trisodium phosphate are also produced commercially as hydrates.

Monosodium dihydrogen phosphate is used as a water soluble solid acid, as a pH buffer for acidic cleaners, as a boiler water precipitant for polyvalent metal ions and as a livestock feed supplement. Disodium monohydrogen phosphate is used in consumer products, as a buffer in food ingredients, in cheese and milk processing, in instant pudding mixes, in animal feed and in chemical processing. Trisodium phosphate is used in automatic dishwashing detergents, as an alkaline source for metal cleaner, as a standard pH buffer, and as an alkaline pH bleaching agent.

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[1] Environmental Protection Agency, RCRA 3007, Survey of Inorganic Chemicals Industry

[2] www.chemistry.co.nz/deterg_inorganic.htm

Sodium tripolyphosphate ($Na_5O_{10}P_3$) is used as a buffering agent, a flavor enhancer in meats, seafood and poultry, a dispersing agent and a protein modifier. It can be found in detergents, cheeses, creams, canned vegetables, meats, seafood, poultry, metal cleaners and water treatment products.[3]

Sodium hexametaphosphate ($Na_6O_{18}P_6$) is used as a flame retardant with textiles, as an emulsifier for cheese, in synthetic dairy products and in tanning of hides.[4]

Industries that produce corrosion inhibitors, the electroplating industry, chemical laboratories, facilities that produce metal degreasing products, facilities that produce pH adjusting agents, and the pulp and paper manufacturing industry use sodium phosphates in their products.[5]

Sodium tripolyphosphate is produced by the thermal dehydration of phosphate salts containing the correct sodium to phosphorus ratio.[6] Both hydrous and anhydrous forms exist.
Sodium hexametaphosphate is a glassy, amorphous sodium polyphosphate with a Na_2O/P_2O_5 molar ratio of approximately 1:1.[7]

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[3] Http://www.solutia.com/Investor/WorldwideLocations/STlCarondelet.html

[4] Ibid

[5] Http://www.scorecard.org/chemical-profiles/

[6] Kirk, R.E. and Othmer, D.F. (1982). Encyclopedia of Chemical Technology. (Vol.17, p.456) New York: John Wiley & Sons.

[7] Http://www.solutia.com/Products/SHexametaphosphate.html

Figure 1.1 Geographical Distribution of Sodium Phosphate Producers[1]

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[1] See **Table 1.1** for facility name and location.

1.3 PRODUCTION CAPACITY

No production or capacity quantities that were not CBI could be located for the sodium phosphate sector.

2. DESCRIPTION OF MANUFACTURING PROCESS

This section provides the general process description for the production of sodium phosphate from wet process phosphoric acid. The processes for monosodium dihydrogen phosphate, disodium monohydrogen phosphate and trisodium phosphate are similar except for the ratio of phosphoric acid to soda ash at the reactor stage and the type, size and construction of the crystallizing and drying equipment. **Figure 2.1** is a general process flow diagram for the production of sodium phosphate from wet process phosphoric acid and may not account for specific process variations.

Initial Reaction

Sodium phosphate salts are produced by an acid base reaction between phosphoric acid and sodium hydroxide or soda ash (sodium carbonate) in a reactor. Two of the facilities, Solutia-Augusta and Solutia-Carondelet add potassium hydroxide and sodium chlorate to the initial reaction mixture. The potassium hydroxide is added to stabilize the crystallization process that occurs later in the production process and the sodium chlorate is added as a bleach.

Overall reactions:

$$\text{a) } 2H_3PO_4 + 3Na_2CO_3 \rightarrow 2Na_3PO_4 + 3H_2CO_3$$

$$\text{b) } H_3PO_4 + 3NaOH \rightarrow Na_3PO_4 + 3H_2O$$

Phosphoric acid used in the production of sodium phosphate is manufactured offsite by outside suppliers using the wet phosphoric acid process. If the plant is manufacturing food grade phosphates then the phosphoric acid is food grade quality, with arsenic levels below 1.0 ppm. At two of the facilities, Rhodia-Chicago Heights and Rhodia-Waterway, the sodium carbonate used in the process is manufactured offsite through the crystallization/purification process of mined Trona. The sodium hydroxide is purchased commercially.

The product that results from the initial reaction depends upon the sodium/phosphate ratio present in the reaction mixture. Three of the facilities, Solutia-Augusta, Solutia-Carondelet and Rhodia-Chicago Heights, report the product as trisodium phosphate (Na_3PO_4) or disodium monohydrogen phosphate (HNa_2PO_4) feed liquor. At Rhodia-Waterway, the initial reaction produces a mixture of monosodium dihydrogen phosphate (H_2NaPO_4) and disodium monohydrogen phosphate.

Processing of initial reaction solution to produce the desired product

At Rhodia-Waterway, the reactor vents through a scrubber. The scrubbing waters are discharged to a publicly-owned treatment works (POTW). These wastewaters are a portion of the scrubber waters and effluents wastestream. The reactor generates residues which are sent to the furnace or to a sewer line which discharges to a POTW. These residues are mixed with scrubber waters and are a portion of the scrubber waters and effluents wastestream. At Rhodia-Chicago Heights, the reaction solution is filtered to remove any precipitated solids. This generates a portion of the filter press cakes wastestream. The filtrate contains a mixture of monosodium/disodium liquor which is used as the feed liquor for all three processes that occur at the facility.

Final product

The next steps in the sodium phosphate production process are determined by the desired final products.

- *Monosodium dihydrogen phosphate process* (H_2NaPO_4)

At Rhodia-Chicago Heights, phosphoric acid is added to the feed liquor to adjust the sodium/phosphate ratio, producing a monosodium dihydrogen phosphate solution. The monosodium phosphate solution passes through a polishing filter to remove any precipitated solids as well as rust and dirt. This filtering step generates a portion of the filter press cakes wastestream.

The liquid monosodium dihydrogen phosphate product is shipped to customers via tanker truck or railcar.

- *Disodium monohydrogen and trisodium phosphate processes* (HNa_2PO_4 *and* Na_3PO_4)

At Rhodia-Chicago Heights, if the requested products are disodium monohydrogen or trisodium phosphate, the feed liquor is mixed with varying amounts of sodium hydroxide to produce the correct ratio of sodium/phosphate. After the ratio correction step, the disodium monohydrogen and trisodium phosphate streams are filtered. This generates a portion of the filter press cakes wastestream.

- *Sodium hexametaphosphate process* ($Na_6O_{18}P_6$)

At Rhodia-Waterway, the product from the initial reaction mixture is fed to a furnace which melts the mix and converts it to sodium hexametaphosphate. The furnace is cleaned out on a periodic basis, generating a portion of the refractory material wastestream.

- *Sodium tripolyphosphate process* ($Na_5O_{10}P_3$)

At Rhodia-Waterway, the product from the initial reaction mixture is fed to a converter, that changes it to sodium tripolyphosphate. The converter is cleaned out on a periodic basis, generating a portion of the refractory material wastestream.

At Solutia-Augusta and Solutia-Carondelet, the reaction mixture is allowed to overflow into tanks where acid is added until the correct pH is reached. A pH of approximately 8.5 produces disodium monohydrogen phosphate, and a pH of approximately 10 produces trisodium phosphate. The resulting products are filtered, generating the mix area filters wastestream. The product is fed into a calciner. The non-regulated gases from the calciner are vented to the atmosphere. The calciner is cleaned out on a periodic basis, generating a portion of the refractory material wastestream. Sodium tripolyphosphate is produced.

Packaging and Sizing

- *Disodium monohydrogen and trisodium phosphate*

At Rhodia-Chicago Heights, the disodium monohydrogen and trisodium phosphate liquor is sent to crystallizers after filtration. The vapors and gases from the crystallizers are scrubbed, and the scrubber waters are returned to the reactors. These scrubber waters are a portion of the scrubber wastewater wastestream. Dust from the dryers is collected in a dust collection system, mixed with water and returned to the mixing reactor. Similarly, dust from the packaging of the finished product is returned to the mixing reactor. The dust collector bags are a portion of the dust collector bags wastestream.

- *Sodium hexametaphosphate*

At Rhodia-Waterway, the mix leaving the furnace is air cooled and sent to a reformer for sizing and blending. The air from the cooler goes to a scrubber, and the scrubber water is a portion of the scrubber wastewaters and effluents wastestream. The product is sized to granular, crushed or powdered form in the reformer. The dust from the reformer goes to a scrubber, and the scrubber waters are a portion of the scrubber wastewaters and effluents wastestream.

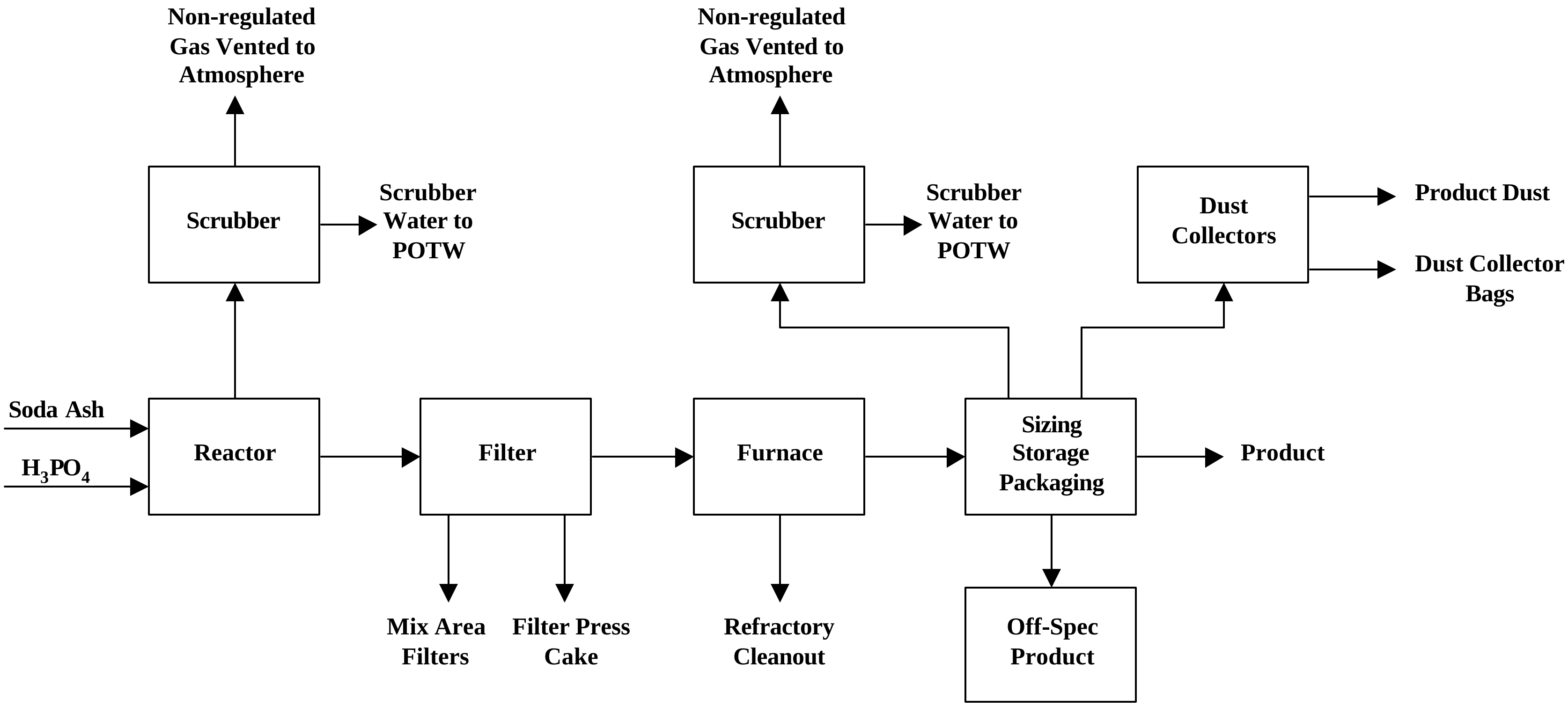
- *Sodium tripolyphosphate*

At Rhodia-Waterway, the sodium tripolyphosphate product leaves the converter and is cooled, sized, stored and packaged for shipment. Three dust collectors are associated with the sizing, storage and packaging operations. The dust from the sizing operation and the dust from the truck loading operation are returned to the process. The dust from the blending and bagging operations is collected and disposed of as a portion of the off-spec product wastestream. The dust collector bags are a portion of the dust collector bags wastestream.

At Solutia-Augusta and Solutia-Carondelet, the product leaves the calciner, is cooled and is conveyed to the appropriate system for milling to a granular or powder form. The fines from this process are recycled back into the process. The granular and powder mills have a dust collector system which generates a portion of the dust collector bags wastestream. The ground product moves to the packaging area. A dust collection system returns collected product to the process. Dust collection bags are generated at this point in the process and are a portion of the dust collector bags wastestream.

