

Minnesota Attorney General: Administrative Rules Proceedings

Copyright Notice:

This material may be protected by copyright law (U.S. Code, Title 17). Researchers are liable for any infringement. For more information, visit www.mnhs.org/copyright.

Version 3
August 20, 2018

DEPARTMENT: Office of the Attorney General **STATE OF MINNESOTA**

OFFICE MEMORANDUM

DATE: July 3, 1991

TO: GLENN SKUTA
MPCA

FROM: CHARLENE HATCHER
Special Assistant Attorney General
525 Park Street, Suite 500 (55103)

PHONE: 296-9422

SUBJECT: In the Matter of the Adopted Rule Relating to Hazardouse Waste Clarifications

The above-referenced rule has been approved as to its legality by the Attorney General on June 26, 1991.

Enclosed is your copy of the approved rule. This office has already filed two copies with the Secretary of State, who will forward one copy to the Revisor of Statutes. The fourth is being retained by this division of the Attorney General's Office for its records.

Also enclosed are any petitions, requests, submissions or comments along with any extra copies of documents which you submitted to the Attorney General.

Your next step is to arrange for publication of the Notice of Adoption in the State Register. In a day or two, you should receive from the Revisor's Office three copies of the notice of adoption of your rule. You should submit two copies of the Notice of Adoption to the State Register for publication. A permanent rule without a hearing does not become effective until five days after a notice of adoption is published in the State Register in accordance with Minn. Stat. § 14.27. An emergency rule becomes effective five working days after approval by the Attorney General; however, the agency must publish a notice in the State Register in accordance with Minn. Stat. § 14.34.

If you have any questions in this regard, please contact me.

CH:sc
Enclosures
cc: Al Mitchell
William Brown, Chief Judge
MaryAnn Hruby

CH

RULE REVIEW CHECKLIST

File No. 1833
DATE RECEIVED 6-12-91
REVIEW DATE 6-21-91
DUE DATE 6-26-91
(DIS)APPROVED 6-26-91
WITHDRAWN

Docket No. 05.0009.2010
ADOPTED W/O HEARING
EMERGENCY RULE
TO REVISOR ON 6-13-91
REVISOR (DIS)APPROVED 6-18-91
FILED W/SEC. OF STATE 7/2/91
RETURNED TO AGENCY 7/3/91

✓ Rule as adopted (4 copies)

Notice to Solicit Outside Information/Opinion (if applicable)
___ Date published in State Register
___ Comments

Petition for Adoption of a Rule

✓ Board's Authorizing Resolution
___ Date adopted Feb 26, 1991

✓ Proposed Rule
✓ Revisor's Certificate

✓ Notice of Intent to Adopt Rule
116.07 subd 4 Statutory Authority
✓ Small Business Statement
___ Expenditure of public money statement
March 5, 1991 Signature

✓ Statement of Need and Reasonableness (if applicable)
✓ Small Business Statement
___ Fees - § 16A.128

✓ Affidavit of Mailing Notice of Intent to Adopt Rule
March 14, 1991 Dated 30/25 days before adoption
___ Notice attached indicates it is attached
___ Copy of rule or summary attached

✓ Publication in State Register
March 18, 1991 Date 30/25 days before adoption

✓ 180-day deadline from:
✓ Effective date of law requiring rule (14.12) (both rules) amendments don't apply
✓ end of comment period (§ 14.26) (rules without hearing)
___ effective date of statutory authority (§ 14.29) (emergency rules)

✓ Resolution Adopting
May 22, 1991 Date adopted

✓ Findings of Fact, Conclusions & Order Adopting
5-22-91 Date

✓ Written Requests, Submissions or Comments

✓ Declaration of Attorney
Al Mitchell Name of SAAG representing agency

✓ Notice of Submission to Attorney General (if applicable)

✓ Affidavit of Mailing Notice to Attorney General (if applicable)

Pollution Control Agency

Adopted Permanent Rules Relating to Hazardous Waste Clarifications

Rules as Adopted

7045.0020 DEFINITIONS.

[For text of subps 1 to 14, see M.R.]

Subp. 15. **Designated facility.** "Designated facility" means a hazardous waste treatment, storage, or disposal facility which:

A. (1) has received interim status;

(2) has received an agency permit,

(3) is subject to the requirements of part 7045.0125, subpart 5, 6, or 10, or subpart 9, item B, or part 7045.0685; or

(4) if located outside Minnesota, has been exempted from the requirements to obtain a permit by the United States Environmental Protection Agency; has either received an Environmental Protection Agency permit or a permit from an authorized state, or has interim status;

B. has been designated on the manifest by the generator pursuant to part 7045.0261, or has been designated on a shipping paper or management plan required by part 7045.0125; and

C. if located in an Environmental Protection Agency authorized state which has not yet obtained authorization to regulate the hazardous waste it is receiving as hazardous, must be a facility allowed by the receiving state to accept the waste.

[For text of subps 16 to 109, see M.R.]

7045.0102 MIXTURES OF WASTES.

[For text of subpart 1, see M.R.]

Subp. 2. **Mixtures of hazardous and nonhazardous wastes.** The mixing of a hazardous waste with a nonhazardous waste as described in this subpart constitutes treatment. Generators who

Approved by Revisor

mix hazardous and nonhazardous wastes on site must meet the requirements of part 7045.0211 for generators with on-site facilities.

A. A mixture is a hazardous waste if it is a mixture of nonhazardous waste and any waste which is hazardous solely because it exhibits the characteristic of ignitability, corrosivity, oxidativity, or reactivity as described in part 7045.0131, unless the resulting mixture does not exhibit any of the characteristics of hazardous waste as defined in part 7045.0131.

B. A mixture is a hazardous waste if it is a mixture of nonhazardous waste and any waste listed in part 7045.0135 solely because of ignitability, corrosivity, or reactivity, unless:

(1) the resulting mixture does not exhibit any of the characteristics of hazardous waste as defined in part 7045.0131;

(2) the resulting mixture has been excluded from regulation pursuant to part 7045.0075, subpart 2; or

(3) the nonhazardous waste is exempt from regulation under part 7045.0120, item I, and the resultant mixture no longer exhibits any characteristic of hazardous waste as defined in part 7045.0131 for which the hazardous waste listed in part 7045.0135 was listed.

[For text of item C, see M.R.]

D. A mixture is a hazardous waste if it is a sewered mixture of nonhazardous waste and any waste which is hazardous because it exhibits the characteristics of extraction procedure (EP) toxicity or toxicity as defined in part 7045.0131 unless:

(1) prior to entering the sewer the resulting mixture no longer exhibits the characteristic of extraction procedure (EP) toxicity or toxicity; and

(2) the sewering of the mixture has been approved by the agency pursuant to parts 7045.0220 to 7045.0255.

This provision does not apply to those mixtures defined as nonhazardous under item F.

Approved
by Revisor _____

[For text of items E to G, see M.R.]

H. Any mixture of a waste from the extraction, beneficiation, and processing of ores and minerals excluded under part 7045.0120, item I, and any other waste exhibiting a characteristic of hazardous waste under part 7045.0131 is a hazardous waste only if:

(1) it exhibits a characteristic that would not have been exhibited by the excluded waste alone if such mixture had not occurred; or

(2) it continues to exhibit any of the characteristics exhibited by the nonexcluded wastes prior to mixture.

For the purposes of applying the toxicity characteristic of part 7045.0131, subpart 7, to such mixtures, the mixture is also a hazardous waste if it exceeds the maximum concentration for any contaminant listed in part 7045.0131, subpart 8, that would not have been exceeded by the excluded waste alone if the mixture had not occurred or if it continues to exceed the maximum concentration for any contaminant exceeded by the nonexempt waste prior to mixture.

[For text of subp 3, see M.R.]

7045.0120 EXEMPT WASTES.

The following wastes may be stored, labeled, transported, treated, processed, and disposed of without complying with the requirements of this chapter:

[For text of items A to H, see M.R.]

I. waste from the extraction, beneficiation, and processing of ores and minerals, including coal, and including phosphate rock and overburden from the mining of uranium ore. For purposes of this item, beneficiation of ores and minerals is restricted to the following activities: crushing; grinding; washing; dissolution; crystalization; filtration; sorting; sizing; drying; sintering; pelletizing; briquetting; ~~calcinizing~~ calcining to remove water or carbon dioxide; roasting, autoclaving, or chlorination in preparation for leaching (except

Approved
by Revisor _____

where the roasting, autoclaving, or chlorination/leaching sequence produces a final or intermediate product that does not undergo further beneficiation or processing); gravity concentration; magnetic separation; electrostatic separation; flotation; ion exchange; solvent extraction; electrowinning; precipitation; amalgamation; and heap, dump, vat, tank, and in situ leaching. For the purposes of this item, waste from the processing of ores and minerals includes only the following wastes:

(1) red and brown muds from bauxite refining;

(2) slag from elemental phosphorus production;

(3) gasifier ash from coal gasification;

(4) process wastewater from coal gasification;

(5) slag tailings from primary copper processing;

(6) fluorogypsum from hydrofluoric acid production;

(7) iron blast furnace slag;

(8) treated residue from the roasting/leaching of chrome ore; and

(9) basic oxygen furnace and open hearth furnace slag from carbon steel production;

[For text of items J to P, see M.R.]

7045.0135 LISTS OF HAZARDOUS WASTES.

[For text of subpart 1, see M.R.]

Subp. 2. **Hazardous wastes from nonspecific sources.** Hazardous wastes from nonspecific sources are listed with the generic hazardous waste number and hazard code in items A to V.

[For text of items A to L, see M.R.]

M. F019, wastewater treatment sludges from the chemical conversion coating of aluminum, except from zirconium phosphating in aluminum can washing when such phosphating is an exclusive conversion coating process: (T);

[For text of items N to Q, see M.R.]

R. F024, process wastes, including but not limited to, distillation residues, heavy ends, tars, and reactor

Approved
by Revisor _____

cleanout wastes from the production of certain chlorinated aliphatic hydrocarbons by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to and including five, with varying amounts and positions of chlorine substitution. This listing does not include wastewaters, wastewater treatment sludges, spent catalysts, and wastes listed in this subpart and subpart 3: (T);

S. F025, condensed light ends, spent filters and filter aids, and spent ~~dessicant~~ desiccant wastes from the production of certain chlorinated aliphatic hydrocarbons, by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to and including five, with varying amounts and positions of chlorine substitution: (T);

T. F026, wastes, except wastewater and spent carbon from hydrogen chloride purification, from the production of materials on equipment previously used for the manufacturing use as a reactant, chemical intermediate, or component in a formulating process of tetra-, penta-, or hexachlorobenzene under alkaline conditions: (H);

U. F027, discarded unused formulations containing tri-, tetra-, or pentachlorophenol or discarded unused formulations containing compounds derived from these chlorophenols. This listing does not include formulations containing hexachlorophene synthesized from prepurified 2,4,5-trichlorophenol as the sole component: (H); and

V. F028, residues resulting from the incineration or thermal treatment of soil contaminated with hazardous waste Nos. F020, F021, F022, F023, F026, and F027: (T).

Subp. 3. **Hazardous waste from specific sources.** Hazardous wastes from specific sources are listed with the industry and hazardous waste number and hazard code in items A to L.

[For text of items A to D, see M.R.]

E. Pesticides:

[For text of subitems (1) to (18), see M.R.]

Approved
by Revisor _____

(19) K125, filtration, evaporation, and centrifugation solids from the production of ethylenebisdithiocarbamic acid and its salts: (T);

(20) K126, bag house dust and floor sweepings in milling and packaging operations from the production or formulation of ethylenebisdithiocarbamic acid and its salts: (T);

(21) K131, wastewater from the reactor and spent sulfuric acid from the acid dryer from the production of methyl bromide: (C,T); and

(22) K132, spent absorbent and wastewater separator solids from the production of methyl bromide: (T).

[For text of items F to L, see M.R.]

[For text of subps 4 and 5, see M.R.]

7045.0139 BASIS FOR LISTING HAZARDOUS WASTES.

[For text of subpart 1, see M.R.]

Subp. 2. **Constituents.** The constituents which are the basis for listing the wastes identified in part 7045.0135, subparts 2 and 3 are listed in items A and B.

A. Constituents of wastes identified in part 7045.0135, subpart 2 are listed in subitems (1) to (22).

[For text of subitems (1) to (18), see M.R.]