Occasionally, off-spec product is produced. This wastestream is produced when the product has exceeded its shelf life or the sizing of the particles does not meet customer specifications. Off-spec product is a portion of the off-spec product wastestream.

Figure 2.1 Process Flow Diagram for the Production of Sodium Phosphate



3. WASTE GENERATION AND MANAGEMENT

Section 3.1 presents a detailed discussion of the production steps that generate the wastestream, the final management steps for the wastestream, a characterization of the physical and chemical properties of the wastestream and the results of the initial risk screening analyses. **Section 3.2** discusses wastes reported by the facilities, in the RCRA §3007 questionnaire, that are outside the scope of the Consent Decree. **Appendix A** presents a complete summary of the wastestreams generated at each of the facilities in the sodium phosphate sector, the volume of the wastestreams generated in metric tons per year (MT/yr), and the associated final management step.

3.1 SUMMARY OF WASTE GENERATION PROCESSES

The wastes generated from the production of sodium phosphate salts consists of filter press cakes, mix area filters, dust collector bags, scrubber waters and effluents, product dust, and off-spec product. These wastestreams are nonhazardous.

The scrubber waters and effluents wastestreams generated at the facilities are managed in a tank, pH adjusted, filtered and discharged to a POTW. For those scenarios where wastes are managed in a tank, the impervious nature of the construction materials (concrete, fiberglass, or steel) of the tanks is unlikely to result in releases to groundwater in all but the most catastrophic scenarios. We also are not concerned with potential air releases from these tanks as neither volatile contaminants nor airborne particulates are likely to be present in these aqueous wastes. Therefore, we did not evaluate these wastes further. For those scenarios where wastes are discharged via the facility’s common sewage line to permitted publicly-owned treatment works (POTW), these wastes are excluded from the Resource Conservation and Recovery Act (RCRA) (40 CFR 261.4(a)(1)(ii)).

Table 3.1 presents a summary of wastestreams generated by facility as reported in their RCRA §3007 questionnaire and in the follow-up responses to the questionnaire .

Table 3.1 Wastes Generated from the Production of Sodium Phosphate

Facilities	Filter Press Cakes	Mix Area Filters	Dust Collector Bags	Scrubber Waters and Effluents	Product Dust	Off-spec Product
Rhodia - Chicago Heights	x		x	x	x	x
Rhodia - Waterway			x	x	x	x
Solutia - Augusta		x	x			x
Solutia - Carondelet			x			x

3.1.1 Filter Press Cakes

Waste Generation

Only one facility, Rhodia-Chicago Heights, reported generating filter press cakes. This wastestream is generated at three points in the production process producing four filter cakes as impurities are filtered out of the phosphate liquor.

- The solution from the initial reaction of phosphoric acid, soda ash and caustic is filtered, generating a filter cake and a monosodium/disodium phosphate liquor (H_2NaPO_4/HNa_2PO_4).

- The monosodium phosphate from the initial reaction passes through a polishing filter generating a second filter press cake, consisting of precipitated solids, rust and dirt, that is removed at this point in the process.

- The sodium to phosphate ratio in the initial monosodium phosphate liquor is adjusted with caustic to make disodium (Na_2HPO_4) and trisodium phosphate (Na_3PO_4). After the disodium and trisodium phosphates are formed, the solution is filtered twice more generating two additional filter cakes. One of the filter cakes is redissolved into a solution and returned to the reaction process and the second is collected for disposal.

The facilities generated process filter press cake at the rate of 10 to 74 MT/yr in 1998.

Waste Management

Filter press cakes are managed by recycling back to the process and by disposal offsite in an industrial Subtitle D landfill. **Table 3.2** presents the residuals that contribute to this wastestream and the total volume that is disposed of in each management unit. The residuals listed in Table 3.2 are the individual waste components that contribute to the wastestream.

Table 3.2 Waste Management Summary for Filter Press Cakes

Final Management	# of Wastestreams with Reported Volumes	Total Volume (MT/yr)
Recycled back to process	1	12
Offsite industrial Subtitle D landfill	3	108

Waste Characterization

Two sources of residual characterization data were developed during the industry study:

- RCRA §3007 questionnaire
- Two record samples collected at Rhodia-Chicago Heights.

This wastestream is reported as nonhazardous in the RCRA §3007 questionnaire and is reported to contain the following chemical constituents: diatomaceous earth, lime, sand and dirt.

Results of Initial Risk Screening Analysis

Two samples of this wastestream were collected at one facility, Rhodia-Chicago Heights. Based on our assessment of the raw materials and production processes used across the industry, we believe these samples are representative of similar wastes at the other three sodium phosphate production facilities.

Table 3.3 shows the filter press cakes samples collected and their corresponding sample numbers.

Table 3.3 Record Samples, Filter Press Cakes

Facility	Sample No.
Rhodia-Chicago Heights	RCH-1-SP-01 RCH-1-SP-02

RCH-1-SP-01 is generated from filtering the reaction mixture produced from the initial reaction between phosphoric acid, soda ash and caustic. The sample was collected from the general phosphate process reactor located in the TSP diliquor area.

RCH-1-SP-02 is generated after the process liquor has caustic added to it to adjust the sodium/phosphate ratio. This disodium monohydrogen solution is filtered generating this filter press cake. The filter press cake was collected from the Sparkler Filter Press in the Vacuum Crystallizer Department.

Table 3.4 presents the applicable analytical data used for risk screening and modeling purposes. Only detected constituents are shown. Complete validated analytical data packages for these record samples can be found in **Appendix B**.

Table 3.4 Waste Characterization for Filter Press Cakes

Parameter	RCH-1-SP-01			RCH-1-SP-02		
	Total mg/kg	TCLP mg/l	SPLP mg/l	Total mg/kg	TCLP mg/l	SPLP mg/l
Antimony	0.5	<0.5	0.0298	<0.5	<0.5	<0.025
Barium	17.8	<2	<0.100	6.0	<2	<0.100
Boron	13.1	<2	0.375	<10	<2	0.166

Parameter	**RCH-1-SP-01**			**RCH-1-SP-02**		
	Total mg/kg	TCLP mg/l	SPLP mg/l	Total mg/kg	TCLP mg/l	SPLP mg/l
Cadmium	6.5	<0.05	<0.005	6.1	<0.05	<0.005
Calcium	25100	18.9	3.32	20800	55.5	1.340
Chromium	111	0.2	0.171	90.8	0.075	0.0222
Cobalt	1.2	<0.05	<0.005	0.8	<0.05	<0.005
Copper	3.6	<0.25	0.0060	1.9	<0.25	0.0035
Iron	3320	<1	<0.050	2160	<1	0.0629
Lead	2.4	0.8[1]	<0.005	0.7	<0.5	<0.005
Mercury	6.2	<0.002	<0.0002	4.6	<0.002	<0.0002
Nickel	61.1	0.4	0.0072	42.5	1.0	0.0162
Potassium	<100	<10	1.7	<100	<10	1.1
Selenium	<0.5	<0.5	0.0084	<0.5	<0.5	<0.005
Sodium	146000	N/A	5310	59200	N/A	812
Thallium	<2	<2	0.0055	<2	<2	0.0079
Titanium	61.5	<0.05	<0.005	49.3	<0.05	<0.005
Zinc	10.3	<3	<0.100	5.2	<3	<0.100
Fluoride	325	N/A	N/A	58.8	N/A	N/A

The initial screen identified antimony and thallium at concentrations above their health-based limits (HBL). The HBL for arsenic is lower than the arsenic detection limit. However, both samples have non-detect levels for arsenic so no modeling was necessary for arsenic.

Based on the sampling results summarized above, we decided that modeling was necessary for two constituents of concern: antimony and thallium. We assessed the off-site, industrial Subtitle D landfill scenario using the hydrogeologic properties associated with the geographic areas where the landfills reported in the survey are located. Synthetic Precipitation Leaching Procedure (SPLP) results were given primary consideration as there is no reported management in municipal landfills (where the TCLP results would be relevant). The SPLP values from both samples were considered. For antimony, we used one-half of the detection limit for sample RCH-1-SP-02 as the input to the modeling. Regardless of the type of measurement, if the result of the chemical analysis for a particular compound was below the limit of detection but the compound was detected in the waste, then we used ½ the value reported by the laboratory as the limit of detection for that compound. For a more complete description of this analysis, see *"Risk Assessment for the Listing Determinations for Inorganic Chemical*

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[1] The sample was analyzed in duplicate; the duplicate result for TCLP lead was 0.007 mg/L (<0.5 mg/L)

Manufacturing Wastes" (August 2000) in the docket for this proposed rulemaking.

3.2.2 Mix Area Filters

Waste Generation

Solutia-Augusta reported generating mix area filters. The reaction mixture formed from the initial reaction of phosphoric acid with soda ash, sodium chlorate, sodium or potassium hydroxide and off-spec product is filtered. These filters are changed out periodically, generating the mix area filters wastestream.

Waste Management

This wastestream is managed in an offsite industrial Subtitle D landfill. **Table 3.5** presents the final management step used by the facility for this wastestream.

Table 3.5 Waste Management Summary for Mix Area Filters

Final Management	# of Wastestreams with Reported Volumes	Total Volume (MT/yr)
Offsite industrial Subtitle D landfill	1	0.009

Results of Initial Risk Screening Analysis

Mix area filters were not sampled and did not warrant risk assessment for the following reasons:

C The location of these filters in the process indicates that any contaminants found would be similar to those of the filter press cakes found at Rhodia-Chicago Heights;
C The volume of this waste is extremely small;
C The raw materials used in this process are food-grade products. This fact ensures extremely low levels of contaminants, such as arsenic.

3.2.3 Dust Collector Bags

Waste Generation

All four facilities generate dust collector bags. At Rhodia-Chicago Heights the dust collector bag system consists of a large cylindrical steel cage-like core surrounded by a polyester/acrylic bag with Teflon coating. At other facilities the filter bags are made of polypropylene.

- At Rhodia-Chicago Heights, the wet crystals from the two processes (disodium phosphate and trisodium phosphate) pass through dryers. Dust from the dryers is collected in a dust collection system.

- At Rhodia-Waterway and at the two Solutia facilities, the dust collector bags are located in the sizing, storage and packaging area.

At all four facilities the dust collector bags are changed intermittently as part of normal maintenance procedures.

Waste Management

Dust collector bags are disposed offsite in an industrial Subtitle D landfill. **Table 3.6** presents the final management step used by the facilities for this wastestream. The residuals listed in **Table 3.6** are the individual waste components that contribute to the wastestream. At some facilities, more than one residual contributes to the same wastestream.

The dust collector bags are generated at various rates from less than .05 MT/yr to 1.12 MT/yr

Table 3.6 Waste Management Summary for Dust Collector Bags

Final Management	# of Wastestreams with Reported Volumes	Total Volume (MT/yr)
Offsite industrial Subtitle D landfill	7	2.1

Waste Characterization

Two sources of residual characterization information were developed during the industry study:

- RCRA §3007 questionnaire
- One record sample collected at Rhodia-Chicago Heights.

Results of Initial Risk Screening Analysis

All four facilities characterized this waste as nonhazardous. One sample of this wastestream was collected. Based on our assessment of the raw materials and production processes used across the industry, we believe this sample is representative of similar wastes at the other three sodium phosphate production facilities. **Table 3.7** shows the dust collector bags sample collected and its sample number.

Table 3.7 Record Samples, Dust Collector Bags

Facility	Sample No.
Rhodia Inc. - Chicago Heights	RCH-1-SP-03

RCH-1-SP-03 is generated after the wet crystals from the two processes, disodium monohydrogen phosphate production and trisodium phosphate production pass through dryers. Dust from the dryers is collected in a dust collection system, dissolved and returned to the mixing reactor. The dust collector bags used in the dust collection system consists of a large cylindrical, steel cage-like core surrounded by a polyester/acrylic bag with Teflon coating. The coating was cut from the core and it was this coating that was sampled. We collected one sample of this residual which we believe is representative of similar wastes at the other three sodium phosphate production facilities.

Table 3.8 presents the applicable analytical data used for risk screening and modeling purposes. Only detected constituents are shown. Complete validated analytical data packages for the record sampling trip can be found in **Appendix B**.

Table 3.8 Waste Characterization for Dust Collector Bags

Parameter	**RCH-1-SP-03**		
	Total (mg/kg)	TCLP (mg/L)	SPLP (mg/L)
Antimony	48.8	<0.5	0.309
Arsenic	<0.5	<0.5	0.0064
Barium	12.5	<2	<0.100
Boron	23.0	<2	0.765
Calcium	344	14.1	1.180
Chromium	10.9	0.087	0.0297
Cobalt	2.8	<0.05	<0.005
Copper	6.0	<0.25	0.0496
Iron	740	1.4	0.101
Lead	4.5	<0.5	<0.005
Nickel	4.8	<0.2	0.0077
Potassium	<100	<10	2.5
Selenium	<0.5	<0.5	0.0091
Sodium	142000	N/A	1640
Titanium	4.3	<0.05	<0.005
Vanadium	0.6	<0.05	0.0084
Zinc	116	<3	<0.100
Fluoride	315	N/A	N/A

Antimony and arsenic are the constituents of concern. Because the volume of this waste is relatively small, we first used the de minimis waste quantity screening analysis to screen the potential risk to groundwater associated with landfilling this waste. We found that the SPLP data for arsenic screens out because the waste volume is insufficient to release arsenic at levels of concern.

The detected SPLP levels for antimony did not screen out using the de minimis volume analysis. We conducted full groundwater modeling for the industrial landfill scenario for this constituent. We assessed the off-site landfill scenario using the hydrogeologic properties associated with the geographic areas where the landfills reported in the survey are located. For a more complete description of this analysis, see *"Risk Assessment for the Listing Determinations for Inorganic Chemical Manufacturing Wastes*" (August 2000) in the docket for this proposed rulemaking.

3.2.4 Scrubber Waters and Effluents

<u>Waste Generation</u>

Two facilities identified scrubber waters and effluents as a wastestream.

- At Rhodia-Waterway, this wastestream is generated at several points in the sodium phosphate process.
  - S The process starts with a reaction between phosphoric acid and soda ash. The reactor vents through a scrubber generating scrubber waters.
  - S The initial product mix is fed to a dryer and then into a furnace which melts and converts the mix to sodium hexametaphosphate. The mix is air cooled and sent to a reformer for sizing and blending. The air from the dryer and cooler goes to a scrubber generating scrubber waters.
  - S Depending on customer specifications, the product may be sized to granular, crushed or powder form in a reformer. The dust from the reformer goes to a scrubber generating scrubber waters.
- At Rhodia-Chicago Heights, the crystallizers used to crystallize disodium and trisodium phosphate are vented through scrubbers generating scrubber waters that are recycled back to the process.

<u>Waste Management</u>

At Rhodia-Waterway, scrubber waters and effluents are stored onsite in a 500 gallon covered equalization tank that discharges to a POTW. At Rhodia-Chicago Heights, the scrubber waters and effluents are returned to the reactors. **Table 3.9** presents the last management step used by the facilities for this wastestream. The residuals listed in Table 3.9 are the individual waste components that contribute to the wastestream. At some facilities more than one residual contributes to the same wastestream.

Table 3.9 Waste Management Summary for Scrubber Waters and Effluents

Final Management	# of Wastestreams with Reported Volumes	# of Wastestreams without Reported Volumes	Total Volume (MT/yr)
Discharged to POTW	3		32
Recycled back to process		1	NR

NR = not reported in RCRA §3007 questionnaire

Waste Characterization

One source of residual characterization was developed during the industry study, which was the RCRA §3007 questionnaire. This wastestream was reported as nonhazardous. The scrubber waters and effluents wastestream has a pH of 6 and contains small amounts of the chemical constituents sodium phosphate and carbonate.

Results of Initial Risk Screening Analysis

Scrubber waters and effluents were not sampled and did not warrant a quantitative risk assessment. We did not evaluate scenarios where these secondary materials are piped back into the production process because there is no potential for exposure. For those scenarios where wastes are managed in a tank, the impervious nature of the construction materials (concrete, fiberglass, or steel) of tanks is unlikely to result in releases to groundwater in all but the most catastrophic scenarios. We also are not concerned with potential air releases from these tanks as neither volatile contaminants nor airborne particulates are likely to be present in these aqueous wastes. For those scenarios where scrubber water and effluents are discharged via the facility's common sewage line to POTWs, these wastes are excluded from RCRA (40 CFR 261.4(a)(1)(ii)). Furthermore, these discharges are regulated by the Clean Water Act pretreatment standards. They do not warrant listing. We propose not to list this waste.

3.2.5 Product Dust

Waste Generation

Two facilities identified product dust as a wastestream. Rhodia-Waterway uses three dust collectors in the area where the sodium tripolyphosphate product stream is sized, stored, and packaged. The sodium tripolyphosphate crystals are returned to the sizing, storing and packaging equipment and are part of the final product. In some cases a small fraction of the product has a food-grade organic material added per customer specifications. When this product must be disposed of, it is not recycled back to the process but is disposed of offsite in an industrial Subtitle D landfill.

Rhodia-Chicago Heights takes the dust from the dryers used to dry wet crystals of disodium and trisodium phosphate, mixes it with water and returns the dust to the mixing reactor. No quantities were reported for this wastestream, and no RINs were assigned.

Waste Management

This wastestream is managed in one of two ways: recycling back into the process or disposal in an offsite industrial Subtitle D landfill. **Table 3.10** presents the final management step used by the facilities for this wastestream. The residuals listed in **Table 3.10** are the individual waste components that contribute to the wastestream. At one facility more than one residual contributes to the same wastestream.

Table 3.10 Waste Management Summary for Product Dust

Final Management	# of Wastestreams without Reported Volumes	Total Volume (MT/yr)
Recycled back to process	2	NR
Offsite industrial Subtitle D landfill	1	NR

NR = not reported in RCRA §3007 questionnaire

Waste Characterization

One source of residual characterization was developed during the industry study, which was the RCRA §3007 questionnaire. This wastestream was characterized as nonhazardous. No additional information was reported.

Results of Initial Risk Screening Analysis

Product dust was not sampled and did not warrant risk assessment. All collected dust that can be recycled is recycled back into the production process. Due to production constraints, some portion of this collected product dust cannot be recycled back to the process and is instead sent to an industrial Subtitle D landfill. However, this landfilled product is still food-grade product. Because this "waste" is, in fact, food-grade product, we believe it unlikely that it contains any constituent exceeding health-based limits based on ingestion. Therefore, we propose not to list this waste.

3.2.6 Off-specification Product

Waste Generation

Solutia-Augusta and Solutia-Carondelet reported generating off-spec product. The Rhodia facilities reported, during the course of a site visit discussion, that they generate off-spec product also. The product may be labeled off-spec and rejected by a customer because of problems with particle size or because the shelf life of the product has been exceeded.

Waste Management

Off-spec product is managed in one of two ways: offsite disposal in an industrial Subtitle D landfill or recycling back into the process. **Table 3.11** presents the final management step used by the facilities for this wastestream. The residuals listed in **Table 3.11** are the individual waste components that contribute to the wastestream. At some facilities more than one residual contributes to the same wastestream. Volumes were only reported for industrial Subtitle D landfill disposal units.

Table 3.11 Waste Management Summary for Off-specification Product

Final Management	# of Wastestreams with Reported Volumes	# of Wastestreams without Reported Volumes	Total Volume (MT/yr)
Recycled back to process		2	NR
Offsite industrial Subtitle D landfill	2		771

NR = not reported in RCRA §3007 questionnaire

Waste Characterization

One source of residual characterization was developed during the industry study which was the RCRA §3007 questionnaire. This wastestream was characterized in the response to the RCRA §3007 questionnaire as nonhazardous with a pH of 9.

Results of Initial Risk Screening Analysis

Off-spec product was not sampled and did not warrant risk assessment. Much of this material is reused in the production process with no potential for exposure. However, because of production constraints, the facilities cannot always work all of this material back into the process, and it must be disposed of in an industrial Subtitle D landfill. In all cases, product is rejected by a customer because of physical property problems - (i.e., particle size) - rather than chemical problems or contaminants. Because this "waste" is, in fact, food-grade product, we believe it unlikely that it contains any constituent exceeding health-based limits based on ingestion. Therefore, we propose not to list this waste.

3.2 WASTES OUTSIDE THE SCOPE OF THE CONSENT DECREE

A number of approaches were used to eliminate from further consideration those wastes that plausibly could not pose a risk, and to identify wastes and chemical constituents that did require further assessment. The sodium phosphate sector has two categories of wastes that did not merit further assessment. These were in process recycled materials and refractory brick. These wastes are described in **Sections 3.2.1** and **3.2.2**.

3.2.1 In process recycled materials

Some facilities reported managing the same wastestream either by recycling back into the process or by disposal offsite in industrial Subtitle D landfills. For those scenarios where wastes are sent to industrial Subtitle D landfills, we performed a risk assessment to help us determine whether these risks warranted listing. For those scenarios where secondary materials (filter press cakes, product dust, off-spec product, and scrubber water) are piped back to the production process, we could identify no potential route for significant exposure prior to reuse. In addition, we evaluated all wastes generated after reinsertion of these materials into the process and we do not believe that these secondary materials present significant threats. Also, off-specification product, when reinserted without reclamation into the process from where it originated, is not a solid waste.

3.2.2 Refractory Brick

EPA does not consider plant component materials to fall within the scope of the consent decree. Two facilities in the sodium phosphate sector reported generating refractory brick. EPA considers this material to be a structural component of the plant where production takes place rather than a waste from the "production" of an inorganic chemical. Refractory brick is outside the scope of the Consent Decree and will not be evaluated further.

APPENDIX A

Summary of Waste Generation and Management

Wastestreams	**Facility**	**Waste Volume (MT/yr)**	**Final Waste Management Step**
Filter Press Cakes	Rhodia-Chicago Heights	108	Offsite industrial Subtitle D landfill
		12	Recycled back to process
	Rhodia-Waterway	NR	NR
	Solutia-Augusta	NR	NR
	Solutia-Carondelet Plant	NR	NR

NR = not reported in RCRA §3007 questionnaire

Wastestreams	**Facility**	**Waste Volume (MT/yr)**	**Final Waste Management Step**
Mix area filters	Rhodia-Chicago Heights	NR	NR
	Rhodia-Waterway	NR	NR
	Solutia-Augusta	0.009	Offsite industrial Subtitle D landfill
	Solutia-Carondelet	NR	NR

NR = not reported in RCRA §3007 questionnaire

Wastestreams	**Facility**	**Waste Volume (MT/yr)**	**Final Waste Management Step**
Dust collector bags	Rhodia-Chicago Heights	1.12	Offsite industrial Subtitle D landfill
	Rhodia-Waterway	0.28	Offsite industrial Subtitle D landfill
	Solutia-Augusta	0.7	Offsite industrial Subtitle D landfill
	Solutia-Carondelet	0.05	Offsite industrial Subtitle D landfill

Wastestreams	**Facility**	**Waste Volume (MT/yr)**	**Final Waste Management Step**
Scrubber waters and effluents	Rhodia-Chicago Heights	NR	Recycled back to process
	Rhodia-Waterway	32	Discharge to POTW
	Solutia-Augusta	NR	NR
	Solutia-Carondelet	NR	NR

NR = not reported in RCRA §3007 questionnaire

Wastestreams	**Facility**	**Waste Volume (MT/yr)**	**Final Waste Management Step**
Product dust	Rhodia-Chicago Heights	NR	Recycled back to process
	Rhodia-Waterway	NR	Recycled back to process Offsite industrial Subtitle D landfill
	Solutia-Augusta	NR	NR
	Solutia-Carondelet	NR	NR

NR = not reported in RCRA §3007 questionnaire

Wastestreams	**Facility**	**Waste Volume (MT/yr)**	**Final Waste Management Step**
Off-specification product	Rhodia-Chicago Heights	NR	Recycled back to process
	Rhodia-Waterway	NR	Recycled back to process Offsite industrial Subtitle D landfill
	Solutia-Augusta	646	Offsite industrial Subtitle D landfill
	Solutia-Carondelet	125	Offsite industrial Subtitle D landfill

NR = not reported in RCRA §3007 questionnaire

APPENDIX B

Record Sampling Analytical Data Report

FINAL DATA VALIDATION REPORT
RHODIA INC., CHICAGO HEIGHTS FACILITY
RECORD SAMPLING

Overview

Four samples were collected at Rhodia Inc., Chicago Heights facility during a site visit on September 14, 1999: two press cake samples, one filter sample, and an equipment blank. The sample set did not include a field duplicate pair, as there was an insufficient sample volume of the sample designated as the field duplicate. The samples were analyzed for the analyses specified in the Rhodia Inc., Chicago Heights Facility Site Sampling and Analysis Plan for Record Sampling Under the Inorganic Listing Determination, dated September 2, 1999. The methods used for these analyses are presented in Table 1. The laboratory did not deviate from the methods as written except for the following: (i) for hexavalent chromium analysis of solid samples, the laboratory extracted the samples 1:1 with deionized water as the samples spattered when the heated digestion (SW-846 method 3060) was attempted (the digestion was attempted twice with the same results); and (ii) for TCLP and SPLP hexavalent chromium, the laboratory used deionized water as the extraction fluid. Because TCLP extraction of hexavalent chromium using deionized water is identical to SPLP extraction of hexavalent chromium using deionized water, the laboratory only reported results for SPLP hexavalent chromium analyses.