(19) F025: Chloromethane; dichloromethane; trichloromethane; carbon tetrachloride; chloroethylene; 1,1-dichloroethane; 1,2-dichloroethane; trans-1,2-dichloroethylene; 1,1-dichloroethylene; 1,1,1-trichloroethane; 1,1,2-trichloroethane; trichloroethylene; 1,1,1,2-tetrachloroethane; 1,1,2,2-tetrachloroethane; tetrachloroethylene; pentachloroethane; hexachloroethane; allyl chloride (3-chloropropene); dichloropropane; dichloropropene; 2-chloro-1,3-butadiene; hexachloro-1,3-butadiene; hexachlorocyclopentadiene; benzene; chlorobenzene; dichlorobenzene; 1,2,4-trichlorobenzene; tetrachlorobenzene; pentachlorobenzene; hexachlorobenzene; toluene; naphthalene;

(20) F026: Tetra-, penta-, and

Approved by Revisor _____

hexachlorodibenzo-p-dioxins; tetra-, penta-, and hexachlorodibenzofurans;

(21) F027: Tetra-, penta-, and hexachlorodibenzo-p-dioxins; tetra-, penta-, and hexachlorodibenzofurans; tri-, tetra-, and pentachlorophenols and their chlorophenoxy derivative acids, esters, ethers, amine, and other salts; and

(22) F028: Tetra-, penta-, and hexachlorodibenzo-p-dioxins; tetra-, penta-, and hexachlorodibenzofurans; tri-, tetra-, and pentachlorophenols and their chlorophenoxy derivative acids, esters, ethers, amine, and other salts.

B. Constituents of wastes identified in part 7045.0135, subpart 3 are listed in subitems (1) to (91).

[For text of subitems (1) to (87), see M.R.]

(88) K126: Ethylene thiourea;

(89) K131: Dimethyl sulfate, methyl bromide;

(90) K132: Methyl bromide; and

(91) K136: Ethylene dibromide.

7045.0141 HAZARDOUS CONSTITUENTS.

[For text of subpart 1, see M.R.]

Subp. 2. **"A" constituents.** Hazardous constituents beginning with the letter A are as follows:

[For text of items A to L, see M.R.]

M. Allyl chloride, 107-18-6, ____;

N. Aluminum phosphide, 20859-73-8, P006;

O. 4-Aminobiphenyl, 92-67-1, ____;

P. 5-(Aminomethyl)-3-isoxazolol, 2763-96-4, P007;

Q. 4-Aminopyridine, 504-24-5, P008;

R. Amitrole, 61-82-5, U011;

S. Ammonium vanadate, 7803-55-6, P119;

T. Aniline, 62-53-3, U012;

U. Antimony, 7440-36-0, ____;

V. Antimony compounds, not otherwise specified in this list, _____, ____;

Approved by Revisor _____

W. Aramite, 140-57-8, ____;

X. Arsenic, 7440-38-2, ____;

Y. Arsenic compounds, not otherwise specified in this list, _____, ____;

Z. Arsenic acid, 7778-39-4, P010;

AA. Arsenic pentoxide, 1303-28-2, P011;

BB. Arsenic trioxide, 1327-53-3, P012;

CC. Auramine, 492-80-8, P014; and

DD. Azaserine, 115-02-6, U015.

[For text of subps 3 to 23, see M.R.]

7045.0265 USE OF MANIFEST.

[For text of subps 1 to 3, see M.R.]

Subp. 4. **Out-of-state shipments.** When a shipment of hazardous waste is to be delivered to a hazardous waste facility located outside the state of Minnesota, the generator must ensure that:

A. the copy of the hazardous waste manifest signed by the facility operator is sent to the commissioner within 40 days of the acceptance of the hazardous waste by the hazardous waste facility; and

B. for shipments of a hazardous waste to a designated facility in ~~an~~ a United States Environmental Protection Agency authorized state which has not yet obtained authorization to regulate that particular waste as hazardous, the designated facility agrees to sign the manifest and return the manifest to the generator, and that any out-of-state transporter signs and forwards the manifest to the designated facility.

[For text of subp 5, see M.R.]

Approved
by Revisor _____

STATE OF MINNESOTA
DEPARTMENT OF STATE
FILED

JUL 0 2 1991

Joan Anderson Growe

Secretary of State

105

APPROVED AS TO FORM AND LEGALITY

June 26, 1991

HUBERT H. HUMPHREY, III
ATTORNEY GENERAL

BY Charlene H. Hatcher
SPECIAL ASSISTANT ATTORNEY GENERAL

STATE OF MINNESOTA
POLLUTION CONTROL AGENCY

In the Matter of Proposed Amendments Governing Mining Wastes, the Lists of of Hazardous Wastes, Shipments of Hazardous Waste Out-of-State, and Mixtures of Hazardous and Nonhazardous Wastes, Minn. Rules Pts. 7045.0020, 7045.0102, 7045.0120, 7045.0135, 7045.0139, 7045.0141, and 7045.0265

FINDINGS OF FACT, CONCLUSIONS, AND ORDER ADOPTING RULES

(1) The above-entitled matter came on for decision before the Minnesota Pollution Control Agency (MPCA) on the day of May 21, 1991. After affording all interested persons the opportunity to present written and oral data, statements, and arguments to the MPCA, in accordance with statutory requirements regarding the adoption of noncontroversial rules, after considering the Statement of Need and Reasonableness, after considering all of the evidence adduced upon the records, files, and proceedings herein, the MPCA, being fully advised in the premises, hereby adopts the following Findings of Fact, Conclusions, and Order:

FINDINGS OF FACT

(1) 1. Notice of the MPCA's intent to adopt the above-entitled rule amendments without a public hearing was published in the State Register on March 18, 1991 (15 SR 2087-2092), and was sent by mail to all persons on the list maintained by the MPCA pursuant to Minn. Stat. §§ 14.14, subd. 1a. and 14.22 (1990) on March 14, 1991.

(2) 2. The Statement of Need and Reasonableness was prepared prior to mailing and publication of the notice and was made available to the public.

(4) 3. All persons were given the opportunity to submit comments on the rule amendments for 30 days after notice of proposed rulemaking. The 30-day comment period, as set out in the notice, expired on April 17, 1991.

(5) 4. No requests for public hearing were received during the comment period.

(7) 5. No requests for notice of submission of the adopted rule amendments to the Attorney General were received by the MPCA.

6. During the comment period the MPCA received two written comment letters. The MPCA received letters from the United States Environmental Protection Agency (EPA), Region V Office and the Environmental Defense Fund. As a result of the comments from EPA, the MPCA finds that two modifications to the proposed rule amendments are justified by the record in this proceeding, as follows:

(6) a. The proposed rule amendments to Minn. Rules pt. 7045.0120, item I define the term "beneficiation". The MPCA is correcting a spelling error made in this subpart by changing the word "calcinizing" to "calcining" as shown below. This modification does not constitute a substantial change.

Minn. Rules pt. 7045.0120, item I is modified to read:

7045.0120 EXEMPT WASTES.

I. waste from the extraction, beneficiation, and processing of ores and minerals, including coal, and including phosphate rock and overburden from the mining of uranium ore. For purposes of this item, beneficiation of ores and minerals is restricted to the following activities: crushing; grinding; washing; dissolution; crystalization; filtration; sorting; sizing; drying; sintering; pelletizing; briquetting; ~~calcinizing~~ calcining to remove water or carbon dioxide; roasting, autoclaving, or chlorination in preparation for leaching (except where the roasting, autoclaving, or chlorination/leaching sequence produces a final or intermediate product that does not undergo further beneficiation or processing); gravity concentration; magnetic separation; electrostatic separation; flotation; ion exchange; solvent extraction; electrowinning; precipitation; amalgamation; and heap, dump, vat, tank, and in situ leaching. For the purposes of this item, waste from the processing of ores and minerals includes only the following wastes:

b. The proposed rule amendments to Minn. Rules pt. 7045.0135, subp. 2, item S add a waste stream to the lists of hazardous wastes. The MPCA is correcting a spelling error made in this item by changing the word "dessicant" to "desiccant" as shown below. This modification does not constitute a substantial change.

Minn. Rules pt. 7045.0135, subp. 2, item S is modified to read:

7045.0135 LISTS OF HAZARDOUS WASTES.

Subp. 2. Hazardous wastes from nonspecific sources. Hazardous wastes from nonspecific sources are listed with the generic hazardous waste number and hazard code in items A to V.

S. F025, condensed light ends, spent filters and filter aids, and spent ~~dessicant~~ desiccant wastes from the production of certain chlorinated aliphatic hydrocarbons, by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to and including five, with varying amounts and positions of chlorine substitution: (T);

7. In addition to the modifications made in Finding No. 6 above, the MPCA is initiating another modification. The proposed rule amendments to Minn. Rules pt. 7045.0265, subp. 4, item B outline the manifesting requirements for out-of-state shipments of hazardous waste. The MPCA is modifying this item by adding the words "United States Environmental Protection Agency" before the words "authorized state" in order to clarify by whom the state is authorized. This modification does not constitute a substantial change.

7045.0265 USE OF MANIFEST.

Subp. 4. Out-of-state shipments. When a hazardous waste is to be delivered to a hazardous waste facility located outside the state of Minnesota, the generator must insure that:

B. for shipments of hazardous waste to a designated facility in ~~an~~ United States Environmental Protection Agency authorized state which has not yet obtained authorization to regulate that particular waste as hazardous, the designated facility agrees to sign the manifest and return the manifest to the generator, and that any out-of-state transporter signs and forwards the manifest to the designated facility.

8. The MPCA adopts the Statement of Need and Reasonableness, in its entirety, as the factual basis for the proposed rules. The MPCA hereby incorporates the Statement of Need and Reasonableness into these findings, except as modified in Finding Nos. 6 and 7 above.

9. The above-captioned rule amendments, together with the modifications made by the MPCA in Finding Nos. 6 and 7 above to respond to comments received during the comment period and initiated ~~by~~ the MPCA to clarify the amendments as proposed, are needed and reasonable. (8)

CONCLUSIONS

1. The MPCA duly acquired and has jurisdiction over this proceeding.

2. The MPCA published and served due, timely, and adequate notice of the intent to adopt the rule amendments without a public hearing.

3. All relevant legal and procedural requirements of statute and rule have been complied with.

4. The modifications to the proposed rule amendments are supported by the record and do not result in a substantial change in the proposed rule amendments.

(9)

ORDER

NOW, THEREFORE, IT IS ORDERED, that the attached amendments to Minn. Rules pts. 7045.0020, 7045.0102, 7045.0120, 7045.0135, 7045.0139, 7045.0141, and 7045.0265 governing the management of hazardous waste, are adopted pursuant to the authority vested in the MPCA by Minn. Stat. § 116.07, subd. 4 (1990).

Dated: 5/22/91

Patricia A. Bloomquist

Charles W. Williams
Commissioner

STATE OF MINNESOTA
MINNESOTA POLLUTION CONTROL AGENCY

In the Matter of Proposed Amendments Governing Mining Wastes, the Lists of Hazardous Wastes, Shipments of Hazardous Wastes Out-of-state, and Mixtures of Hazardous and Nonhazardous Wastes, Minn. Rules Pts. 7045.0020, 7045.0102, 7045.0120, 7045.0135, 7045.0139, 7045.0141, and 7045.0265

STATEMENT OF NEED AND REASONABLENESS

I. INTRODUCTION

The subject of this proceeding is the amendment of the rules of the Minnesota Pollution Control Agency (hereinafter "Agency") governing the management of hazardous waste. Specifically, the amendments the Agency is proposing pertain to the following:

A. Limiting the hazardous waste regulatory exclusion for mineral processing wastes to nine specific waste streams. In 1980, the United States Environmental Protection Agency (EPA) excluded all mineral processing wastes from regulation as hazardous wastes. In federal amendments promulgated January 23, 1990, EPA limited the scope of the exclusion to twenty mineral processing waste streams. Based upon EPA data, however, the Agency is of the opinion that eleven of the twenty wastes that EPA has decided to retain within the exclusion are potentially too hazardous to remain within the exclusion (see Exhibits 2, 3, 7, and 9). Therefore, the proposed amendments exempt only nine mineral processing wastes from hazardous waste regulation.

B. Requirements for mixtures of hazardous and nonhazardous wastes in cases where the nonhazardous waste is a mining waste excluded from hazardous waste regulation. These proposed amendments incorporate federal amendments promulgated September 1, 1989. The proposed amendments contain specific

requirements for determining whether or not mixtures of hazardous wastes and mining wastes excluded from hazardous waste regulation are subject to hazardous waste regulation.