Because of insufficient sample volume, analysis for specific gravity could not be completed for RCH-1-SP-02. In addition, oxidation/reduction analysis of this sample was hindered by a matrix effect, and an insufficient sample prevented re-analysis of the sample. The laboratory reported that sample RCH-1-SP-01 was off-gassing which prevented the accurate determination of specific gravity and moisture content. The laboratory provided alternate results based on their best technical judgement (see Table 2).

The data were reviewed according to the procedures outlined in the Quality Assurance Project Plan for Characterization Sampling for Inorganic Chemicals Listing Determination. The text of this report addresses only those problems affecting usability.

The analytical results for the Rhodia samples, with the applied data qualifiers, are presented in Table 2. The results for the method blanks and leachate blanks prepared at the laboratory are also presented.

Data Validation Summary

The samples identified in the SAP were collected in the volumes specified in the SAP, with the exceptions described above.

Holding Times: All extractions and analyses were completed within the required holding times with the exception of hexavalent chromium in RCH-1-SP-05. The result was qualified as estimated with a low bias (UL for non-detect results) in this sample.

The dates of analysis for each sample are detailed in the attached worksheet.

Instrument Calibration: All QC requirements for instrument calibration were met for all analyses. Calibration curves for CVAA, AA, and colorimetric analyses had correlation coefficients >0.995. All initial calibration verification samples were within the QC limits of 90-110%, and all continuing calibration verification samples were within the QC limits of 90-110% for ICP and 80-120% for CVAA, AA, and colorimetric analyses.

Blank Analysis Results: No target analyses were detected in the method and leachate blanks. Calcium and lead were detectable in the equipment blank, RCH-1-SP-05 (see Table 2). No qualification of data was necessary as the levels of these analyses in the samples greatly exceeded the levels in the blanks.

Interference Check Sample (ICP Analyses): The recovery of spiked analyses in the Interference Check Sample (ICS) was within the QC limits of 80-120% for all analyses.

Matrix Spike/Matrix Spike Duplicate Results: The results of matrix spike/matrix spike duplicate analyses are presented in Tables 3 (total inorganics), 4 (TCLP), and 5 (SPLP). The recovery of analyses in the matrix spike and matrix spike duplicate samples was within the QC limits of 75-125%, and the duplication was within the QC limits of 0-25% relative percent difference, with the exception of total calcium, iron, mercury, sodium, and titanium; TCLP boron; and SPLP sodium. The data qualifiers that were applied to data as a result of these QC exceedances are detailed in the footnotes to the respective tables. For total calcium, iron, mercury, and sodium, and SPLP sodium, no action was necessary as the sample concentration greatly exceeded the spike concentration.

For some analyses, the laboratory did not conduct matrix spike analyses but did conduct duplicate analyses; these results are presented in Table 3.

Post-Digestion Spike Results: Although the laboratory conducted post-digestion spike analyses for all ICP analyses, post-digestion spike results were only reported for analyses for which matrix spike recovery failed. For this sample set, post-digestion spike recovery was reported for total titanium; the recovery was below the QC limits of 75-125% (73.5%). No additional qualification of data was necessary as all affected sample results previously had been qualified due to poor matrix spike recovery.

Laboratory Control Sample Results: The recovery of analyses in the laboratory control samples is presented in Tables 6 (aqueous sample), 7 (solid sample), 8 (TCLP sample), and 9 (SPLP sample). The recovery was within the QC limits of 80-120% for all analyses except total boron, TCLP zinc (extraction fluid #2), SPLP barium, and SPLP boron. The actions that were taken as a result of these QC exceedances are detailed in the respective tables.

ICP Serial Dilution Results (ICP Analyses): The laboratory conducted serial dilution analyses for ICP analyses only in cases for which matrix spike recovery failed and no post-digestion spike analysis was conducted (because sample concentration greatly exceeded spike concentration). No serial dilution results were reported for this sample set.

Target Detection Limits: The target detection limits identified in the QAPP were met for all analyses except as detailed in the table below:

Target Compound	**Target Detection Limit (mg/L)**	**Achieved Method Detection Limit (mg/L) [1]**
Wastewaters		
Arsenic	0.002	0.00237 (0.005)
Thallium	0.0005	0.00216 (0.005)

[1] Quantitation limit used for reporting in parentheses.

Field Duplicate Results: No field duplicate samples were collected on this sampling trip due to limited sample volume.

Attachments:

1. Glossary of Data Qualifier Codes
2. List of Acronyms
3. Data Validation Worksheet

Table 1. Digestion and Analysis Methods Used for Rhodia Samples.[1]

Target Analyte	Digestion Method[2]	Analysis Method
Antimony	3010/3050	6010 (ICP)
Arsenic	3010/3050	6010 (ICP)
Barium	3010/3050	6010 (ICP)
Beryllium	3010/3050	6010 (ICP)
Boron	3010/3050	6010 (ICP)
Cadmium	3010/3050	6010 (ICP)
Calcium	3010/3050	6010 (ICP)
Chromium	3010/3050	6010 (ICP)
Chromium $^{6+}$	—[3]	7196 (colorimetric)
Cobalt	3010/3050	6010 (ICP)
Copper	3010/3050	6010 (ICP)
Iron	3010/3050	6010 (ICP)
Lead	3010/3050	6010 (ICP)
Mercury	7470/7471	7470/7471[4] (CVAA)
Nickel	3010/3050	6010 (ICP)
Potassium	3010/3050	7610 (Flame AA)
Selenium	3010/3050	6010 (ICP)
Silver	3010/3050	6010 (ICP)
Sodium	3010/3050	7770 (Flame AA)
Thallium	3010/3050	6010 (ICP)
Titanium	3010/3050	6010 (ICP)
Vanadium	3010/3050	6010 (ICP)
Zinc	3010/3050	6010 (ICP)
Fluoride	EPA 300.0	EPA 300.0 (ion chromatographic)
TCLP	1311[5]	N/A
SPLP	1312[5]	N/A
pH	N/A	EPA 150.1/ SW-846 9045[3]
Oxidation/reduction (mV)	N/A	ASTM D1498-93
Specific gravity	N/A	ASTM D854-83
Total non-filterable residues	N/A	EPA 160.2
Moisture content	N/A	CLP 3/90

[1] All methods are SW-846 methods unless otherwise indicated.

Table 1 (continued).

[2] The first method listed is the digestion method for aqueous matrices (leachates); the second method listed is for solid matrices.

[3] The laboratory found that the samples spattered when the requested alkaline digestion 3060 was attempted. (The digestion was attempted twice with the same results. Instead, the samples were extracted 1:1 with deionized water.

[4] The first method is for aqueous matrices (leachates); the second method is for solid matrices.

[5] Following the leaching procedure, the leachates were digested according to the digestion method listed for each analyte.

Table 2. Rhodia, Inc. Chicago Heights Facility - Sample Results [1]

Laboratory Sample Number	**AP83770**						**AP83771**					
EPA Sample Number	**RCH-1-SP-01**						**RCH-1-SP-02**					
Date Sampled	**09/14/1999**						**09/14/1999**					
Sample Description	**Initial filter press cake**						**Filter press cake**					
Result Type	**Total**		**TCLP**		**SPLP**		**Total**		**TCLP**		**SPLP**	
Units	**mg/kg**		**mg/L**		**mg/L**		**mg/kg**		**mg/L**		**mg/L**	
Target Analyte	**Result**	**DQ [2]**	**Result**	**DQ**	**Result**	**DQ**	**Result**	**DQ**	**Result**	**DQ**	**Result**	**DQ**
Inorganics												
Antimony	0.5		<0.5	U	0.0298		<0.5	U	<0.5	U	<0.025	U
Arsenic	<0.5	U	<0.5	U	<0.005	U	<0.5	U	<0.5	U	<0.005	U
Barium	17.8		<2	U	<0.100	U	6.0		<2	U	<0.100	U
Beryllium	<0.2	U	<0.02	U	<0.002	U	<0.2	U	<0.02	U	<0.002	U
Boron	13.1		<2	U	0.375	J	<10	U	<2	U	0.166	J
Cadmium	6.5		<0.05	U	<0.005	U	6.1		<0.05	U	<0.005	U
Calcium	25100		18.9		3.32		20800		55.5		1.340	
Chromium	111		0.2		0.171		90.8		0.075		0.0222	
Chromium $^{6+}$	<0.4 [3]	U	N/A [4]		<0.02	U	<0.4 [3]	U	N/A [4]		<0.02	U
Cobalt	1.2		<0.05	U	<0.005	U	0.8		<0.05	U	<0.005	U
Copper	3.6		<0.25	U	0.0060		1.9		<0.25	U	0.0035	
Iron	3320		<1	U	<0.050	U	2160		<1	U	0.0629	
Lead	2.4		0.8 [5]		<0.005	U	0.7		<0.5	U	<0.005	U
Mercury	*6.2*		<0.002	U	<0.0002	U	4.6		<0.002	U	<0.0002	U
Nickel	61.1		0.4		0.0072		42.5		1.0		0.0162	
Potassium	<100	U	<10	U	1.7		<100	U	<10	U	1.1	
Selenium	<0.5	U	<0.5	U	0.0084		<0.5	U	<0.5	U	<0.005	U
Silver	<0.1	U	<0.1	U	<0.001	U	<0.1	U	<0.1	U	<0.001	U
Sodium	146000		N/A		5310		59200		N/A		812	
Thallium	<2	U	<2	U	0.0055		<2	U	<2	U	0.0079	
Titanium	61.5	L	<0.05	U	<0.005	U	49.3	L	<0.05	U	<0.005	U
Vanadium	<0.5	U	<0.05	U	<0.005	U	<0.5	U	<0.05	U	<0.005	U
Zinc	10.3		<3	U	<0.100	U	5.2		<3	U	<0.100	U
Fluoride	325		N/A		N/A		58.8		N/A		N/A	
Physical Properties												
pH, pH units	8.8		N/A		N/A		9.4		N/A		N/A	
Oxidation/reduction, O/R	1370000		N/A		N/A		N/A [6]		N/A		N/A	
Specific gravity (unitless)	N/A [7]		N/A		N/A		N/A [8]		N/A		N/A	
Moisture content, %	42.9 [9]		N/A		N/A		71.7		N/A		N/A	
Final pH of leachate	N/A		6.98		9.01		N/A		5.93		9.90	

Laboratory Sample Number	**AP83772**
EPA Sample Number	**RCH-1-SP-03**

Table 2 (continued).

Date Sampled	09/14/1999					
Sample Description	Dust collector filter bags					
Result Type	Total		TCLP		SPLP	
Units	mg/kg		mg/L		mg/L	
Target Analyte	Result	DQ	Result	DQ	Result	DQ
Inorganics						
Antimony	48.8		<0.5	U	0.309	
Arsenic	<0.5	U	<0.5	U	0.0064	
Barium	12.5		<2	U	<0.100	U
Beryllium	<0.2	U	<0.02	U	<0.002	U
Boron	23.0		<2	U	0.765	J
Cadmium	<0.5	U	<0.05	U	<0.005	U
Calcium	344		14.1		1.180	
Chromium	10.9		0.087		0.0297	
Chromium $^{6+}$	<0.4 [3]	U	N/A [4]		<0.02	U
Cobalt	2.8		<0.05	U	<0.005	U
Copper	6.0		<0.25	U	0.0496	
Iron	740		1.4		0.101	
Lead	4.5		<0.5	U	<0.005	U
Mercury	<0.1	U	<0.002	U	<0.0002	U
Nickel	4.8		<0.2	U	0.0077	
Potassium	<100	U	<10	U	2.5	
Selenium	<0.5	U	<0.5	U	0.0091	
Silver	<0.1	U	<0.1	U	<0.001	U
Sodium	142000		N/A		1640	
Thallium	<2	U	<2	U	<0.005	U
Titanium	4.3	L	<0.05	U	<0.005	U
Vanadium	0.6		<0.05	U	0.0084	
Zinc	116		<3	U	<0.100	U
Fluoride	315		N/A		N/A	
Physical Properties						
pH, pH units	10.1		N/A		N/A	
Oxidation/reduction, O/R	1.14 x 10^{10}		N/A		N/A	
Specific gravity (unitless)	2.0		N/A		N/A	
Moisture content, %	22.6		N/A		N/A	
Final pH of leachate	N/A		6.27		10.6	

Laboratory Sample Number	AP83773							
EPA Sample Number	RCH-1-SP-05							
Date Sampled	09/14/1999							
Sample Description	Equipment blank		Method blank - water		Method blank - solid		Leachate blank	
Result Type	Total		Total		Total		TCLP	
Units	mg/L		mg/L		mg/kg		mg/L	
Target Analyte	Result	DQ	Result	DQ	Result	DQ	Result	DQ
Inorganics								
Antimony	<0.005	U	<0.005	U	<0.5	U	<0.5	U
Arsenic	<0.005	U	<0.005	U	<0.5	U	<0.5	U
Barium	<0.005	U	<0.005	U	<0.5	U	<2	U

(continued; footnotes follow)

Table 2 (continued).

Laboratory Sample Number	**AP83773**							
EPA Sample Number	**RCH-1-SP-05**							
Date Sampled	**09/14/1999**							
Sample Description	**Equipment blank**		**Method blank - water**		**Method blank - solid**		**Leachate blank**	
Result Type	**Total**		**Total**		**Total**		**TCLP**	
Units	**mg/L**		**mg/L**		**mg/kg**		**mg/L**	
Target Analyte	**Result**	**DQ**	**Result**	**DQ**	**Result**	**DQ**	**Result**	**DQ**
Beryllium	<0.002	U	<0.002	U	<0.2	U	<0.02	U
Boron	<0.050	U	<0.050	U	<10	U	<2	U
Cadmium	<0.005	U	<0.005	U	<0.5	U	<0.05	U
Calcium	0.211		<0.100	U	<100	U	<2	U
Chromium	<0.005	U	<0.005	U	<0.5	U	<0.05	U
Chromium $^{6+}$	<0.02	UL	<0.020	U	N/A		N/A	
Cobalt	<0.005	U	<0.005	U	<0.5	U	<0.05	U
Copper	<0.005	U	<0.005	U	<0.5	U	<0.25	U
Iron	<0.050	U	<0.050	U	<5	U	<1	U
Lead	0.0032		<0.003	U	<0.5	U	<0.5	U
Mercury	<0.0002	U	<0.0002	U	<0.1	U	<0.002	U
Nickel	<0.005	U	<0.005	U	<0.5	U	<0.2	U
Potassium	<1	U	<1	U	<100	U	<10	U
Selenium	<0.005	U	<0.005	U	<0.5	U	<0.5	U
Silver	<0.001	U	<0.001	U	<0.1	U	<0.2	U
Sodium	<1	U	<1	U	<100	U	N/A	
Thallium	<0.005	U	<0.005	U	<2	U	<2	U
Titanium	<0.005	U	<0.005	U	<0.5	U	<0.1	U
Vanadium	<0.005	U	<0.005	U	<0.5	U	<0.05	U
Zinc	<0.050	U	<0.050	U	<5	U	<3	U
Fluoride	<0.1	U	<0.1	U	<10	U	N/A	
Physical Properties								
pH, pH units	3.4		N/A		N/A		N/A	
Oxidation/reduction, O/R	279		N/A		N/A		N/A	
Specific gravity (unitless)	1.0		201.9		N/A		N/A	
Total non-filterable residues, mg/L	<10	U	<10		N/A		N/A	

[1] < = Less than the reporting limit specified. N/A = Not analyzed.

[2] DQ = Data Qualifier.

[3] The laboratory reported that the sample spattered when the alkaline digestion for hexavalent chromium was attempted. (The digestion was attempted twice with the same results.) ; Instead the samples were extracted 1:1 with deionized water and the extract was analyzed. The result is reported as mg/L.

[4] TCLP/SPLP extraction was conducted using deionized water at a 20:1 ratio (deionized water:sample); therefore, the laboratory reported the result as SPLP leachate.

[5] The sample was analyzed in duplicate; the duplicate result for TCLP lead was 0.007 mg/L (<0.5 mg/L).

[6] A matrix effect hindered the initial analysis of this sample, and the laboratory had insufficient sample volume to reanalyze the sample.

[7] The report moisture content (see footnote 9) led to the determination of a negative specific gravity for this sample. If a moisture content of zero was assumed, the laboratory calculated the specific gravity to be 2.9.

[8] The laboratory had insufficient sample volume to conduct specific gravity analysis.

[9] The laboratory believes that this result is erroneous, due to the outgassing of the sample. The laboratory stated that their was no apparent moisture in the sample.

Table 3. Matrix Spike/Matrix Spike Duplicate Results - Total Inorganics

Sample ID: RCH-1-SP-01

Analyte	MS Recovery, %	MSD Recovery, %	% RPD	Action [1]
Antimony	93.1	92.0	1.2	None
Arsenic	92.8	90.4	2.6	None
Barium	93.2	91.8	1.1	None
Beryllium	90.1	89.4	0.8	None
Boron	90.5	91.2	0.6	None
Cadmium	85.5	85.3	0.2	None
Calcium	62.3	76.0	2.6	None [2]
Chromium	84.0	77.3	2.2	None
Chromium $^{6+}$	101	116	13.9	None
Cobalt	89.2	87.8	1.5	None
Copper	100.7	98.7	1.9	None
Iron	3.0	-7.2	0.6	None [2]
Lead	90.6	89.5	1.1	None
Mercury	139	187	4.2	None [2]
Nickel	85.5	82.0	1.7	None
Potassium	98.6	98.4	0.2	None
Selenium	83.7	82.8	1.1	None
Silver	91.7	90.0	1.9	None
Sodium	186	-76.0	8.8	None [2]
Thallium	93.0	91.0	2.2	None
Titanium	70.5	69.2	0.6	L - positive results; UL - non-detect results
Vanadium	94.4	93.2	1.2	None
Zinc	95.5	93.4	1.8	None
Fluoride	87.3	87.5	0.1	None

Sample ID: RCH-1-SP-05

Analyte	MS Recovery, %	MSD Recovery, %	% RPD	Action [1]
Fluoride	92.0	96.3	4.5	None

[1] QC limits are 75-125% recovery and 0-25% RPD (relative percent difference).

[2] No action taken as sample concentration greatly exceeded spike concentration.

Inorganics, Laboratory Duplicate
Sample ID: RCH-1-SP-01

Analyte	Sample Result	Duplicate Result	% RPD	Action [1]
Moisture content, %	42.9	38.4	11.1%	None
pH, pH units	8.76	8.72	0.5%	None

Inorganics, Laboratory Duplicate
Sample ID: RCH-1-SP-05

Analyte	Sample Result	Duplicate Result	% RPD	Action [1]
Oxidation/reduction, mV	13.7	14.1	2.9%	None

[1] QC limits are 0-25% RPD (relative percent difference).

Table 4. Matrix Spike/Matrix Spike Duplicate Results - TCLP Inorganics

Analyte	**Sample ID: RCH-1-SP-01**			**Action** [1]
	MS Recovery, %	**MSD Recovery, %**	**RPD, %**	
Antimony	98.4	97.6	0.9	None
Arsenic	100.7	100.6	0.0	None
Barium	101.7	100.7	1.0	None
Beryllium	95.1	94.2	1.0	None
Boron	88.5	308.4	96.3	None [2]
Cadmium	98.0	97.9	0.1	None
Calcium	100.6	99.9	0.7	None
Chromium	97.1	98.0	0.8	None
Cobalt	93.7	93.2	0.5	None
Copper	108.5	110.0	1.3	None
Iron	96.7	97.6	1.0	None
Lead	81.5	81.5	0.0	None
Mercury	100	100	0.3	None
Nickel	94.2	94.2	0.0	None
Potassium	112	116	3.5	None
Selenium	95.6	96.0	0.4	None
Silver	103.0	102.5	0.5	None
Thallium	98.5	98.6	0.1	None
Titanium	97.4	96.9	0.5	None
Vanadium	101.1	100.4	0.7	None
Zinc	112.6	110.1	2.3	None

[1] QC limits are 75-125% recovery and 0-25% RPD.

[2] No action necessary as TCLP boron was not detected in RCH-1-SP-01, RCH-1-SP-02, or RCH-1-SP-03.

Table 5. Matrix Spike/Matrix Spike Duplicate Results - SPLP Inorganics

Analyte	Sample ID: RCH-1-SP-01			Action [1]
	MS Recovery, %	MSD Recovery, %	RPD, %	
Antimony	87.6	83.6	4.0	None
Arsenic	98.9	97.1	1.8	None
Barium	89.2	87.6	1.8	None
Beryllium	84.0	82.4	1.9	None
Boron	98.8	97.1	0.7	None
Cadmium	86.2	83.9	2.7	None
Calcium	86.6	84.5	2.1	None
Chromium	87.8	85.4	1.6	None
Chromium $^{6+}$	100	95.3	4.8	None
Cobalt	87.3	85.4	2.3	None
Copper	105.5	103.4	1.9	None
Iron	89.4	86.3	3.5	None
Lead	88.1	85.6	2.9	None
Mercury	106	105	1.0	None
Nickel	83.2	81.6	1.9	None
Potassium	100	99.1	0.7	None
Selenium	87.9	87.2	0.7	None
Silver	102.6	100.4	2.2	None
Sodium	-648	516	5.5	None [2]
Thallium	80.9	80.6	0.4	None
Titanium	87.2	85.9	1.6	None
Vanadium	88.4	86.8	1.8	None
Zinc	109.1	106.2	2.6	None

[1] QC limits are 75-125% recovery and 0-25% RPD (relative percent difference).

[2] No action was taken as the sample concentration greatly exceeded the spike concentration.

Table 6. Laboratory Control Sample (LCS) Results - Inorganics Water Matrix

Analyte	**LCS Recovery, %** [1]		**QC Limits** [2]	**Compliant?**
	LCSW-1	**LCSW-2**		
Antimony	99.3	100.8	80-120	Yes
Arsenic	99.6	101.9	80-120	Yes
Barium	104.4	105.2	80-120	Yes
Beryllium	101.7	100.5	80-120	Yes
Boron	100.5	131.6	80-120	No [3]
Cadmium	102.6	103.5	80-120	Yes
Calcium	106.0	105.4	80-120	Yes
Chromium	105.0	105.9	80-120	Yes
Chromium $^{6+}$	98.0	101 (9/21/99)	80-120	Yes
Cobalt	101.7	102.9	80-120	Yes
Copper	102.9	104.1	80-120	Yes
Iron	104.6	109.7	80-120	Yes
Lead	102.6	103.8	80-120	Yes
Mercury	100 (9/29/99)	—	80-120	Yes
Nickel	103.5	103.6	80-120	Yes
Potassium	105 (9/26/99)	104 (9/26/99)	80-120	Yes
Selenium	94.4	96.7	80-120	Yes
Silver	99.9	101.9	80-120	Yes
Sodium	104 (9/26/99)	98.0 (9/26/99)	80-120	Yes
Thallium	98.9	100.0	80-120	Yes
Titanium	98.7	99.8	80-120	Yes
Vanadium	105.3	106.5	80-120	Yes
Zinc	108.6	111.0	80-120	Yes
Fluoride	95.5	97.5 (10/11/99)	80-120	Yes

[1] Samples were analyzed 9/25/99 unless otherwise indicated in parentheses.

[2] QC limits reported by laboratory.

[3] No qualification of data necessary as boron was not detected in the aqueous sample (RCH-1-SP-05).

Table 7. Laboratory Control Sample (LCS) Results - Inorganics Solid Matrix

Analyte	LCS Recovery, % [1]		QC Limits [2]	Compliant?
	1	2		
Antimony	91.8	93.9	80-120	Yes
Arsenic	90.7	91.9	80-120	Yes
Barium	96.7	98.5	80-120	Yes
Beryllium	98.4	100.6	80-120	Yes
Boron	98.1	95.3	80-120	Yes
Cadmium	96.5	98.0	80-120	Yes
Calcium	99.6	101.7	80-120	Yes
Chromium	100.6	102.6	80-120	Yes
Cobalt	95.3	97.2	80-120	Yes
Copper	102.5	104.3	80-120	Yes
Iron	100.2	103.4	80-120	Yes
Lead	95.8	97.4	80-120	Yes
Mercury	103 (9/28/99) 101 (10/7/99)	104 (9/28/99)	80-120	Yes
Nickel	96.3	97.1	80-120	Yes
Potassium	96.3 (9/27/99)	98.7 (9/27/99)	80-120	Yes
Selenium	81.9	83.1	80-120	Yes
Silver	91.1	92.3	80-120	Yes
Sodium	94.4 (9/27/99)	99.1 (9/27/99)	80-120	Yes
Thallium	89.0	90.8	80-120	Yes
Titanium	100.9	105.0	80-120	Yes
Vanadium	99.9	102.3	80-120	Yes
Zinc	98.0	100.9	80-120	Yes
Fluoride	100	102 (10/7/99)	80-120	Yes

[1] Samples were analyzed 9/26/99 unless otherwise indicated in parentheses.

[2] QC limits reported by laboratory.

Table 8. Laboratory Control Sample (LCS) Results - TCLP Inorganics

Analyte	**LCS Recovery, % (Extraction Fluid #2)** [1]	**QC Limits** [2]	**Compliant?**
Antimony	99.8	80-120	Yes
Arsenic	102.2	80-120	Yes
Barium	109.1	80-120	Yes
Beryllium	96.3	80-120	Yes
Boron	105.6	80-120	Yes
Cadmium	100.1	80-120	Yes
Calcium	102.9	80-120	Yes
Chromium	99.4	80-120	Yes
Cobalt	94.2	80-120	Yes
Copper	103.3	80-120	Yes
Iron	102.0	80-120	Yes
Lead	99.0	80-120	Yes
Mercury	101 (10/7/99)	80-120	Yes
Nickel	96.6	80-120	Yes
Potassium	104	80-120	Yes
Selenium	100.6	80-120	Yes
Silver	104.1	80-120	Yes
Thallium	94.5	80-120	Yes
Titanium	101.3	80-120	Yes
Vanadium	102.8	80-120	Yes
Zinc	183.1, 132.0	80-120	No [3]

[1] Sample was analyzed 10/6/99 unless otherwise indicated in parentheses.