C. Clarification of the definition of "designated facility". This proposed amendment incorporates a federal amendment promulgated January 23, 1990. The proposed amendment clarifies the requirements for designated facilities receiving hazardous wastes from out-of-state.

D. Clarification of the requirements for generators of hazardous waste when using hazardous waste manifests. This proposed amendment incorporates a federal amendment promulgated January 23, 1990. The proposed amendment clarifies that a generator is responsible for assuring that any out-of-state transporters or facilities, which handle the generator's waste, sign the hazardous waste manifest used for tracking that waste.

E. Changes in the listings of hazardous wastes. These proposed amendments incorporate federal amendments which added three waste streams to the lists of hazardous wastes and changed the listing description of two currently listed waste streams.

F. Clarifications of the existing rules regarding mixtures of hazardous and nonhazardous wastes. These proposed amendments clarify the existing rules for mixtures by changing the language and format and by explicitly stating some of the implicit aspects of the existing rules. The proposed amendments state directly that the mixing of hazardous waste and nonhazardous waste constitutes treatment and is subject to additional requirements.

The bulk of these proposed amendments are based upon federally mandated regulations. The proposed amendments, which add three waste streams to the lists of hazardous wastes and change the listing description of a currently listed waste, were promulgated by EPA under the authority of the Hazardous and

Solid Waste Amendments of 1984 (HSWA). Federal amendments promulgated under HSWA, such as these, are effective in Minnesota on the effective date of the federal regulation, even if the amendments have not yet been incorporated into state rules by that time. The effective dates for these federal amendments have passed. The federal amendments, which limit the hazardous waste regulatory exclusion for mineral processing wastes, set out the requirements for mixtures of excluded mineral processing wastes and hazardous wastes; clarify the definition of "designated facility"; clarify the requirements for generators of hazardous wastes when using hazardous waste manifests; and modify the scope of a currently listed waste stream, were promulgated by EPA under the authority of the Resource Conservation and Recovery Act (RCRA). Federal amendments promulgated under RCRA are not effective in Minnesota until they are incorporated into state rules. The remaining proposed amendments, those which seek to clarify the rules governing mixtures of hazardous and nonhazardous wastes, are changes initiated by the Agency. The Agency's authority to adopt all of these amendments is provided under Minn. Stat. § 116.07, subd. 4 (1990).

This Statement of Need and Reasonableness is divided into seven parts. Following this introduction, Part II contains the Agency's explanation of the need for the proposed amendments. Part III discusses the reasonableness of the proposed amendments. Part IV documents how the Agency has considered the methods of reducing the impact of the proposed amendments on small businesses as required by Minn. Stat. § 14.115 (1990). Part V documents the economic factors the Agency considered in drafting the amendments as required by Minn. Stat. § 116.07, subd. 6 (1990). Part VI sets forth the Agency's conclusion regarding the amendments. Part VII contains a list of exhibits relied on by the Agency to support the proposed amendments. The exhibits are available for review at the Agency's offices at 520 Lafayette Road North, St. Paul, Minnesota 55155.

II. NEED FOR THE PROPOSED AMENDMENTS TO THE HAZARDOUS WASTE RULES

Minn. Stat. ch. 14 (1990) requires an agency to make an affirmative presentation of facts establishing the need for and reasonableness of the rules or amendments proposed. In general terms, this means that an agency must set forth the reasons for its proposal, and the reasons must not be arbitrary or capricious. However, to the extent that need and reasonableness are separate, need has come to mean that a problem exists which requires administrative attention and reasonableness means that the solution proposed by an agency is appropriate. Need is a broad test which does not easily lend itself to evaluation of each proposed revision. In the case of this proceeding, the need for amendments to the Agency's rules governing the management of hazardous waste has two bases: (A) the need for consistency with federal hazardous waste regulations; and (B) the need to provide clarity in the state hazardous waste rules.

A. Need for Consistency with Federal Regulations.

In 1976, Congress adopted RCRA (42 U.S.C. § 6901 et seq.) to regulate the management of hazardous waste. In adopting RCRA, Congress provided for eventual state control of the hazardous waste program and set up a mechanism for the EPA to grant authority to states to operate the program. In states that receive authorization, the state environmental agency administers the state program in lieu of the federal program. To receive and maintain authorization, the state program must be "equivalent" to the federal program and consistent with federal or state programs applicable to other states. EPA has defined "equivalent" to mean that the state requirements are at least as stringent as federal requirements. In terms of consistency, EPA's goal is to achieve an integrated national program which requires that final state programs do not conflict with each other or with the federal program. The proposed amendments contained in

this rulemaking are at least as stringent as the applicable federal amendments. The proposed amendments limiting the hazardous waste regulatory exclusion for mineral processing wastes to nine specific waste streams is more stringent than the applicable federal amendments which retain an additional eleven wastes within the federal exclusion. The rest of the proposed amendments are as stringent as the applicable federal amendments.

Minnesota received final authorization from EPA for its hazardous waste program pursuant to RCRA effective February 11, 1985 (see 50 FR 3756, published on January 28, 1985). A state with final authorization administers its hazardous waste program in lieu of the EPA program for those regulations which were promulgated pursuant to RCRA. In order to maintain authorization, the state must enact equivalent requirements within specific time frames when new, more stringent federal requirements are promulgated by EPA. The bulk of the federal amendments incorporated in this rulemaking were promulgated by EPA under RCRA, including the exclusion of specific mineral processing wastes from hazardous waste regulation, the requirements for the management of mixtures of hazardous and nonhazardous wastes, the requirements for generators of hazardous waste, the changes in the definition of "designated facility", and the exclusion of a specific source waste from zirconium phosphating from the lists of hazardous wastes. Minnesota must adopt all of these amendments by July 1, 1991, in order to maintain EPA authorization. The federal amendment excluding a specific source waste from zirconium phosphating from the hazardous wastes list represents a less stringent form of regulation than is currently found in the state hazardous waste rules, so the Agency is not required to adopt it. Based upon findings by EPA, however, the Agency has decided to incorporate this amendment into state rules. These RCRA regulations will not be effective in Minnesota until they are adopted by the Agency.

Federal amendments promulgated under HSWA, such as the federal amendments which added waste streams to the lists of hazardous wastes and changed the listing description of a currently listed hazardous waste, become effective nationally regardless of state authorization. These federal amendments are enforced by EPA until the states modify their programs to include the HSWA amendments. Thus, Minnesota must modify its hazardous waste rules to incorporate HSWA amendments and apply for and receive authorization from EPA to enforce HSWA provisions in lieu of EPA as a part of its state program.

The proposed rules incorporate federal amendments promulgated under RCRA and HSWA in order for the state hazardous waste rules to be consistent with federal regulations and to maintain state authorization from EPA to administer the hazardous waste program.

B. Need to Provide Clarity in the Existing State Hazardous Waste Rules.

The proposed rules clarify the existing rules governing mixtures of hazardous and nonhazardous wastes. Sections of the existing rules governing mixtures are difficult to read and interpret and warrant change for the sake of clarity. The proposed amendments explicitly state implicit requirements of the rules and change the language and format of parts of the rules in an attempt to make the rules more understandable.

III. REASONABLENESS OF THE PROPOSED AMENDMENTS

The Agency is required by Minn. Stat. ch. 14 (1990) to make an affirmative presentation of facts establishing the reasonableness of the proposed rules or amendments. The Agency proposes to incorporate federal amendments promulgated by EPA into the state hazardous waste rules. A complete discussion of the reasonableness of these federal amendments is presented in Exhibits 3, 5, 6, 7, and 8 listed in Part VII of this document, which are hereby incorporated by reference. The proposed amendments involve Minn. Rules pts. 7045.0020,

7045.0102, 7045.0120, 7045.0135, 7045.0139, 7045.0141, and 7045.0265. The reasonableness of each proposed amendment to the state hazardous waste rules is discussed below.

A. Minn. Rules pt. 7045.0020 Definitions.

The existing Minn. Rules pt. 7045.0020 provides definitions for a variety of terms found in the rules. The proposed rules incorporate a federal clarification of the definition of the term "designated facility" found in subpart 15 of this part. This clarification was promulgated by EPA on January 23, 1990. The proposed rules require that before a shipment of hazardous waste can be sent to a designated facility located in a state not authorized by EPA to regulate that particular waste as hazardous, the receiving state must first give the facility permission to accept that particular waste. It is reasonable to incorporate this federal amendment into the state rules in order to clarify the definition and provide consistency between state rules and federal regulations.

B. Minn. Rules pt. 7045.0102 Mixtures of Wastes.

The existing Minn. Rules pt. 7045.0102, subpart 2 regulates the mixing of hazardous and nonhazardous wastes. All of the proposed amendments to this part are found in subpart 2. The proposed amendments are of two types: amendments to incorporate federal amendments promulgated by EPA on September 1, 1989; and state-initiated clarifications of the existing rules.

The proposed amendments to items B and H of subpart 2 of this part incorporate federal amendments which provide requirements for mixtures of hazardous wastes and mining wastes exempt from hazardous waste regulation under Minn. Rules pt. 7045.0120, item I. The proposed amendments to item B

state that mixtures of listed wastes and exempt mining wastes are exempt from hazardous waste regulation if the mixtures no longer exhibit any characteristic for which the hazardous waste was listed. As in current rules for mixtures involving listed hazardous wastes, the proposed amendments allow only wastes listed because of ignitability, corrosivity, or reactivity to be mixed. This is more stringent than the corresponding federal amendments which allow mixing of all types of listed wastes. The proposed amendments create a new item H which states that mixtures of exempt mining wastes and characteristic hazardous wastes are hazardous if the mixtures exhibit a characteristic which the exempt waste alone would not have exhibited, or if the mixtures continue to exhibit any characteristic exhibited by the hazardous waste prior to mixture. These proposed amendments are reasonable because they prevent these types of mixtures, even though they contain exempt mining wastes, from being treated as nonhazardous wastes when they continue to exhibit characteristics of hazardous waste. It is also reasonable to incorporate these federal amendments into the state rules in order to maintain consistency between state rules and federal regulations.

The Agency proposes to make state-initiated changes to subpart 2 of this part in order to clarify the requirements of the rule by adding explanatory text and in order to make the rule more easily read by changing the language and format of parts of the rule. The proposed amendments add a statement to the introduction of this subpart which explains that the mixing of hazardous and nonhazardous wastes as described in this subpart is treatment, and subsequently subject to additional requirements found in part 7045.0211. This is not a new requirement; it is an explicit statement of an implicit requirement of the rule.

The mixing of wastes fits the definition of "treatment" in Minn. Rules pt. 7045.0020, subp. 97, and the requirements for generators of hazardous waste that treat wastes are explicitly outlined in Minn. Rules pt. 7045.0211. This amendment explicitly states how these requirements found elsewhere in the rules apply to the requirements of this subpart. It is reasonable to add this statement to clarify the existing requirements of the rule.

The proposed amendments change the language of item A of subpart 2 by condensing the existing language. Item A currently specifies each of the hazardous waste characteristics individually. The proposed amendments condense this language into a statement which refers to "the characteristics of hazardous waste" as a whole. This is a cosmetic change which is intended to shorten and clarify the rule. This proposed change is also made to item B, but it also adds the characteristic of oxidativity to the list of characteristics identified. The Agency feels that this characteristic should also be considered in determining whether or not a mixture is hazardous in the event that mixing as described in item B produces an oxidative waste. This change will provide consistency between items A and B by adding the omitted characteristic of oxidativity. The proposed amendments also divide items B and D into subitems to make the rule more easily read. It is reasonable to make these changes for the sake of clarity and consistency.

C. Minn. Rules pt. 7045.0120 Exempt Wastes.

The existing Minn. Rules. pt. 7045.0120 exempts specific wastes from regulation as hazardous wastes. Item I of this part currently provides an exemption for all wastes from the extraction, beneficiation, and processing of ores and minerals. The Agency is proposing to amend item I to incorporate

federal amendments promulgated by EPA on September 1, 1989, and January 23, 1990. The proposed amendments define the term "beneficiation" and specify the mineral processing wastes contained in this exemption. The proposed amendments incorporate the federal definition of "beneficiation". The proposed amendments which specify the scope of the exemption for mineral processing wastes incorporate the federal amendments, except the proposed amendments more stringently restrict the scope of the exclusion as explained directly below.