[2] QC limits reported by laboratory.

[3] No action necessary as TCLP zinc was not detected in the affected samples (RCH-1-SP-01, RCH-1-SP-02, and RCH-1-SP-03).

Table 9. Laboratory Control Sample (LCS) Results - SPLP Inorganics

Analyte	**LCS Recovery, %** [1]	**QC Limits** [2]	**Compliant?**
Antimony	101.0	80-120	Yes
Arsenic	94.2	80-120	Yes
Barium	100.2, 137.0	80-120	No [3]
Beryllium	96.1	80-120	Yes
Boron	123.6, 77.8	80-120	No [4]
Cadmium	96.4	80-120	Yes
Calcium	99.1	80-120	Yes
Chromium	99.2	80-120	Yes
Chromium $^{6+}$	94.7, 98.0 (10/1/99)	80-120	Yes
Cobalt	95.4	80-120	Yes
Copper	100.4	80-120	Yes
Iron	99.9	80-120	Yes
Lead	96.3	80-120	Yes
Mercury	98.5, 99.9 (10/7/99)	80-120	Yes
Nickel	96.8	80-120	Yes
Potassium	105	80-120	Yes
Selenium	88.1	80-120	Yes
Silver	98.9	80-120	Yes
Sodium	102, 106 (10/4/99)	80-120	Yes
Thallium	93.7	80-120	Yes
Titanium	101.7	80-120	Yes
Vanadium	99.2	80-120	Yes
Zinc	114.7	80-120	Yes

[1] Samples were analyzed 10/6/99 unless otherwise indicated in parentheses.

[2] QC limits reported by laboratory.

[3] No qualification of data was necessary as SPLP barium was not detected in RCH-1-SP-01, RCH-1-SP-02, or RCH-1-SP-03.

[4] Positive results for SPLP boron in RCH-1-SP-01, RCH-1-SP-02, and RCH-1-SP-03 were qualified as estimated (J).

ATTACHMENT 1

Glossary of Data Qualifier Codes

(continued; footnotes follow)

GLOSSARY OF DATA QUALIFIERS CODES

Code	Definition
Codes Relating to Identification	
(NO CODE)	Confirmed identification.
U	Not detected. The associated number indicates approximate sample concentration necessary to be detected.
B	Detected at greater than the reporting limit but not substantially above the level reported in laboratory or field blanks.
R	Results are rejected. Analyte may or may not be present in the sample. Supporting data necessary to confirm result.
Codes Relating to Quantitation	
J	Analyte present. Reported value may not be accurate or precise. This qualifier is applied in cases where the relative percent difference between duplicate analyses (matrix spike/matrix spike duplicate, laboratory duplicate, and/or field duplicate) is outside the QC limits.
K	Analyte present. Reported value may be biased high. Actual value is expected to be lower. This qualifier is applied in cases where the matrix spike, post-digestion spike, or laboratory control sample recovery is higher than the QC limits.
L	Analyte present. Reported value may be biased low. Actual value is expected to be higher. This qualifier is applied in cases where samples were analyzed outside holding times, or where the matrix spike, post-digestion spike, or laboratory control sample recovery is lower than the QC limits.
UJ	Not detected; reporting limit may be inaccurate or imprecise. This qualifier is applied in cases where the relative percent difference between duplicate analyses (matrix spike/matrix spike duplicate, laboratory duplicate, and/or field duplicate) is outside the QC limits.
UL	Not detected; reporting limit is probably higher. This qualifier is applied in cases where samples were analyzed outside holding times, or where the matrix spike, post-digestion spike, or laboratory control sample recovery is lower than the QC limits.

(continued; footnotes follow)

ATTACHMENT 2

List of Acronyms

(continued; footnotes follow)

AA	Atomic Absorption Spectroscopy
AL	Action Level
ASTM	American Society for Testing and Materials
CBI	Confidential Business Information
CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
COC	Chain of Custody
CVAA	Cold Vapor Atomic Absorption Spectroscopy
%D	Percent Difference
DOT	Department of Transportation
DQ	Data Qualifier
DQA	Data Quality Assessment
DQO	Data Quality Objectives
EPA	Environmental Protection Agency
GC/MS	Gas Chromatography/Mass Spectrometry
GFAA	Gas Furnace Atomic Absorption Spectroscopy
HRGC	High Resolution Gas Chromatography
HRMS	High Resolution Mass Spectrometry
ICB	Initial Calibration Blank
ICP	Inductively Coupled Argon Plasma Spectroscopy
ICS	Interference Check Sample
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
IS	Internal Standard
LCS	Laboratory Control Sample
MDL	Method Detection Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PAH	Polynuclear Aromatic Hydrocarbon
PDS	Post-Digestion Spike
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QC	Quality Control
%R	Percent Recovery
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
RT	Retention Time
SAP	Sampling and Analysis Plan
SR	Sample result
SA	Spike added
SOP	Standard Operating Procedure
SPLP	Synthetic Precipitation Leaching Procedure
SVOC	Semi-Volatile Organic Compound
TCLP	Toxicity Characteristic Leaching Procedure
VOC	Volatile Organic Compound

(continued; footnotes follow)

ATTACHMENT 3

Data Validation Worksheet

(continued; footnotes follow)

REVIEW OF LABORATORY DATA PACKAGE - INORGANICS
INORGANIC CHEMICALS LISTING DETERMINATION

The hardcopied APPL, Inc. data package has been reviewed and the quality assurance and performance data summarized. The data review included:

Analytical Request Form Number:	31124	Sampling Date(s):	9/14/99
Matrix:	solid/water	Shipping Date(s):	9/14/99
No. of Samples:	3/1	Date Rec'd by Lab:	9/15/99
Sample No.:	RCH-1-SP-01, RCH-1-SP-02, RCH-1-SP-03, RCH-1-SP-05		
Equipment Blank No.:	RCH-1-SP-05		
Field Blank No.:	None		
Field Duplicate Nos:	None		

Samples were analyzed using SW-846 Methods 1311, 1312, 6010, 7196, 7470, 7471, 7610, and 7770, and EPA method 300.0. These methods require that specific analytical work be done. The general criteria used to determine the performance were based on an examination of:

-Data Completeness/Reasonableness
-Holding Times
-Calibrations
-Blanks
-ICP Interference Check Results
-Matrix Spike Recoveries
-Post-Digestion Spike Recoveries
-Laboratory Duplicates
-Field Duplicates
-Lab Control Sample Results
-Furnace AA Results
-ICP Serial Dilution Results
-Detection Limit Results
-Sample Quantitation

Overall Comments: An insufficient sample was available for collection for RCH-1-SP-02, the sample designated to be collected in duplicate for the field duplicate pair. Because of insufficient sample volume, analysis for specific gravity could not be completed for this sample, and oxidation/reduction analysis was hindered by a matrix effect. (Insufficient sample volume prevented re-analysis of the sample.). The laboratory reported that the solid samples spattered when the alkaline digestion for hexavalent chromium was attempted. (The digestion was attempted twice with the same results.); Instead, the samples were extracted 1:1 with deionized water and the extract was analyzed. The laboratory reported that sample RCH-1-SP-01 was off-gassing which prevented the accurate determination of specific gravity.

Definitions and Qualifiers:

J - Approximate data due to quality control criteria.
K - Results biased high.
L - Results biased low.
R - Reject data due to quality control criteria.
U - Compound not detected.

(continued; footnotes follow)

REVIEW OF LABORATORY DATA PACKAGE - INORGANICS
INORGANIC CHEMICALS LISTING DETERMINATION
Reviewer: Kelly Luck Date: November 12, 1999

(continued; footnotes follow)

IV. DATA COMPLETENESS/REASONABLENESS

A. Completeness: Except as reported below, all required information was included in the data packages, including supporting raw data.

MISSING/INCORRECT INFORMATION	DATE LAB CONTACTED	DATA RECEIVED
Results for total metals in solid samples were corrected for moisture content.	11/1/99	11/1/99 (fax)
MS/MSD results for RCH-1-SP-01, ICP metals were not reported	11/8/99	Results were reported in another data package (Degussa)
Case narrative did not contain information about problems with sample analysis due to alkalinity (hex. chrome) or insufficient sample volume	11/8/99	11/11/99 (fax)

Was the sample collection plan outlined in the SAP followed (all samples that were to be collected were collected, all field QC samples to be collected were collected, etc.)?
No, please - see trip report. Insufficient sample volume was available at the facility for RCH-1-SP-02, preventing collection of the other sample of the field duplicate pair, and restricting the analyses that could be completed on the sample. The laboratory was able to perform all requested analyses on this sample with the exception of specific gravity and oxidation/reduction.

B. Reasonableness:

Were results for TCLP and SPLP consistent with total results (in consideration of the minimum 20-fold dilution factor)?
Yes, with the exception of TCLP lead in RCH-1-SP-01 (0.8 mg/L versus 2.4 mg/kg total lead). This sample was analyzed in duplicate and the duplicate result for TCLP lead was 0.0071 mg/L.

(continued; footnotes follow)

V. HOLDING TIMES Complete table for all samples.

Sample ID	Date Sampled	Analyte	Preparation Date	Analysis Date
RCH-1-SP-01	9/14/99	oxidation/reduction	10/13/99	10/13/99
		specific gravity	10/5/99	10/5/99
		moisture	9/17/99	9/17/99
		pH	9/17/99	9/17/99
		fluoride	10/7/99	10/15/99
		Cr^{6+}	9/21/99	9/21/99
		SPLP Cr^{6+}	10/1/99	10/1/99
		metals except mercury	9/24/99	9/25/99 (9/27/99 for Na and K)
		mercury	10/1/99	10/7/99
		TCLP extraction	—	10/1/99
		TCLP metals except mercury	10/4/99	10/6/99 (10/8/99 for K)
		TCLP mercury	10/6/99	10/7/99
		SPLP extraction	—	9/29/99
		SPLP metals except mercury	10/1/99	10/6/99 (10/4/99 for Na and K)
		SPLP mercury	10/5/99	10/7/99
RCH-1-SP-02	9/14/99	moisture	9/17/99	9/17/99
		pH	9/17/99	9/17/99
		fluoride	10/7/99	10/15/99
		Cr^{6+}	9/21/99	9/21/99
		SPLP Cr^{6+}	10/1/99	10/1/99
		metals except mercury	9/24/99	9/25/99 (9/27/99 for Na and K)
		mercury	9/27/99	9/28/99
		TCLP extraction	—	10/1/99
		TCLP metals except mercury	10/4/99	10/6/99 (10/8/99 for K)
		TCLP mercury	10/6/99	10/7/99
		SPLP extraction	—	9/29/99
		SPLP metals except mercury	10/1/99	10/6/99 (10/4/99 for Na and K)
		SPLP mercury	10/5/99	10/7/99

(continued; footnotes follow)

Sample ID	Date Sampled	Analyte	Preparation Date	Analysis Date
RCH-1-SP-03	9/14/99	oxidation/reduction	10/13/99	10/13/99
		specific gravity	10/5/99	10/5/99
		moisture	9/17/99	9/17/99
		pH	9/17/99	9/17/99
		fluoride	10/7/99	10/14/99
		Cr^{6+}	9/21/99	9/21/99
		SPLP Cr^{6+}	10/1/99	10/1/99
		metals except mercury	9/24/99	9/25/99 (9/27/99 for Na and K)
		mercury	9/27/99	9/28/99
		TCLP extraction	—	10/1/99
		TCLP metals except mercury	10/4/99	10/6/99 (10/8/99 for K)
		TCLP mercury	10/6/99	10/7/99
		SPLP extraction	—	9/29/99
		SPLP metals except mercury	10/1/99	10/6/99 (10/4/99 for Na and K)
		SPLP mercury	10/5/99	10/7/99
RCH-1-SP-05	9/14/99	oxidation/reduction	10/13/99	10/13/99
		specific gravity	10/11/99	10/11/99
		pH	9/17/99	9/17/99
		total non-filterable residues	9/20/99	9/20/99
		fluoride	10/7/99	10/7/99
		Cr^{6+}	9/21/99	9/21/99
		metals except mercury	9/24/99	9/25/99 (9/26/99 for Na and K)
		mercury	9/28/99	9/29/99

Metals - 180 days from sample collection
Mercury - 28 days from sample collection
TCLP & SPLP - 180 days from sample collection to extraction and 180 days from extraction to analysis for total metals
- 28 days from sample collection to extraction for mercury
$Chromium^{6+}$ - one month from sample collection to extraction and 4 days from extraction to analysis for solid samples
- 24 hours from sample collection to analysis for aqueous samples
Fluoride - 28 days from sample collection
TSS - 7 days from sample collection

ACTIONS: Holding time for Cr^{6+} was exceeded in sample RCH-1-SP-05; sample results were qualified as estimated with a low bias (L(+);UL(ND)).