In federal amendments promulgated September 1, 1989, EPA limited the scope of the exclusion for mineral processing wastes to twenty-five specific waste streams. In later federal amendments promulgated January 23, 1990, EPA removed five of these wastes from the exclusion, bringing the number of mineral processing wastes contained in the exclusion to twenty waste streams. These twenty wastes are currently being examined further by EPA to determine their final regulatory status.

The Agency proposes to exempt from hazardous waste regulation only nine of the twenty mineral processing wastes which EPA has retained in the exclusion. Based on data given on these twenty wastes in EPA's July 1990 Report to Congress on Special Wastes From Mineral Processing and other EPA proposed and final regulations (see Exhibits 2, 3, 7, and 9), the Agency believes that eleven of these wastes are potentially hazardous and should not be excluded from hazardous waste regulation. Data given in these EPA documents shows that all of these eleven wastes are known to have exhibited a characteristic of hazardous waste at some time in the past. Thus, the Agency believes that these eleven wastes should be subject to evaluation to determine whether or not they are hazardous,

rather than exempt from hazardous waste regulation. These eleven wastes are: slag from primary lead processing; process wastewater from hydrofluoric acid production; chloride process waste solids from titanium tetrachloride production; calcium sulfate wastewater treatment plant sludge from primary copper processing; process wastewater from phosphoric acid production; process wastewater from primary magnesium processing by the anhydrous process; slag from primary zinc processing; phosphogypsum from phosphoric acid production; slag from primary copper processing; air pollution control dust sludge from iron blast furnaces; and basic oxygen furnace and open hearth furnace air pollution control dust/sludge from carbon steel production. The nine wastes which the Agency is retaining within the exclusion are not known to have displayed a characteristic of hazardous waste, even though EPA has studied and tested these wastes extensively. These nine wastes are: slag from elemental phosphorous production; fluorogypsum from hydrofluoric acid production; gasifier ash from coal gasification; red and brown muds from bauxite refining; basic oxygen furnace and open hearth furnace slag from carbon steel production; iron blast furnace slag; process wastewater from coal gasification; treated residue from the roasting/leaching of chrome ore; and slag tailings from primary copper processing.

In incorporating federal regulations, the Agency must be at least as stringent as or more stringent than the federal regulations. The proposed amendments which incorporate the federal definition of "beneficiation" and retain the exclusion for the nine specified mineral processing wastes are reasonable because they provide for consistency with federal regulations by being as stringent as federal regulations. By not exempting the other eleven processing wastes which EPA has excluded from regulation, the proposed rules are

more stringent than EPA's. It is reasonable to not exempt these eleven processing wastes from hazardous waste regulation because these wastes are known to display hazardous waste characteristics. EPA states in its Report to Congress on Special Wastes From Mineral Processing that four of the processing wastes EPA has excluded "have posed or may pose a danger to health or the environment." Although EPA does not state this directly about the other seven wastes, data in the report shows that these wastes have displayed characteristics of hazardous waste. It is reasonable to not exclude wastes such as these in order to provide for greater protection of human health and the environment. Although these eleven wastes are not retained within the exemption, they are not subject automatically to regulation as hazardous wastes. They are, however, subject to evaluation to determine whether or not they are hazardous and if they should be treated as such.

In deciding whether or not to retain some of these potentially hazardous wastes within the exclusion, EPA considered the economic factors which would affect existing facilities which generate these wastes if these wastes would have to be regulated as hazardous. In some cases, such as in the case of lead slag from primary lead processing, the economic costs were substantial enough to cause EPA to retain some of these wastes within the exclusion. The Agency did not need to consider existing facilities producing these wastes in deciding whether or not to exempt these wastes, because there are currently no facilities in Minnesota which produce any of these twenty processing wastes. Not being bound by the same economic constraints as EPA, the Agency proposes to not exempt eleven of these processing wastes in consideration of possible future situations where these potentially hazardous wastes are produced or disposed of in Minnesota.

The Agency believes that the possibility of a mineral processing facility being sited in Minnesota in the future is remote. The high cost of siting a new processing facility mandates that any new processing facility would need to be sited near a very large reserve of ore. Minnesota contains taconite (a type of iron ore) and copper reserves. The taconite reserve in northern Minnesota is large, but the capacity of existing out-of-state facilities which process the ore is sufficient to handle the quantity of ore mined. This situation makes the siting of a new taconite processing facility unlikely. If copper were ever mined in Minnesota, it would most likely be shipped for processing to existing nearby facilities in Michigan and Canada. Thus, the combination of the types and sizes of mineral reserves in Minnesota and the numbers and locations of processing facilities outside Minnesota makes the siting of a mineral processing facility in Minnesota economically impractical. Since it is very unlikely that such a facility will be sited in Minnesota in the future, the proposed rules will not have an impact on the mining industry in Minnesota. In the event that these wastes would be produced in Minnesota, the potential hazardousness of these wastes makes it reasonable to require that they be evaluated. It is more consistent to require evaluation of these wastes than to allow a blanket exclusion for wastes known to have the potential to be hazardous.

The possibility also remains that mineral processing wastes from out-of-state could be disposed of in Minnesota. Most processing wastes are disposed of on-site, but some are shipped off-site for disposal. Given this possibility, the proposed rules remove eleven of the twenty mineral processing wastes from EPA's exclusion because they are known to have exhibited a characteristic of hazardous waste at some time in the past. The Agency believes that these wastes should be subject to evaluation to determine whether or not they are hazardous wastes.

D. Minn. Rules pt. 7045.0135 Lists of Hazardous Wastes.

The existing Minn. Rules pt. 7045.0135 contains the lists of hazardous wastes. Subpart 2 of this part contains the list of hazardous wastes from nonspecific sources. The Agency proposes to amend subpart 2 to incorporate federal amendments promulgated by EPA on February 14, 1990. The proposed rules modify the scope of the listing of hazardous waste number F019, wastewater treatment sludges from the chemical conversion coating process of aluminum, found in this subpart. The proposed amendment excludes wastewater treatment sludges from the zirconium phosphating step of this process. This proposed amendment is reasonable because EPA has determined that this particular wastewater treatment sludge is nonhazardous.

The Agency also proposes to amend subpart 2 to incorporate a federal amendment promulgated by EPA on December 11, 1989. The proposed rules clarify the listing description of hazardous waste number F024, certain wastes from the production of chlorinated aliphatic hydrocarbons, and add another waste, to be numbered F025, to the list of hazardous wastes from nonspecific sources found in subpart 2 of this part. The proposed listing for waste number F025 includes other wastes from the production of certain chlorinated aliphatic hydrocarbons. It is reasonable to incorporate these federal amendments into the state rules in order to maintain consistency between state rules and federal regulations.

Subpart 3 of this part contains the list of hazardous wastes from specific sources. The Agency proposes to amend subpart 3 to incorporate federal amendments promulgated by EPA on October 6, 1989. The proposed amendments add two waste streams from the production of methyl bromide to this list. These wastes are numbered as K131 and K132 in the proposed rules. It is reasonable to incorporate these federal amendments into the state rules in order to maintain consistency between state rules and federal regulations.

E. Minn. Rules pt. 7045.0139 Basis for Listing Hazardous Wastes.

The existing Minn. Rules pt. 7045.0139, subp. 2 contains a list of the hazardous constituents which caused the Agency to list wastes as hazardous in part 7045.0135. As discussed in Section D above, the proposed amendments to part 7045.0135 add waste streams to the lists of hazardous wastes. Therefore, the Agency is proposing to amend Minn. Rules pt. 7045.0139, subpart 2 to add the constituents which caused the Agency to add these wastes to the lists of hazardous wastes. The constituents causing hazardous waste numbers F025, K131, and K132 to be added to the lists of hazardous wastes are added to the list of constituents in subpart 2. It is reasonable to incorporate these federal amendments into state rules in order to maintain consistency between state rules and federal regulations.

F. Minn. Rules pt. 7045.0141 Hazardous Constituents.

The existing Minn. Rules pt. 7045.0141 provides a list of hazardous constituents and their Chemical Abstract Service registry numbers. The Agency is proposing to amend this part to incorporate federal amendments promulgated by EPA on December 11, 1989. The proposed amendments add the constituent allyl chloride to the list of constituents found in subpart 2 of this part. It is reasonable to incorporate this federal amendment into state rules in order to maintain consistency between state rules and federal regulations.

G. Minn. Rules pt. 7045.0265 Use of Manifest.

The existing Minn. Rules pt. 7045.0265, subp. 4 contains the requirements for generators using hazardous waste manifests when shipping hazardous wastes out-of-state. The proposed amendment to this part incorporates a federal amendment promulgated by EPA on January 23, 1990, and changes the format of subpart 4 to accommodate this amendment. The proposed amendment clarifies that

it is the responsibility of the generator to assure that any out-of-state transporters and designated facilities handling the generator's waste sign the hazardous waste manifest accompanying the waste shipment. In changing the format of this subpart to accommodate the proposed amendments, the existing rules in subpart 4 will be contained in an introduction to the subpart and in item A of the subpart. The proposed amendment will be contained in a new item B. This proposed amendment is only a clarification of the existing rules and adds no new requirements. It is reasonable to incorporate this proposed amendment into state rules in the interest of clarity and to maintain consistency of language between state rules and federal regulations.

IV. SMALL BUSINESS CONSIDERATIONS IN RULEMAKING

To comply with Minn. Stat. § 14.115 (1990), the Agency has considered the statutory methods for reducing the impact of the proposed rules on small businesses. The statute requires that each of the following methods be considered:

1. The establishment of less stringent compliance or reporting requirements;

2. The establishment of less stringent schedules or deadlines for compliance or reporting requirements;

3. The consolidation or simplification of compliance or reporting requirements;

4. The establishment of performance standards for small businesses to replace design or operational standards in the rule; and

5. The exemption of small businesses from any or all requirements of the rule.

None of the proposed amendments will have a negative impact on small businesses. The proposed amendments dealing with the definition of "designated facility", the requirements for hazardous waste generators, and the state

initiated changes in the rules for mixtures are only clarifications and do not contribute additional requirements to the hazardous waste rules. Thus, these amendments will not have any impact on small businesses. The proposed amendments to the lists of hazardous wastes will not affect small businesses either. One of these amendments removes a waste stream from regulation, which would have a beneficial effect on businesses that produce that waste stream. The other amendments add wastes to the lists of hazardous wastes which are not produced by small entities (see Exhibits 5, 6, and 8), thus having no effect on small businesses. Regarding the proposed amendments to the rules governing mining wastes, EPA has determined that these requirements will not have a significant adverse impact on a substantial number of small businesses (see Exhibits 3 and 7). The Agency believes that the proposed rules governing mining wastes will not have any effect on Minnesota businesses because there are currently no mineral processing facilities of the type contained in these amendments in the state. Thus, the limitation of the exclusion for mineral processing wastes from hazardous waste regulation will not affect small businesses. The proposed amendments dealing with mixtures of mining wastes and hazardous wastes apply in Minnesota to mining operations, which are not considered small businesses.

V. CONSIDERATION OF ECONOMIC FACTORS

In exercising its powers, the Agency is required by Minn. Stat. § 116.07, subd. 6 (1990) to give due consideration to economic factors. The statute provides:

> In exercising all its powers, the Pollution Control Agency shall give due consideration to the establishment, maintenance, operation, and expansion of business, commerce, trade, industry, traffic, and other economic factors and other material matters affecting the feasibility and practicability of any proposed action, including, but not limited to, the burden on a municipality of any tax that may result therefrom, and shall take or provide for such action as may be reasonable, feasible, and practical under the circumstances.

In order to remain authorized by EPA to administer its hazardous waste program, the Agency is required to adopt federal amendments which are more stringent than current hazardous waste rules. The bulk of the proposed amendments in this rulemaking are more stringent than current rules. Since these requirements were first promulgated by EPA, the Agency is not increasing the amount of regulation or the economic burden of hazardous waste management by incorporating these federal amendments into the state rules. Though the Agency is being more stringent than EPA in the proposed amendment which excludes fewer mineral processing wastes from hazardous waste regulation than EPA excludes, this will not incur additional economic costs in Minnesota because the wastes which the Agency has decided not to exempt from hazardous waste regulation are not currently generated in Minnesota. These more stringent amendments will not have adverse future economic impacts on industry in Minnesota because the possibility of the siting of facilities that produce these wastes in Minnesota is remote. The proposed amendment which excludes a specific source waste from

the listings of hazardous wastes would provide an economic benefit to any business producing that waste since that waste no longer needs to be managed as hazardous waste. The proposed clarification amendments will have no economic impact since they do not change the content of the rules.

VI. CONCLUSION

The Agency has, in this document and its exhibits, made its presentation of facts establishing the need for and reasonableness of the proposed amendments to Minnesota's hazardous waste rules. The Agency has also stated in this document that the proposed amendments will not affect small businesses and will not incur greater economic costs than the federal amendments that they incorporate. This document constitutes the Agency's Statement of Need and Reasonableness for the proposed amendments to the hazardous waste rules.

VII. LIST OF EXHIBITS

The Agency is relying on the following documents to support these amendments:

Agency Ex. No.	Title
1	Federal Register, Vol. 53, No. 203, pages 41288-41300, October 20, 1988.
2	Federal Register, Vol. 54, No. 72, pages 15316-15354, April 17, 1989.
3	Federal Register, Vol. 54, No. 169, pages 36592-36642, September 1, 1989.
4	Federal Register, Vol. 54, No. 184, pages 39298-39318, September 25, 1989.
5	Federal Register, Vol. 54, No. 193, pages 41402-41407, October 6, 1989.
6	Federal Register, Vol. 54, No. 236, pages 50968-50979, December 11, 1989.
7	Federal Register, Vol. 55, No. 15, pages 2322-2354, January 23, 1990.
8	Federal Register, Vol. 55, No. 31, pages 5340-5342, February 14, 1990.
9	EPA Report to Congress on Special Wastes from Mineral Processing, July 1990.

2-15-91
Date

for Barbara Lindsay Sims
Charles W. Williams
Commissioner

Minn. Stat. 116.07 subd 4

Pursuant and subject to the provisions of chapter 14, and the provisions hereof, the pollution control agency may adopt, amend and rescind rules and standards having the force of law relating to any purpose within the provisions of Laws 1969, chapter 1046 . . . .

end of comment period April 17, 1991

STATE OF MINNESOTA

OFFICE MEMORANDUM

DEPARTMENT: ATTORNEY GENERAL

DATE: June 11, 1991

Rec 6-12-91

TO: PATTY NOLTE
Public Finance Division
525 Park, Suite 500

FROM: ALAN R. MITCHELL ARM
Special Assistant
Attorney General

PHONE: 6-7200

SUBJECT: **Proposed Rule Amendments**

Attached are the materials for your review of a noncontroversial rulemaking proceeding conducted by the Minnesota Pollution Control Agency. This proceeding involves amendments to the Agency's hazardous waste rules. Minn. Rules ch. 7045.

I wanted to advise you that the Agency did not publish a Notice of Intent to Solicit Outside Opinion in this proceeding.

ARM:jlm:AY7

Enclosures

Minnesota Pollution Control Agency
520 Lafayette Road, Saint Paul, Minnesota 55155-3898
Telephone (612) 296-6300

June 11, 1991

Ms. Patty Nolte
Legal Assistant
Office of the Attorney General
525 Park Street, Suite 500
St. Paul, Minnesota 55155

Dear Ms. Nolte:

Re: In the Matter of the Proposed Rule Amendments Governing Mining Wastes, the Lists of Hazardous Wastes, Shipments of Hazardous Wastes Out-of-State, and mixtures of Hazardous and Nonhazardous Wastes, Minn. Rules Pts. 7045.0020, 7045.0102, 7045.0120, 7045.0135, 7045.0139, 7045.0141, and 7045.0265.

On May 21, 1991, the Minnesota Pollution Control Agency adopted the above-captioned rule amendments governing mining wastes, the lists of hazardous wastes, shipments of hazardous wastes out-of-state, and mixtures of hazardous and nonhazardous wastes. Enclosed for your review are the following:

1. Certificate of Agency's Authorizing Resolution (February 26, 1991).

2. Rules as proposed with Revisor's certificate.

3. Notice of Intent to Adopt Rule Amendments Without a Public Hearing, as mailed (March 5, 1991).

4. Affidavit of Mailing the Notice of Intent to Adopt Rules Without a Public Hearing and Certificate of Mailing List (April 26, 1991).

5. Statement of Need and Reasonableness.

6. Notice of Intent to Adopt Rules Without a Public Hearing and rule amendments as proposed (15 SR 2087-2092, March 18, 1991).

7. Comment letter received from U.S. Environmental Protection Agency, Region V during the comment period (received April 9, 1991).

8. Comment received from the Environmental Defense Fund during the comment period (received April 5, 1991).

9. Rules as adopted (original and three copies).

10. Certificate of Resolution Adopting Rules (May 22, 1991).

11. Findings of Fact, Conclusions, and Order Adopting Rules (May 28, 1991) (two copies).

12. Affidavit of Receiving No Requests for Notice of Submission of Rule Amendments Adopted Without a Public Hearing to the Attorney General (June 5, 1991).

13. Declaration of Counsel.

For your information, the four-digit client code is 0697.

Sincerely,

Glenn Skuta

Glenn Skuta
Rules Unit
Program Development Section
Hazardous Waste Division

GS:jap

Enclosures

Pollution Control Agency

Proposed Permanent Rules Relating to Hazardous Waste Clarifications

Rules as Proposed

7045.0020 DEFINITIONS.

[For text of subps 1 to 14, see M.R.]

Subp. 15. **Designated facility.** "Designated facility" means a hazardous waste treatment, storage, or disposal facility which:

A. (1) has received interim status;

(2) has received an agency permit,

(3) is subject to the requirements of part 7045.0125, subpart 5, 6, or 10, or subpart 9, item B, or part 7045.0685; or

(4) if located outside Minnesota, has been exempted from the requirements to obtain a permit by the United States Environmental Protection Agency; has either received an Environmental Protection Agency permit or a permit from an authorized state, or has interim status; ~~and~~

B. has been designated on the manifest by the generator pursuant to part 7045.0261, or has been designated on a shipping paper or management plan required by part 7045.0125; and

C. if located in an Environmental Protection Agency authorized state which has not yet obtained authorization to regulate the hazardous waste it is receiving as hazardous, must be a facility allowed by the receiving state to accept the waste.

[For text of subps 16 to 109, see M.R.]

7045.0102 MIXTURES OF WASTES.

[For text of subpart 1, see M.R.]

Subp. 2. **Mixtures of hazardous and nonhazardous wastes.** The mixing of a hazardous waste with a nonhazardous waste as described in this subpart constitutes treatment.

Approved by Revisor

Generators who mix hazardous and nonhazardous wastes on site must meet the requirements of part 7045.0211 for generators with on-site facilities.

A. A mixture is a hazardous waste if it is a mixture of nonhazardous waste and any waste which is hazardous solely because it exhibits the characteristic of ignitability, corrosivity, oxidativity, or reactivity as described in part 7045.0131, unless the resulting mixture ~~no longer exhibits~~ does not exhibit any of the characteristics of ~~ignitability, corrosivity, oxidativity, or reactivity and does not exhibit characteristics of extraction procedure (EP) toxicity or toxicity~~ hazardous waste as defined in part 7045.0131.

B. A mixture is a hazardous waste if it is a mixture of nonhazardous waste and any waste listed in part 7045.0135 solely because of ignitability, corrosivity, or reactivity, unless:

(1) the resulting mixture ~~either no longer exhibits~~ does not exhibit any of the characteristics of ~~ignitability, corrosivity, and reactivity, and does not exhibit characteristics of extraction procedure (EP) toxicity or toxicity~~ hazardous waste as defined in part 7045.0131~~, or~~;

(2) the resulting mixture has been excluded from regulation pursuant to part 7045.0075, subpart 2; or

(3) the nonhazardous waste is exempt from regulation under part 7045.0120, item I, and the resultant mixture no longer exhibits any characteristic of hazardous waste as defined in part 7045.0131 for which the hazardous waste listed in part 7045.0135 was listed.

[For text of item C, see M.R.]

D. A mixture is a hazardous waste if it is a sewered mixture of nonhazardous waste and any waste which is hazardous because it exhibits the characteristics of extraction procedure (EP) toxicity or toxicity as defined in part 7045.0131 unless:

(1) prior to entering the sewer the resulting mixture no longer exhibits the ~~characteristics~~ characteristic of extraction procedure (EP) toxicity or toxicity~~,~~; and

Approved by Revisor _____

(2) the sewering of the mixture has been approved by the agency pursuant to parts 7045.0220 to 7045.0255.

This provision does not apply to those mixtures defined as nonhazardous under item F.

[For text of items E to G, see M.R.]

H. Any mixture of a waste from the extraction, beneficiation, and processing of ores and minerals excluded under part 7045.0120, item I, and any other waste exhibiting a characteristic of hazardous waste under part 7045.0131 is a hazardous waste only if:

(1) it exhibits a characteristic that would not have been exhibited by the excluded waste alone if such mixture had not occurred; or

(2) it continues to exhibit any of the characteristics exhibited by the nonexcluded wastes prior to mixture.

For the purposes of applying the toxicity characteristic of part 7045.0131, subpart 7, to such mixtures, the mixture is also a hazardous waste if it exceeds the maximum concentration for any contaminant listed in part 7045.0131, subpart 8, that would not have been exceeded by the excluded waste alone if the mixture had not occurred or if it continues to exceed the maximum concentration for any contaminant exceeded by the nonexempt waste prior to mixture.

[For text of subp 3, see M.R.]

7045.0120 EXEMPT WASTES.

The following wastes may be stored, labeled, transported, treated, processed, and disposed of without complying with the requirements of this chapter:

[For text of items A to H, see M.R.]

I. waste from the extraction, beneficiation, and processing of ores and minerals, including coal, and including phosphate rock and overburden from the mining of uranium ore~~;~~. For purposes of this item, beneficiation of ores and minerals is restricted to the following activities: crushing; grinding;

Approved by Revisor _____

washing; dissolution; crystalization; filtration; sorting; sizing; drying; sintering; pelletizing; briquetting; calcinizing to remove water or carbon dioxide; roasting, autoclaving, or chlorination in preparation for leaching (except where the roasting, autoclaving, or chlorination/leaching sequence produces a final or intermediate product that does not undergo further beneficiation or processing); gravity concentration; magnetic separation; electrostatic separation; flotation; ion exchange; solvent extraction; electrowinning; precipitation; amalgamation; and heap, dump, vat, tank, and in situ leaching. For the purposes of this item, waste from the processing of ores and minerals includes only the following wastes:

(1) red and brown muds from bauxite refining;

(2) slag from elemental phosphorus production;

(3) gasifier ash from coal gasification;

(4) process wastewater from coal gasification;

(5) slag tailings from primary copper processing;

(6) fluorogypsum from hydrofluoric acid production;

(7) iron blast furnace slag;

(8) treated residue from the roasting/leaching of chrome ore; and

(9) basic oxygen furnace and open hearth furnace slag from carbon steel production;

[For text of items J to P, see M.R.]

7045.0135 LISTS OF HAZARDOUS WASTES.

[For text of subpart 1, see M.R.]

Subp. 2. **Hazardous wastes from nonspecific sources.** Hazardous wastes from nonspecific sources are listed with the generic hazardous waste number and hazard code in items A to ~~U~~ V.

[For text of items A to L, see M.R.]

M. F019, wastewater treatment sludges from the chemical conversion coating of aluminum, except from zirconium phosphating in aluminum can washing when such phosphating is an exclusive conversion coating process: (T);

Approved by Revisor _____

[For text of items N to Q, see M.R.]

R. F024, process wastes, including but not limited to, distillation residues, heavy ends, tars, and reactor cleanout wastes from the production of certain chlorinated aliphatic hydrocarbons~~, having carbon content from one to five, utilizing~~ by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to and including five, with varying amounts and positions of chlorine substitution. This listing does not include ~~light ends, spent filters and filter aids, spent dessicants, wastewater~~ wastewaters, wastewater treatment sludges, ~~and~~ spent catalysts, and wastes listed in this subpart and subpart 3: (T);

S. F025, condensed light ends, spent filters and filter aids, and spent dessicant wastes from the production of certain chlorinated aliphatic hydrocarbons, by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to and including five, with varying amounts and positions of chlorine substitution: (T);

T. F026, wastes, except wastewater and spent carbon from hydrogen chloride purification, from the production of materials on equipment previously used for the manufacturing use as a reactant, chemical intermediate, or component in a formulating process of tetra-, penta-, or hexachlorobenzene under alkaline conditions: (H);

~~T.~~ U. F027, discarded unused formulations containing tri-, tetra-, or pentachlorophenol or discarded unused formulations containing compounds derived from these chlorophenols. This listing does not include formulations containing hexachlorophene synthesized from prepurified 2,4,5-trichlorophenol as the sole component: (H); and

~~U.~~ V. F028, residues resulting from the incineration or thermal treatment of soil contaminated with hazardous waste Nos. F020, F021, F022, F023, F026, and F027: (T).