NOTE: Extraction fluid #2 was used for TCLP metal extraction of RCH-1-SP-01, RCH-1-SP-02, and RCH-1-SP-03. Extraction fluid #1 was used for SPLP metal extractions.

(continued; footnotes follow)

Action: 1. If holding times are exceeded all positive results are estimated with a low bias (L) and non-detects are estimated with a low bias (UL).

2. If holding times are grossly exceeded (>2x), all results are qualified unusable (R).

(continued; footnotes follow)

VI. INSTRUMENT CALIBRATION

1. Recovery Criteria

List the analyses which did not meet the percent recovery (%R) criteria for Initial or Continuing Calibration.

ANALYSIS	ICV/CCV#	ANALYTE	%R	ACTION	SAMPLES AFFECTED

ACTIONS: None; all criteria met.

If any analyte does not meet the %R criteria follow the actions stated below:

Positive Results	Non-detected Results	%R	
		Methods 6010, 7196, and 300.0	Methods 7470, 7471, 7610, and 7770
L	UL	<90	<80
K		>110	>120

$$\text{Recovery (\%)} = \frac{\text{QC Result}}{\text{True Value}} \times 100$$

(continued; footnotes follow)

III. INSTRUMENT CALIBRATION (Section 2)

2. Analytical Sequence

A. Did the laboratory use the proper number of standards for calibration as described in method?
Yes

B. Were calibrations performed at the beginning of each analysis? Yes

C. Were calibration standards analyzed at the beginning of sample analysis and at a minimum frequency of ten percent or every two hours during analysis, whichever is more frequent? Yes

D. Were the correlation coefficients for the calibration curves for Hg, nitrate, nitrite, ammonia, sodium, potassium, TOC, hexavalent chromium, and CN $ 0.995?
Yes

ACTION: None; all criteria met.

1. If the minimum number of standards were not used for initial calibration or if the instrument was not calibrated daily and each time the instrument was set up, reject the associated data (R).

2. If the correlation coefficient is <0.995, qualify results >IDL as estimated (J), and results <IDL as estimated (UJ).

(continued; footnotes follow)

REVIEW OF LABORATORY DATA PACKAGE - INORGANICS
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VII. BLANK ANALYSIS RESULTS (Section 1)

List the blank contamination in Section 1 below.

1. Laboratory Blanks

ANALYSIS: Total

DATE	ICB/CCB#	PREP BL	ANALYTE	CONC/UNITS

ANALYSIS: TCLP

DATE	ICB/CCB#	PREP BL	ANALYTE	CONC/UNITS

ANALYSIS: SPLP

DATE	ICB/CCB#	PREP BL	ANALYTE	CONC/UNITS

(continued; footnotes follow)

IV. BLANK ANALYSIS RESULTS (Section 2)

List the blank contamination in Section 2 below.

2. Equipment/Trip Blanks

SAMPLE NUMBER	ANALYTE	CONCENTRATION/ UNITS
RCH-1-SP-05	total calcium	0.211 mg/L
	total lead	0.0032 mg/L

3. Frequency Requirements

A. Was a preparation blank analyzed for each matrix, for every 20 samples and for each digestion batch? Yes

B. Was a calibration blank run every 10 samples or every 2 hours whichever is more frequent (inorganics analyses only)? Yes

C. Were the ICB/CCB results <3xIDL (Method 6010 only)? Yes

If not, were samples reanalyzed? ____

If no, the data may be affected. Use professional judgement to determine the severity of the effect and qualify the data accordingly. Discuss any actions below and list the samples affected.

(continued; footnotes follow)

IV. BLANK ANALYSIS RESULTS (Section 4)

4. Blank Actions

The Action Level for any analyte is equal to five times the highest concentration of that element's contamination in any blank. The action level for samples that have been concentrated or diluted should be multiplied by the concentration/dilution factor. No positive sample results should be reported unless the concentration of the analyte in the sample exceeds the Action Level (AL). Specific actions are as follows:

1. When the concentration is greater than the IDL, but less than the Action Level, report the sample concentration detected with a B.

2. When the sample concentration is greater than the Action Level, report the sample concentration unqualified.

ANALYTE	MAX. CONC. (mg/L)	AL (mg/L)	ANALYTE	MAX. CONC./UNITS	AL/UNITS
Total calcium	0.211	1.055			
Total lead	0.0032	0.016			

ACTION: None; all results for the affected analyses were much greater than the action levels.

(continued; footnotes follow)

V. ICP INTERFERENCE CHECK SAMPLE (Section 1 & 2)

1. Recovery Criteria

List any elements in the ICS AB solution which did not meet the criteria for %R.

DATE	ELEMENT	%R	ACTION	SAMPLES AFFECTED

$$\text{Recovery (\%)} = \frac{\text{QC Result}}{\text{True Value}} \times 100$$

ACTIONS: None; all criteria met.

For samples with concentrations of Al, Ca, Mg, and Fe or other potential interferents which are 50% or more than their respective levels in the ICS, the following actions apply if an element does not meet the %R criteria:

%R	Positive results	Non-detected results
<50%	R	R
50-79%	L	UL
>120%	K	

2. Frequency Requirements

Were Interference QC samples run at the beginning of each sample analysis run? Yes

If no, the data may be affected. Use professional judgement to determine the severity of the effect and qualify the data accordingly. Discuss any actions below and list the samples affected.

(continued; footnotes follow)

REVIEW OF LABORATORY DATA PACKAGE - INORGANICS
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VI. MATRIX SPIKE/MATRIX SPIKE DUPLICATE (Section 1 & 2)

Sample No.: RCH-1-SP-01 Analysis: Total

1. Recovery Criteria

List the percent recoveries for analyses which did not meet the required criteria.

$$Recovery\ (\%) = \frac{(SSR-SR)}{SA} \times 100$$

where SSR = Spiked sample result
SR = Sample result
SA = Spike added

ANALYTE	SAMPLE	SSR	SR	SA	%R	ACTION
Calcium	MS	25649.5996	22534.6426	5000	62.3	None; see 1 below
Iron	MS	3322.7864	3316.7280	200	3.0	None; see 1 below
	MSD	3302.2925			-7.2	
Mercury	MS	7.0688	6.1792	0.64	139	None; see 1 below
	MSD	7.3728			187	
Sodium	MS	155000	145700	5000	186	None; see 1 below
	MSD	141900			-76.0	
Titanium	MS	96.7559	61.5286	50	70.5	L(+);UL(ND)
	MSD	96.1523			69.2	

Matrix Spike Actions apply to all samples of the same matrix.

ACTIONS: See table above. In addition, the laboratory ran duplicate analyses for moisture content and pH; all results were within criteria. Sample RCH-1-SP-05 was used for duplicate analyses for oxidation/reduction; the result was within criteria.

1. If the sample concentration exceeds the spike concentration by a factor of 4 of more, no action is taken.

2. If any analyte does not meet the %R criteria, follow the actions stated below:

Positive Results	Non-detected Results	%R	
		Metals/CN	Ammonia/Nitrate/Nitrite
L/R [1]	R	<50%	<50%
L	UL	50-74%	50-79%
K		>125%	>120
K/R [1]		>135%	>135

[1] Professional judgement will be used to determine the appropriate data qualifier.

2. Frequency Criteria

A. Was a matrix spike prepared at the required frequency? Yes

(continued; footnotes follow)

A separate worksheet should be used for each matrix spike pair.

(continued; footnotes follow)

REVIEW OF LABORATORY DATA PACKAGE - INORGANICS
INORGANIC CHEMICALS LISTING DETERMINATION
VI. MATRIX SPIKE/MATRIX SPIKE DUPLICATE (Section 1 & 2)

Sample No.: RCH-1-SP-01

Analysis: TCLP

1. Recovery Criteria

List the percent recoveries for analyses which did not meet the required criteria.

$$Recovery\ (\%) = \frac{(SSR-SR)}{SA} \times 100$$

where SSR = Spiked sample result
SR = Sample result
SA = Spike added

ANALYTE	SAMPLE	SSR	SR	SA	%R	ACTION
Boron	MSD	16.9117	1.4967	1	308.4	K(+)

Matrix Spike Actions apply to all samples of the same matrix.

ACTIONS: See table above.

1. If the sample concentration exceeds the spike concentration by a factor of 4 of more, no action is taken.

2. If any analyte does not meet the %R criteria, follow the actions stated below:

Positive Results	Non-detected Results	%R	
		Metals/CN	Ammonia/Nitrate/Nitrite
L/R [1]	R	<50%	<50%
L	UL	50-74%	50-79%
K		>125%	>120
K/R [1]		>135%	>135

[1] Professional judgement will be used to determine the appropriate data qualifier.

2. Frequency Criteria

A. Was a matrix spike prepared at the required frequency? Yes

A separate worksheet should be used for each matrix spike pair.

(continued; footnotes follow)

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VI. MATRIX SPIKE/MATRIX SPIKE DUPLICATE (Section 1 & 2)

Sample No.: RCH-1-SP-01

Analysis: SPLP

1. Recovery Criteria

List the percent recoveries for analyses which did not meet the required criteria.

$$Recovery\ (\%) = \frac{(SSR - SR)}{SA} \times 100$$

where SSR = Spiked sample result
SR = Sample result
SA = Spike added

ANALYTE	SAMPLE	SSR	SR	SA	%R	ACTION
Sodium	MS	5145	5307	25	-648	None; see 1 below.
	MSD	5436			516	

Matrix Spike Actions apply to all samples of the same matrix.

ACTIONS:

1. If the sample concentration exceeds the spike concentration by a factor of 4 of more, no action is taken.

2. If any analyte does not meet the %R criteria, follow the actions stated below:

Positive Results	Non-detected Results	%R	
		Metals/CN	Ammonia/Nitrate/Nitrite
L/R [1]	R	<50%	<50%
L	UL	50-74%	50-79%
K		>125%	>120
K/R [1]		>135%	>135

[1] Professional judgement will be used to determine the appropriate data qualifier.

2. Frequency Criteria

A. Was a matrix spike prepared at the required frequency? Yes

A separate worksheet should be used for each matrix spike pair.

(continued; footnotes follow)

VI. MATRIX SPIKE/MATRIX SPIKE DUPLICATE (Section 3)

3. Duplicate Criteria

Sample No.: RCH-1-SP-01 Analysis: Total

List the relative percent difference (RPD) for analyses which did not meet the required criteria.

$$RPD\ (\%) = \frac{|MS-MSD|}{(MS+MSD)/2} \times 100$$

where RPD = Relative percent difference
MS = Matrix spike value
MSD = Matrix spike duplicate value

ANALYTE	MS	MSD	RPD	ACTION

Matrix Spike Actions apply to all samples of the same matrix.

ACTIONS: None; all criteria met. In addition, the laboratory ran duplicate analyses for moisture content and pH; all results were within criteria. Sample RCH-1-SP-05 was used for duplicate analyses for oxidation/reduction; the result was within criteria.

1. For positive results which have an RPD >25%, use professional judgement to determine whether to estimate (J) or reject (R) the results.

A separate worksheet should be used for each matrix spike pair.

(continued; footnotes follow)

VI. MATRIX SPIKE/MATRIX SPIKE DUPLICATE (Section 3)

3. Duplicate Criteria

Sample No.: RCH-1-SP-01

Analysis: TCLP

List the relative percent difference (RPD) for analyses which did not meet the required criteria.

$$RPD\ (\%) = \frac{|MS - MSD|}{(MS+MSD)/2} \times 100$$

where RPD = Relative percent difference
MS = Matrix spike value
MSD = Matrix spike duplicate value

ANALYTE	MS	MSD	RPD	ACTION
Boron	5.9228	16.9177	96.3	J(+)

Matrix Spike Actions apply to all samples of the same matrix.

ACTIONS: See table above.

1. For positive results which have an RPD >25%, use professional judgement to determine whether to estimate (J) or reject (R) the results.

A separate worksheet should be used for each matrix spike pair.

(continued; footnotes follow)

VI. MATRIX SPIKE/MATRIX SPIKE DUPLICATE (Section 3)

3. Duplicate Criteria

Sample No.: RCH-1-SP-01

Analysis: SPLP

List the relative percent difference (RPD) for analyses which did not meet the required criteria.

$$RPD\ (\%) = \frac{|MS - MSD|}{(MS+MSD)/2} \times 100$$

where RPD = Relative percent difference
MS = Matrix spike value
MSD = Matrix spike duplicate value

ANALYTE	MS	MSD	RPD	ACTION

Matrix Spike Actions apply to all samples of the same matrix.