Subp. 3. **Hazardous waste from specific sources.** Hazardous

Approved by Revisor _____

wastes from specific sources are listed with the industry and hazardous waste number and hazard code in items A to L.

[For text of items A to D, see M.R.]

E. Pesticides:

[For text of subitems (1) to (18), see M.R.]

(19) K125, filtration, evaporation, and centrifugation solids from the production of ethylenebisdithiocarbamic acid and its salts: (T); ~~and~~

(20) K126, bag house dust and floor sweepings in milling and packaging operations from the production or formulation of ethylenebisdithiocarbamic acid and its salts: (T);

(21) K131, wastewater from the reactor and spent sulfuric acid from the acid dryer from the production of methyl bromide: (C,T); and

(22) K132, spent absorbent and wastewater separator solids from the production of methyl bromide: (T).

[For text of items F to L, see M.R.]

[For text of subps 4 and 5, see M.R.]

7045.0139 BASIS FOR LISTING HAZARDOUS WASTES.

[For text of subpart 1, see M.R.]

Subp. 2. **Constituents.** The constituents which are the basis for listing the wastes identified in part 7045.0135, subparts 2 and 3 are listed in items A and B.

A. Constituents of wastes identified in part 7045.0135, subpart 2 are listed in subitems (1) to ~~(21)~~ (22).

[For text of subitems (1) to (18), see M.R.]

(19) F025: Chloromethane; dichloromethane; trichloromethane; carbon tetrachloride; chloroethylene; 1,1-dichloroethane; 1,2-dichloroethane; trans-1,2-dichloroethylene; 1,1-dichloroethylene; 1,1,1-trichloroethane; 1,1,2-trichloroethane; trichloroethylene; 1,1,1,2-tetrachloroethane; 1,1,2,2-tetrachloroethane; tetrachloroethylene; pentachloroethane; hexachloroethane; allyl chloride (3-chloropropene); dichloropropane; dichloropropene;

Approved by Revisor _____

2-chloro-1,3-butadiene; hexachloro-1,3-butadiene; hexachlorocyclopentadiene; benzene; chlorobenzene; dichlorobenzene; 1,2,4-trichlorobenzene; tetrachlorobenzene; pentachlorobenzene; hexachlorobenzene; toluene; naphthalene;

(20) F026: Tetra-, penta-, and hexachlorodibenzo-p-dioxins; tetra-, penta-, and hexachlorodibenzofurans;

~~(20)~~ (21) F027: Tetra-, penta-, and hexachlorodibenzo-p-dioxins; tetra-, penta-, and hexachlorodibenzofurans; tri-, tetra-, and pentachlorophenols and their chlorophenoxy derivative acids, esters, ethers, amine, and other salts; and

~~(21)~~ (22) F028: Tetra-, penta-, and hexachlorodibenzo-p-dioxins; tetra-, penta-, and hexachlorodibenzofurans; tri-, tetra-, and pentachlorophenols and their chlorophenoxy derivative acids, esters, ethers, amine, and other salts.

B. Constituents of wastes identified in part 7045.0135, subpart 3 are listed in subitems (1) to ~~(89)~~ (91).

[For text of subitems (1) to (87), see M.R.]

(88) K126: Ethylene thiourea; ~~and~~

(89) K131: Dimethyl sulfate, methyl bromide;

(90) K132: Methyl bromide; and

(91) K136: Ethylene dibromide.

7045.0141 HAZARDOUS CONSTITUENTS.

[For text of subpart 1, see M.R.]

Subp. 2. **"A" constituents.** Hazardous constituents beginning with the letter A are as follows:

[For text of items A to L, see M.R.]

M. Allyl chloride, 107-18-6, ____;

N. Aluminum phosphide, 20859-73-8, P006;

~~N.~~ O. 4-Aminobiphenyl, 92-67-1, ____;

~~O.~~ P. 5-(Aminomethyl)-3-isoxazolol, 2763-96-4, P007;

~~P.~~ Q. 4-Aminopyridine, 504-24-5, P008;

~~Q.~~ R. Amitrole, 61-82-5, U011;

Approved by Revisor _____

~~R.~~ S. Ammonium vanadate, 7803-55-6, P119;

~~S.~~ T. Aniline, 62-53-3, U012;

~~T.~~ U. Antimony, 7440-36-0, ____;

~~U.~~ V. Antimony compounds, not otherwise specified in this list, _____, ____;

~~V.~~ W. Aramite, 140-57-8, ____;

~~W.~~ X. Arsenic, 7440-38-2, ____;

~~X.~~ Y. Arsenic compounds, not otherwise specified in this list, _____, ____;

~~Y.~~ Z. Arsenic acid, 7778-39-4, P010;

~~Z.~~ AA. Arsenic pentoxide, 1303-28-2, P011;

~~AA.~~ BB. Arsenic trioxide, 1327-53-3, P012;

~~BB.~~ CC. Auramine, 492-80-8, P014; and

~~CC.~~ DD. Azaserine, 115-02-6, U015.

[For text of subps 3 to 23, see M.R.]

7045.0265 USE OF MANIFEST.

[For text of subps 1 to 3, see M.R.]

Subp. 4. **Out-of-state shipments.** When a shipment of hazardous waste is to be delivered to a hazardous waste facility located outside the state of Minnesota, the generator must ensure that:

A. the copy of the hazardous waste manifest signed by the facility operator is sent to the commissioner within 40 days of the acceptance of the hazardous waste by the hazardous waste facility; and

B. for shipments of a hazardous waste to a designated facility in an authorized state which has not yet obtained authorization to regulate that particular waste as hazardous, the designated facility agrees to sign the manifest and return the manifest to the generator, and that any out-of-state transporter signs and forwards the manifest to the designated facility.

[For text of subp 5, see M.R.]

Approved
by Revisor _____

Office of the Revisor of Statutes

Administrative Rules

TITLE: Proposed Permanent Rules Relating to Hazardous Waste Clarifications

AGENCY: Pollution Control Agency

MINNESOTA RULES: Chapter 7045

The attached rules are approved for publication in the State Register

Carla M. Riehle
Assistant Revisor

CERTIFICATE OF AGENCY'S AUTHORIZING RESOLUTION

I, Charles W. Williams, do hereby certify that I am the Commissioner of the Minnesota Pollution Control Agency, an agency duly authorized under the laws of the State of Minnesota, and that the following is a true, complete, and correct copy of a resolution adopted at a meeting of the Minnesota Pollution Control Agency duly and properly called and held on the twenty-sixth day of February, 1991, that a quorum was present at said meeting, that a majority of those present voted for the resolution, and that said resolution will be set forth in the minutes of said meeting and has not been rescinded or modified:

BE IT RESOLVED, that the Commissioner of the Minnesota Pollution Control Agency is hereby granted the authority to sign and to give notice of the Minnesota Pollution Control Agency's intent to adopt, without a public hearing, the attached amendments to the Minnesota Pollution Control Agency's hazardous waste rules governing the management, treatment, storage, and disposal of hazardous waste, Minn. Rules pts. 7045.0020, 7045.0102, 7045.0120, 7045.0135, 7045.0139, 7045.0141, and 7045.0265, to all persons who have registered their names with the Minnesota Pollution Control Agency for that purpose and publish the notice and the rule amendments in the State Register, and to perform any acts incidental thereto, including making any form changes in the rule amendments that the Revisor of Statutes requires the Minnesota Pollution Control Agency to make in order to obtain the Revisor's certification as required by Minn. Stat. § 14.07, subd. 2 (1990).

BE IT FURTHER RESOLVED, that in the event a public hearing becomes necessary, the Commissioner is hereby granted the authority and directed to call a hearing for the purpose of promulgating said rule amendments as well as to perform any and all acts incidental thereto, including but not limited to signing an Order for and Notice of Hearing, as well as acting as the Minnesota Pollution Control Agency's representative at all hearings.

IN WITNESS WHEREOF, I have hereunto subscribed my name this 26 day of Feb, 1991.

Charles W. Williams
Commissioner

STATE OF MINNESOTA
POLLUTION CONTROL AGENCY

In the Matter of the Proposed Rule Amendments Governing the Regulation of Mining Wastes, the Lists of Hazardous Wastes, Out-of-state Shipments of Hazardous Waste, and Mixtures of Hazardous and Nonhazardous Wastes, Minn. Rules Ch. 7045

NOTICE OF INTENT TO ADOPT RULES WITHOUT A PUBLIC HEARING

(1) Notice is hereby given that the Minnesota Pollution Control Agency (MPCA) intends to adopt the above-entitled rule amendments without a public hearing following the procedures set forth in the Administrative Procedure Act for adopting rule amendments without a public hearing in Minn. Stat. §§ 14.22 to 14.28 (1990). The MPCA's authority to adopt the rule amendments is set forth in Minn. Stat. § 116.07, subd. 4 (1990).

(2) All persons have until 5:00 p.m. on April 17, 1991, to submit comments in support of or in opposition to the proposed rule amendments or any part or subpart of the rules. Comment is encouraged. (3) Each comment should identify the portion of the proposed rule amendments addressed, the reason for the comment, and any change proposed.

Any person may make a written request for a public hearing on the proposed rule amendments within the comment period. (4) If 25 or more persons submit a written request for a public hearing within the comment period, a public hearing will be held unless a sufficient number withdraw their requests in writing. (6) Any person requesting a public hearing should state his or her name and address, and is encouraged to identify the portion of the proposed rule amendments addressed, the reason for the request, and any change proposed. (7) If a public hearing is required, the MPCA will proceed pursuant to Minn. Stat. §§ 14.131 to 14.20 (1990).

(5) Comments or written requests for a public hearing must be submitted to:

Glenn Skuta
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, Minnesota 55155
612/643-3478

(8) The proposed rule amendments may be modified if the modifications are supported by data and views submitted to the MPCA and do not result in a substantial change in the proposed rule amendments as noticed.

(11) The proposed rule amendments pertaining to the management of hazardous waste, if adopted, incorporate federal regulations into state rules and clarify the existing state rules governing the management of mixtures of hazardous and nonhazardous wastes. The federal amendments incorporated by the proposed rule amendments address the management of mining wastes, the lists of hazardous wastes, and the requirements for out-of-state shipments of hazardous wastes.

The proposed rule amendments regarding mining wastes limit the current hazardous waste regulatory exclusion for all mineral processing wastes to nine specific waste streams. These proposed rules are more stringent than the federal exclusion for twenty mineral processing waste streams which they incorporate. While the federal amendments exclude twenty mineral processing wastes, the proposed rules exempt only nine of these waste streams. These proposed rule amendments also include requirements for the management of mixtures of hazardous wastes with excluded mining wastes. The proposed rule amendments regarding the lists of hazardous wastes add two waste streams from the production of methyl bromide, one waste stream from the production of chlorinated aliphatic hydrocarbons, and the compound allyl chloride to the lists. These proposed rule amendments also modify the listing descriptions for waste streams from the production of chlorinated aliphatic hydrocarbons and the chemical conversion coating of aluminum. The proposed rule amendments regarding out-of-state shipments of hazardous wastes clarify the definition of "designated facility" and the requirements for generators of hazardous waste. One free copy of the rules is available upon request from Glenn Skuta at the address and telephone number given above.

(12) A Statement of Need and Reasonableness that describes the need for and reasonableness of each provision of the proposed rule amendments has been prepared and is available from Glenn Skuta upon request.

(14) You are hereby advised, pursuant to Minn. Stat. § 14.115 (1990), "Small business considerations in rulemakings," that the proposed rule amendments will not affect small businesses which generate hazardous waste. The hazardous wastes which these proposed rule amendments regulate are not generated by small businesses.

(9) If no hearing is required, upon adoption of the rule amendments, the rule amendments and required supporting documents will be submitted to the Attorney General for review as to legality and form to the extent form relates to legality. Any person may request notification of the date of submission to the Attorney General. Persons who wish to be advised of the submission of this material to the Attorney General, or who wish to receive a copy of the rules as adopted, must submit the written request to Glenn Skuta.

Dated: 3/5/91

Charles W. Williams
Commissioner

STATE OF MINNESOTA
POLLUTION CONTROL AGENCY

In the Matter of the Proposed Amendments of Rules Governing Mining Wastes, the Lists of Hazardous Wastes, Shipments of Hazardous Wastes Out-of-state, and Mixtures of Hazardous and Nonhazardous Wastes, Minn. Rules Pts. 7045.0020, 7045.0102, 7045.0120, 7045.0135, 7045.0139, 7045.0141, 7045.265

AFFIDAVIT OF MAILING THE NOTICE OF INTENT TO ADOPT RULES WITHOUT A PUBLIC HEARING AND CERTIFICATE OF MAILING LIST

STATE OF MINNESOTA)
) ss.
COUNTY OF RAMSEY)

Glenn Skuta, being duly sworn says:

I hereby certify that the list of persons and associations who have requested, pursuant to Minn. Stat. §§ 14.14, subd. 1a and 14.22 (1990) that their names be placed on the Minnesota Pollution Control Agency's rulemaking mailing list is accurate, complete, and current as of the 14th day of March, 1991.

That on the 14th day of March, 1991, at the City of St. Paul, County of Ramsey, State of Minnesota, I mailed the attached Notice of Intent to Adopt Rules Without a Public Hearing by depositing in the State of Minnesota Central Mail System or in the United States mail for first class mailing a copy thereof, with postage prepaid, to all persons and associations on the aforementioned mailing list.

Glenn Skuta

Subscribed and sworn to before me
this 26 day of April, 1991.

Marilyn J. Wegwart
Notary Public

MARILYN J. WEGWART
NOTARY PUBLIC - MINNESOTA
RAMSEY COUNTY
My commission expires 4-19-96

Proposed Rules

Pursuant to Minn. Stat. §§ 14.22, an agency may propose to adopt, amend, suspend or repeal rules without first holding a public hearing, as long as the agency determines that the rules will be noncontroversial in nature. The agency must first publish a notice of intent to adopt rules without a public hearing, together with the proposed rules, in the *State Register*. The notice must advise the public:

1. that they have 30 days in which to submit comment on the proposed rules;
2. that no public hearing will be held unless 25 or more persons make a written request for a hearing within the 30-day comment period;
3. of the manner in which persons shall request a hearing on the proposed rules; and
4. that the rule may be modified if the modifications are supported by the data and views submitted.

If, during the 30-day comment period, 25 or more persons submit to the agency a written request for a hearing of the proposed rules, the agency must proceed under the provisions of §§ 14.14-14.20, which state that if an agency decides to hold a public hearing, it must publish a notice of intent in the *State Register*.

Pursuant to Minn. Stat. §§ 14.29 and 14.30, agencies may propose emergency rules under certain circumstances. Proposed emergency rules are published in the *State Register* and, for at least 25 days thereafter, interested persons may submit data and views in writing to the proposing agency.

Pollution Control Agency

Proposed Permanent Rules Relating to Hazardous Waste Clarifications

Notice of Intent to Adopt Rules Without a Public Hearing

NOTICE IS HEREBY GIVEN that the Minnesota Pollution Control Agency (MPCA) intends to adopt the above-entitled rule amendments without a public hearing following the procedures set forth in the Administrative Procedure Act for adopting rule amendments without a public hearing in *Minnesota Statutes* §§ 14.22 to 14.28 (1990). The MPCA's authority to adopt the rule amendments is set forth in *Minnesota Statutes* § 116.07, subd. 4 (1990).

All persons have until 5:00 p.m. on April 17, 1991 to submit comments in support of or in opposition to the proposed rule amendments or any part or subpart of the rules. Comment is encouraged. Each comment should identify the portion of the proposed rule amendments addressed, the reason for the comment, and any change proposed.

Any person may make a written request for a public hearing on the proposed rule amendments within the comment period. If 25 or more persons submit a written request for a public hearing within the comment period, a public hearing will be held unless a sufficient number withdraw their requests in writing. Any person requesting a public hearing must state his or her name and address, and is encouraged to identify the portion of the proposed rule amendments addressed, the reason for the request, and any change proposed. If a public hearing is required, the MPCA will proceed pursuant to *Minnesota Statutes* §§ 14.131 to 14.20 (1990).

Comments or written requests for a public hearing must be submitted to Glenn Skuta, Minnesota Pollution Control Agency, 520 Lafayette Road North, St. Paul, Minnesota 55155 (telephone 612/643-3478).

The proposed rule amendments may be modified if the modifications are supported by data and views submitted to the MPCA and do not result in a substantial change in the proposed rule amendments as noticed.

The proposed rule amendments pertaining to the management of hazardous waste, if adopted, incorporate federal regulations into state rules and clarify the existing state rules governing the management of mixtures of hazardous and nonhazardous wastes. The federal amendments incorporated by the proposed rule amendments address the management of mining wastes, the lists of hazardous wastes, and the requirements for out-of-state shipments of hazardous waste. The proposed rule amendments regarding mining wastes limit the current hazardous waste regulatory exclusion for all mineral processing wastes to nine specific waste streams. These proposed rules are more stringent than the federal exclusion for mineral processing wastes which they incorporate. While the federal amendments exclude twenty mineral processing wastes, the proposed rules exempt only nine of these waste streams. These proposed rule amendments also include requirements for the management of mixtures of hazardous wastes with excluded mining wastes. The proposed rule amendments regarding the lists of hazardous wastes add two waste streams from the production of methyl bromide, one waste stream from the production of chlorinated aliphatic hydrocarbons, and the compound allyl chloride to the lists. These proposed rule amendments also modify the listing descriptions for waste streams from the production of chlorinated aliphatic hydrocarbons and the chemical conversion coating of aluminum. The proposed rule amendments regarding out-of-state shipments of hazardous wastes clarify the definition of "designated facility" and the requirements for generators of hazardous waste. The proposed rule amendments are

KEY: PROPOSED RULES SECTION — Underlining indicates additions to existing rule language. ~~Strike outs~~ indicate deletions from existing rule language. If a proposed rule is totally new, it is designated "all new material." ADOPTED RULES SECTION — Underlining indicates additions to proposed rule language. ~~Strike outs~~ indicate deletions from proposed rule language.

published below. One free copy of the rules is available upon request from Glenn Skuta at the address and telephone number given above.

A STATEMENT OF NEED AND REASONABLENESS that describes the need for and reasonableness of each provision of the proposed rule amendments has been prepared and is available from Glenn Skuta upon request.

You are hereby advised, pursuant to *Minnesota Statutes* § 14.115 (1990), "Small business considerations in rulemakings," that the proposed rule amendments will not affect small businesses which generate hazardous waste. The hazardous wastes which these proposed amendments regulate are not generated by small businesses.

If no hearing is required, upon adoption of the rule amendments, the rule amendments and required supporting documents will be submitted to the Attorney General for review as to legality and form to the extent form relates to legality. Any person may request notification of the date of submission to the Attorney General. Persons who wish to be advised of the submission of this material to the Attorney General, or who wish to receive a copy of the rules as adopted, must submit the written request to Glenn Skuta.

Charles W. Williams
Commissioner

Rules as Proposed

7045.0020 DEFINITIONS.

[For text of subps 1 to 14, see M.R.]

Subp. 15. **Designated facility.** "Designated facility" means a hazardous waste treatment, storage, or disposal facility which:

A. (1) has received interim status;

(2) has received an agency permit,

(3) is subject to the requirements of part 7045.0125, subpart 5, 6, or 10, or subpart 9, item B, or part 7045.0685; or

(4) if located outside Minnesota, has been exempted from the requirements to obtain a permit by the United States Environmental Protection Agency; has either received an Environmental Protection Agency permit or a permit from an authorized state, or has interim status; ~~and~~

B. has been designated on the manifest by the generator pursuant to part 7045.0261, or has been designated on a shipping paper or management plan required by part 7045.0125; and

C. if located in an Environmental Protection Agency authorized state which has not yet obtained authorization to regulate the hazardous waste it is receiving as hazardous, must be a facility allowed by the receiving state to accept the waste.

[For text of subps 16 to 109, see M.R.]

7045.0102 MIXTURES OF WASTES.

[For text of subpart 1, see M.R.]

Subp. 2. **Mixtures of hazardous and nonhazardous wastes.** The mixing of a hazardous waste with a nonhazardous waste as described in this subpart constitutes treatment. Generators who mix hazardous and nonhazardous wastes on site must meet the requirements of part 7045.0211 for generators with on-site facilities.

A. A mixture is a hazardous waste if it is a mixture of nonhazardous waste and any waste which is hazardous solely because it exhibits the characteristic of ignitability, corrosivity, oxidativity, or reactivity as described in part 7045.0131, unless the resulting mixture ~~no longer exhibits~~ does not exhibit any of the characteristics of ~~ignitability, corrosivity, oxidativity, or reactivity and does not exhibit characteristics of extraction procedure (EP) toxicity or toxicity~~ hazardous waste as defined in part 7045.0131.

B. A mixture is a hazardous waste if it is a mixture of nonhazardous waste and any waste listed in part 7045.0135 solely because of ignitability, corrosivity, or reactivity, unless:

(1) the resulting mixture ~~either no longer exhibits~~ does not exhibit any of the characteristics of ~~ignitability, corrosivity, and reactivity, and does not exhibit characteristics of extraction procedure (EP) toxicity or toxicity~~ hazardous waste as defined in part 7045.0131; ~~or~~;

(2) the resulting mixture has been excluded from regulation pursuant to part 7045.0075, subpart 2; or

(3) the nonhazardous waste is exempt from regulation under part 7045.0120, item I, and the resultant mixture no longer exhibits any characteristic of hazardous waste as defined in part 7045.0131 for which the hazardous waste listed in part 7045.0135 was listed.

[For text of item C, see M.R.]

D. A mixture is a hazardous waste if it is a sewered mixture of nonhazardous waste and any waste which is hazardous because it exhibits the characteristics of extraction procedure (EP) toxicity or toxicity as defined in part 7045.0131 unless:

(1) prior to entering the sewer the resulting mixture no longer exhibits the ~~characteristics~~ characteristic of extraction procedure (EP) toxicity or toxicity~~.~~; and

(2) the sewering of the mixture has been approved by the agency pursuant to parts 7045.0220 to 7045.0255.

This provision does not apply to those mixtures defined as nonhazardous under item F.

[For text of items E to G, see M.R.]

H. Any mixture of a waste from the extraction, beneficiation, and processing of ores and minerals excluded under part 7045.0120, item I, and any other waste exhibiting a characteristic of hazardous waste under part 7045.0131 is a hazardous waste only if:

(1) it exhibits a characteristic that would not have been exhibited by the excluded waste alone if such mixture had not occurred; or

(2) it continues to exhibit any of the characteristics exhibited by the nonexcluded wastes prior to mixture.

For the purposes of applying the toxicity characteristic of part 7045.0131, subpart 7, to such mixtures, the mixture is also a hazardous waste if it exceeds the maximum concentration for any contaminant listed in part 7045.0131, subpart 8, that would not have been exceeded by the excluded waste alone if the mixture had not occurred or if it continues to exceed the maximum concentration for any contaminant exceeded by the nonexempt waste prior to mixture.

[For text of subp 3, see M.R.]

7045.0120 EXEMPT WASTES.

The following wastes may be stored, labeled, transported, treated, processed, and disposed of without complying with the requirements of this chapter:

[For text of items A to H, see M.R.]

I. waste from the extraction, beneficiation, and processing of ores and minerals, including coal, and including phosphate rock and overburden from the mining of uranium ore~~.~~. For purposes of this item, beneficiation of ores and minerals is restricted to the following activities: crushing; grinding; washing; dissolution; crystalization; filtration; sorting; sizing; drying; sintering; pelletizing; briquetting; calcinizing to remove water or carbon dioxide; roasting, autoclaving, or chlorination in preparation for leaching (except where the roasting, autoclaving, or chlorination/leaching sequence produces a final or intermediate product that does not undergo further beneficiation or processing); gravity concentration; magnetic separation; electrostatic separation; flotation; ion exchange; solvent extraction; electrowinning; precipitation; amalgamation; and heap, dump, vat, tank, and in situ leaching. For the purposes of this item, waste from the processing of ores and minerals includes only the following wastes:

(1) red and brown muds from bauxite refining;

(2) slag from elemental phosphorus production;

(3) gasifier ash from coal gasification;

(4) process wastewater from coal gasification;

(5) slag tailings from primary copper processing;

(6) fluorogypsum from hydrofluoric acid production;

(7) iron blast furnace slag;

(8) treated residue from the roasting/leaching of chrome ore; and

(9) basic oxygen furnace and open hearth furnace slag from carbon steel production;

[For text of items J to P, see M.R.]