ACTIONS: None; all criteria met.

1. For positive results which have an RPD >25%, use professional judgement to determine whether to estimate (J) or reject (R) the results.

A separate worksheet should be used for each matrix spike pair.

(continued; footnotes follow)

REVIEW OF LABORATORY DATA PACKAGE - INORGANICS
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VII. POST-DIGESTION SPIKE RESULTS (Section 1 & 2)

Sample ID RCH-1-SP-01

Analysis: Total

1. List the percent recoveries for analyses which did not meet the required criteria in the post-digestion spike sample.

S - amount of spike added
SSR - spiked sample result
SR - sample result

SAMPLE	ANALYTE	SSR	SR	S	%R	ACTION
	Ti	79.8970	61.5286	25	73.5	L(+);UL(ND)

Post-Digestion Spike Actions apply to all samples of the same matrix.

ACTIONS: See table above. Although the laboratory conducted post-digestion spike analyses for all ICP analyses, post-digestion spike results were only reported for analyses for which matrix spike recovery failed.

1. If the sample concentration exceeds the spike concentration by a factor of 4 of more, no action is taken.

2. If any analyte does not meet the %R criteria, follow the actions stated below:

Positive results	Non-detected results	%R	
		Methods 6010 and 7196	Methods 7060, 7470, 7471, 7740, and 7841
L	R	<30%	<30%
L	UL	30-74%	30-84%
K		>125%	>115%

2. Frequency Criteria

Was a post-digestion spike prepared at the required frequency? Yes

(continued; footnotes follow)

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VII. POST-DIGESTION SPIKE RESULTS (Section 1 & 2)

Sample ID RCH-1-SP-01

Analysis: TCLP

1. List the percent recoveries for analyses which did not meet the required criteria in the post-digestion spike sample.

S - amount of spike added
SSR - spiked sample result
SR - sample result

SAMPLE	ANALYTE	SSR	SR	S	%R	ACTION

Post-Digestion Spike Actions apply to all samples of the same matrix.

ACTIONS: Although the laboratory conducted post-digestion spike analyses for all ICP analyses, post-digestion spike results only were reported for analyses for which matrix spike and matrix spike duplicate recovery failed. No post-digestion spike results were reported for this sample.

1. If the sample concentration exceeds the spike concentration by a factor of 4 of more, no action is taken.

2. If any analyte does not meet the %R criteria, follow the actions stated below:

Positive results	Non-detected results	%R	
		Methods 6010 and 7196	Methods 7060, 7470, 7471, 7740, and 7841
L	R	<30%	<30%
L	UL	30-74%	30-84%
K		>125%	>115%

2. Frequency Criteria

Was a post-digestion spike prepared at the required frequency? Yes

(continued; footnotes follow)

REVIEW OF LABORATORY DATA PACKAGE - INORGANICS
INORGANIC CHEMICALS LISTING DETERMINATION
VII. POST-DIGESTION SPIKE RESULTS (Section 1 & 2)

Sample ID RCH-1-SP-01

Analysis: SPLP

1. List the percent recoveries for analyses which did not meet the required criteria in the post-digestion spike sample.

S - amount of spike added
SSR - spiked sample result
SR - sample result

SAMPLE	ANALYTE	SSR	SR	S	%R	ACTION

Post-Digestion Spike Actions apply to all samples of the same matrix.

ACTIONS: Although the laboratory conducted post-digestion spike analyses for all ICP analyses, post-digestion spike results were only reported for analyses for which matrix spike and matrix spike duplicate recovery failed. No post-digestion spike results were reported for this sample.

1. If the sample concentration exceeds the spike concentration by a factor of 4 of more, no action is taken.

2. If any analyte does not meet the %R criteria, follow the actions stated below:

Positive results	Non-detected results	%R	
		Methods 6010 and 7196	Methods 7060, 7470, 7471, 7740, and 7841
L	R	<30%	<30%
L	UL	30-74%	30-84%
K		>125%	>115%

2. Frequency Criteria

Was a post-digestion spike prepared at the required frequency? Yes

(continued; footnotes follow)

REVIEW OF LABORATORY DATA PACKAGE - INORGANICS
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VIII. FIELD DUPLICATES

Sample Nos.: _______, _______ Matrix: _______

List the concentrations of the compounds for which RPD is ≥50%.

FRACTION	ANALYTE	SAMPLE CONC.	DUP SAMPLE CONC.	RPD	ACTION

NOTE: Professional judgement may be utilized to apply duplicate actions.

A separate worksheet should be filled out for each field duplicate pair.

ACTIONS: None; no field duplicate samples were collected.

1. Estimate (J) positive results for elements which have an RPD >50% when sample results are >5x the reporting limit.
2. If sample results are less than 5x the reporting limit, estimate (J) positive results for elements whose absolute difference is >4x the reporting limit. If both samples are non-detected, the RPD is not calculated (NC).

(continued; footnotes follow)

IX. LABORATORY CONTROL SAMPLE

1. Aqueous LCS

List any LCS recoveries not within the 80-120% criteria and the samples affected.

DATE	ANALYTE	%R	ACTION	SAMPLES AFFECTED
9/25/99	Total boron	131.6	K(+)	RCH-1-SP-05
10/6/99	TCLP zinc (extraction fluid #2)	132.0, 183.1	K(+)	RCH-1-SP-01, RCH-1-SP-02, RCH-1-SP-03
10/6/99	SPLP barium	137.0	K(+)	RCH-1-SP-01, RCH-1-SP-02, RCH-1-SP-03
10/6/99	SPLP boron	77.8, 123.6	J(+);UJ(ND)	

2. Solid LCS

List any analyses that were not within the control windows set for the solid LCS sample. The 80-120% criteria is not used evaluate solid LCS results.

ELEMENT	DATE	LCS %R	CONTROL WINDOWS	ACTION	SAMPLES AFFECTED

ACTIONS: See table above.

Aqueous LCS:

%R	Positive results	Non-detected results
<50%	R	R
50-79%	L	UL
>120%	K	

Solid LCS:

	Positive results	Non-detected results
<Control Windows	L	UL
>Control Windows	K	

3. Frequency Criteria

A. Was an LCS analyzed for every matrix, every digestion batch, and every 20 samples?

Yes

(continued; footnotes follow)

X. ICP SERIAL DILUTION ANALYSIS

________ Serial dilutions were performed for each matrix and results of the diluted sample analysis agreed within ten percent of the original undiluted analysis for analyte concentrations greater than 50x the LOD before dilution.

________ Serial dilutions were not performed for the following: ______________________________

________ Serial dilutions were performed, but analytical results did not agree within 10% for analyte concentrations greater than 50x the LOD before dilution.

Report all results below that do not meet the required laboratory criteria for ICP serial dilution analysis.

Analysis: Total

ELEMENT	LOD	50xLOD	SAMPLE RESULT	SERIAL DILUTION	%D	ACTION

Actions apply to all samples of the same matrix.

ACTIONS: The laboratory conducted serial dilution analyses for ICP analyses only in cases for which matrix spike recovery failed, the sample result was greater than 4 times the spike added, and the sample result was greater than 50 times the reporting limit. Serial dilution was not required for any analyses in this sample.

1. Estimate (J) positive results if %D >10%.

(continued; footnotes follow)

X. ICP SERIAL DILUTION ANALYSIS

_______ Serial dilutions were performed for each matrix and results of the diluted sample analysis agreed within ten percent of the original undiluted analysis for analyte concentrations greater than 50x the LOD before dilution.

_______ Serial dilutions were not performed for the following: ____

_______ Serial dilutions were performed, but analytical results did not agree within 10% for analyte concentrations greater than 50x the LOD before dilution.

Report all results below that do not meet the required laboratory criteria for ICP serial dilution analysis.

Analysis: _TCLP_______

ELEMENT	LOD	50xLOD	SAMPLE RESULT	SERIAL DILUTION	%D	ACTION

Actions apply to all samples of the same matrix.

ACTIONS: The laboratory conducted serial dilution analyses for ICP analyses only in cases for which matrix spike recovery failed, the sample result was greater than 4 times the spike added, and the sample result was greater than 50 times the reporting limit. Serial dilution was not required for any analyses in this sample.

1. Estimate (J) positive results if %D >10%.

(continued; footnotes follow)

X. ICP SERIAL DILUTION ANALYSIS

________ Serial dilutions were performed for each matrix and results of the diluted sample analysis agreed within ten percent of the original undiluted analysis for analyte concentrations greater than 50x the LOD before dilution.

________ Serial dilutions were not performed for the following: ____

________ Serial dilutions were performed, but analytical results did not agree within 10% for analyte concentrations greater than 50x the LOD before dilution.

Report all results below that do not meet the required laboratory criteria for ICP serial dilution analysis.

Analysis: SPLP

ELEMENT	LOD	50xLOD	SAMPLE RESULT	SERIAL DILUTION	%D	ACTION

Actions apply to all samples of the same matrix.

ACTIONS: The laboratory conducted serial dilution analyses for ICP analyses only in cases for which matrix spike recovery failed, the sample result was greater than 4 times the spike added, and the sample result was greater than 50 times the reporting limit. Serial dilution was not required for any analyses in this sample.

1. Estimate (J) positive results if %D >10%.

(continued; footnotes follow)

XI. DETECTION LIMIT RESULTS

1. Instrument Detection Limits (IDLs)

_______ IDL results were present and found to be less than the required detection limits.

_______ IDLs were not included in the data package.

X IDLs were present, but the criteria was not met for the following elements: arsenic in wastewaters and leachates (0.00237 mg/L versus 0.002 mg/L target) and thallium in wastewaters and leachates (0.00216 mg/L versus 0.0005 mg/L target).

Detection limit requirements were not specified for familiarization samples.

2. Reporting Requirements

Yes Were sample results on Form 1s reported down to the PQL for all analyses?

Yes Were sample weights, volumes, and dilutions taken into account when reporting detection limits?

If not, the reported results may be inaccurate. Make the necessary changes on the data summary tables and request that the laboratory resubmit the corrected data.

(continued; footnotes follow)

XII. SAMPLE QUANTITATION

__X__ Samples results fall within the linear range for ICP and within the calibrated range for all other parameters.

______ Samples results were beyond the linear range/calibration range of the instrument for the following samples/elements: ____

In the space below, please show a minimum of one sample calculation per method type:

<u>ICP</u>: Cr in RCH-1-SP-01 (total): results were reported directly in mg/kg using a correction factor, 0.1 calculated as follows:

$$\text{results in ug / L x } \frac{100\text{ mL}}{1.00\text{ g}} \text{ x } \frac{1\text{ L}}{1000\text{ mL}} \text{ x } \frac{1000\text{ g}}{1\text{ kg}} \text{ x } \frac{1\text{ mg}}{1000\text{ ug}} = \text{ results in mg / kg}$$

<u>Flame AA</u>: Na in RCH-1-SP-01 (total):

$$1457\text{ mg / L x } \frac{100\text{ mL}}{1.00\text{ g}} \text{ x } \frac{1\text{ L}}{1000\text{ mL}} \text{ x } \frac{1000\text{ g}}{1\text{ kg}} \text{ x 1000 (dilution factor)} = 145700\text{ mg / kg}$$

<u>CVAA</u>: Hg in RCH-1-SP-01 (total):

$$38.62\text{ ug / L x } \frac{96\text{ mL}}{0.6\text{ g}} \text{ x } \frac{1\text{ L}}{1000\text{ mL}} \text{ x } \frac{1000\text{ g}}{1\text{ kg}} \text{ x } \frac{1\text{ mg}}{1000\text{ ug}} = 6.179\text{ mg / kg}$$

<u>Colorimetric</u>: Fluoride in RCH-1-SP-01:

$$3.25\text{ mg / L x } \frac{100\text{ mL}}{10.03\text{ g}} \text{ x } \frac{1\text{ L}}{1000\text{ mL}} \text{ x } \frac{1000\text{ g}}{1\text{ kg}} \text{ x 10 (dilution factor)} = 325\text{ mg / kg}$$

Cr^{6+} in RCH-1-SP-01:

$$0.0129\text{ mg / L x } \frac{50\text{ mL}}{50.01\text{ g}} \text{ x } \frac{1\text{ L}}{1000\text{ mL}} \text{ x } \frac{1000\text{ g}}{1\text{ kg}} = 0.0129\text{ mg / kg } (< 0.4\text{ mg / kg})$$

For soil samples, the following equation may be necessary to convert raw data values (usually reported in :g/L) to actual sample concentrations (mg/kg):

$$\text{Conc. in ug / L x } \frac{\text{volume diluted to (mL)}}{\text{weight digested (g)}} \text{ x } \frac{1\text{ L}}{1000\text{ mL}} \text{ x } \frac{1000\text{ g}}{1\text{ kg}} \text{ x } \frac{1\text{ mg}}{1000\text{ ug}} = \text{ mg / kg}$$

(continued; footnotes follow)