7045.0135 LISTS OF HAZARDOUS WASTES.

[For text of subpart 1, see M.R.]

Subp. 2. **Hazardous wastes from nonspecific sources.** Hazardous wastes from nonspecific sources are listed with the generic hazardous waste number and hazard code in items A to ~~U~~ V.

KEY: PROPOSED RULES SECTION — Underlining indicates additions to existing rule language. ~~Strike outs~~ indicate deletions from existing rule language. If a proposed rule is totally new, it is designated "all new material." ADOPTED RULES SECTION — Underlining indicates additions to proposed rule language. ~~Strike outs~~ indicate deletions from proposed rule language.

[For text of items A to L, see M.R.]

M. F019, wastewater treatment sludges from the chemical conversion coating of aluminum, except from zirconium phosphating in aluminum can washing when such phosphating is an exclusive conversion coating process: (T);

[For text of items N to Q, see M.R.]

R. F024, process wastes, including but not limited to, distillation residues, heavy ends, tars, and reactor cleanout wastes from the production of certain chlorinated aliphatic hydrocarbons~~, having carbon content from one to five, utilizing~~ by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to and including five, with varying amounts and positions of chlorine substitution. This listing does not include ~~light ends, spent filters and filter aids, spent dessicants, wastewater~~ wastewaters, wastewater treatment sludges, ~~and~~ spent catalysts, and wastes listed in this subpart and subpart 3: (T);

S. F025, condensed light ends, spent filters and filter aids, and spent dessicant wastes from the production of certain chlorinated aliphatic hydrocarbons, by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to and including five, with varying amounts and positions of chlorine substitution: (T);

T. F026, wastes, except wastewater and spent carbon from hydrogen chloride purification, from the production of materials on equipment previously used for the manufacturing use as a reactant, chemical intermediate, or component in a formulating process of tetra-, penta-, or hexachlorobenzene under alkaline conditions: (H);

~~T.~~ U. F027, discarded unused formulations containing tri-, tetra-, or pentachlorophenol or discarded unused formulations containing compounds derived from these chlorophenols. This listing does not include formulations containing hexachlorophene synthesized from prepurified 2,4,5-trichlorophenol as the sole component: (H); and

~~U.~~ V. F028, residues resulting from the incineration or thermal treatment of soil contaminated with hazardous waste Nos. F020, F021, F022, F023, F026, and F027: (T).

Subp. 3. **Hazardous waste from specific sources.** Hazardous wastes from specific sources are listed with the industry and hazardous waste number and hazard code in items A to L.

[For text of items A to D, see M.R.]

E. Pesticides:

[For text of subitems (1) to (18), see M.R.]

(19) K125, filtration, evaporation, and centrifugation solids from the production of ethylenebisdithiocarbamic acid and its salts: (T); ~~and~~

(20) K126, bag house dust and floor sweepings in milling and packaging operations from the production or formulation of ethylenebisdithiocarbamic acid and its salts: (T);

(21) K131, wastewater from the reactor and spent sulfuric acid from the acid dryer from the production of methyl bromide: (C,T); and

(22) K132, spent absorbent and wastewater separator solids from the production of methyl bromide: (T).

[For text of items F to L, see M.R.]

[For text of subps 4 and 5, see M.R.]

7045.0139 BASIS FOR LISTING HAZARDOUS WASTES.

[For text of subpart 1, see M.R.]

Subp. 2. **Constituents.** The constituents which are the basis for listing the wastes identified in part 7045.0135, subparts 2 and 3 are listed in items A and B.

A. Constituents of wastes identified in part 7045.0135, subpart 2 are listed in subitems (1) to ~~(21)~~ (22).

[For text of subitems (1) to (18), see M.R.]

(19) F025: Chloromethane; dichloromethane; trichloromethane; carbon tetrachloride; chloroethylene; 1,1-dichloroethane; 1,2-dichloroethane; trans-1,2-dichloroethylene; 1,1-dichloroethylene; 1,1,1-trichloroethane; 1,1,2-trichloroethane; trichloroethylene; 1,1,1,2-tetrachloroethane; 1,1,2,2-tetrachloroethane; tetrachloroethylene; pentachloroethane; hexachloroethane; allyl chloride (3-chloropropene); dichloropropane; dichloropropene; 2-chloro-1,3-butadiene; hexachloro-1,3-butadiene; hexachlorocyclopentadiene; benzene; chlorobenzene; dichlorobenzene; 1,2,4-trichlorobenzene; tetrachlorobenzene; pentachlorobenzene; hexachlorobenzene; toluene; naphthalene;

(20) F026: Tetra-, penta-, and hexachlorodibenzo-p-dioxins; tetra-, penta-, and hexachlorodibenzofurans;

~~(20)~~ (21) F027: Tetra-, penta-, and hexachlorodibenzo-p-dioxins; tetra-, penta-, and hexachlorodibenzofurans; tri-, tetra-, and pentachlorophenols and their chlorophenoxy derivative acids, esters, ethers, amine, and other salts; and

~~(21)~~ (22) F028: Tetra-, penta-, and hexachlorodibenzo-p-dioxins; tetra-, penta-, and hexachlorodibenzofurans; tri-, tetra-, and pentachlorophenols and their chlorophenoxy derivative acids, esters, ethers, amine, and other salts.

B. Constituents of wastes identified in part 7045.0135, subpart 3 are listed in subitems (1) to ~~(89)~~ (91).

[For text of subitems (1) to (87), see M.R.]

(88) K126: Ethylene thiourea; ~~and~~

(89) K131: Dimethyl sulfate, methyl bromide;

(90) K132: Methyl bromide; and

(91) K136: Ethylene dibromide.

7045.0141 HAZARDOUS CONSTITUENTS.

[For text of subpart 1, see M.R.]

Subp. 2. **"A" constituents.** Hazardous constituents beginning with the letter A are as follows:

[For text of items A to L, see M.R.]

M. Allyl chloride, 107-18-6, _____;

N. Aluminum phosphide, 20859-73-8, P006;

~~N.~~ O. 4-Aminobiphenyl, 92-67-1, _____;

~~O.~~ P. 5-(Aminomethyl)-3-isoxazolol, 2763-96-4, P007;

~~P.~~ Q. 4-Aminopyridine, 504-24-5, P008;

~~Q.~~ R. Amitrole, 61-82-5, U011;

~~R.~~ S. Ammonium vanadate, 7803-55-6, P119;

~~S.~~ T. Aniline, 62-53-3, U012;

~~T.~~ U. Antimony, 7440-36-0, _____;

~~U.~~ V. Antimony compounds, not otherwise specified in this list, _____, _____;

~~V.~~ W. Aramite, 140-57-8, _____;

~~W.~~ X. Arsenic, 7440-38-2, _____;

~~X.~~ Y. Arsenic compounds, not otherwise specified in this list, _____, _____;

~~Y.~~ Z. Arsenic acid, 7778-39-4, P010;

~~Z.~~ AA. Arsenic pentoxide, 1303-28-2, P011;

~~AA.~~ BB. Arsenic trioxide, 1327-53-3, P012;

~~BB.~~ CC. Auramine, 492-80-8, P014; and

~~CC.~~ DD. Azaserine, 115-02-6, U015.

[For text of subps 3 to 23, see M.R.]

7045.0265 USE OF MANIFEST.

[For text of subps 1 to 3, see M.R.]

Subp. 4. **Out-of-state shipments.** When a shipment of hazardous waste is to be delivered to a hazardous waste facility located outside the state of Minnesota, the generator must ensure that:

A. the copy of the hazardous waste manifest signed by the facility operator is sent to the commissioner within 40 days of the acceptance of the hazardous waste by the hazardous waste facility; and

KEY: PROPOSED RULES SECTION — Underlining indicates additions to existing rule language. ~~Strike outs~~ indicate deletions from existing rule language. If a proposed rule is totally new, it is designated "all new material." **ADOPTED RULES SECTION** — Underlining indicates additions to proposed rule language. ~~Strike outs~~ indicate deletions from proposed rule language.

B. for shipments of a hazardous waste to a designated facility in an authorized state which has not yet obtained authorization to regulate that particular waste as hazardous, the designated facility agrees to sign the manifest and return the manifest to the generator, and that any out-of-state transporter signs and forwards the manifest to the designated facility.

[For text of subp 5, see M.R.]

Public Utilities Commission

Proposed Permanent Rules Relating to Telephone Assistance Plan

Notice of Intent to Adopt Rules Without a Public Hearing and Notice of Intent to Adopt Rules With a Public Hearing if Twenty-five or More Persons Request a Hearing

NOTICE IS HEREBY GIVEN that the Minnesota Public Utilities Commission (Commission) intends to adopt the above-entitled rules without a public hearing following the procedures for adopting rules without a public hearing set forth in the Administrative Procedure Act, *Minnesota Statutes* sections 14.22 to 14.28. The Commission's authority to adopt the rules is set forth in *Minnesota Statutes* sections 237.71, 237.711 and 237.10.

All persons have until 4:30 p.m. on April 17, 1991, to submit comments in support of or in opposition to the proposed rules or any part or subpart of the rules. Comment is encouraged. Each comment should identify the portion of the proposed rules addressed, the reason for the comment, and any change proposed. PLEASE USE DOCKET NO. P-999/R-90-86 ON ALL CORRESPONDENCE.

Any person may make a written request for a public hearing on the rules within the comment period. If 25 or more persons submit a written request for a public hearing within the comment period, a public hearing will be held unless a sufficient number withdraw their requests in writing. Any person requesting a public hearing should state his or her name and address, and is encouraged to identify the portion of the proposed rules addressed, the reason for the request, and any change proposed.

If a public hearing is required, the Commission will proceed pusuant to *Minnesota Statutes* sections 14.131 to 14.20. **PLEASE NOTE that if twenty-five or more persons submit written requests for a public hearing within the 30-day comment period, a hearing will be held on Wednesday, April 24, 1991, in accordance with the notice of public hearing of these same rules published in this *State Register* and mailed to persons registered with the commission.** To verify whether a hearing will be held, please call the Commission between April 18, 1991, and April 23, 1991 at (612) 296-7124.

Comments or written requests for a public hearing must be submitted to:

Dan Lipschultz
Minnesota Public Utilities Commission
780 American Center Building
150 East Kellogg Boulevard
St. Paul, Minnesota 55101
(612) 296-9617

The proposed rules may be modified if the modifications are supported by data and views submitted to the Commission and do not result in a substantial change in the proposed rules as noticed.

The proposed rules, if adopted, will establish a uniform time frame for reimbursing company expenses incurred administering the telephone assistance plan and provide a formula to determine the maximum reimbursement a company is entitled to receive. The proposed rules are published below. One free copy of the rules is available upon request from the Commission by contacting the Commission's receptionist, Kris Kline, at the above address or by calling (612) 296-7124.

A STATEMENT OF NEED AND REASONABLENESS that describes the need for and reasonableness of each provision of the proposed rules and identifies the data and information relied upon to support the proposed rules has been prepared and is available from the Commission by contacting the Commission's receptionist, Kris Kline, at the above address or by calling (612) 296-7124.

YOU ARE HEREBY ADVISED, pursuant to *Minnesota Statutes* section 14.115, "small business considerations in rulemaking," that the proposed rules affect small businesses. The rules apply to all phone companies in Minnesota. Therefore, they will have an impact on smaller companies which qualify as "small businesses" under *Minnesota Statutes* section 14.115, subd. 1.

The proposed rules will impact companies that file their required periodic expense reports before the deadline for these filings. Instead of being reimbursed within 60 days of their filings as they are now, they will be reimbursed within 60 days of the date their filings are due. The proposed rules may also reduce the compensation some companies are accustomed to receiving because of the ceiling these rules place on reimbursement. Finally, companies may, under these rules, choose to petition the Commission to establish "TAP enrollment charges" to use in determining the maximum reimbursement they can receive for administrative expenses.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

REPLY TO ATTENTION OF:
5HR-JCK-13

Ms. Carol Nankivel
Supervisor, Rules Unit
Hazardous Waste Division
Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, Minnesota 55155

Dear Ms. Nankivel:

We have reviewed the rules package sent on March 15, 1991, containing the September 1, 1989; October 6, 1989; December 11, 1989; January 23, 1990; and February 14, 1990, Federal rules.

We have included our notes for two minor corrections on the attached sheet.

Please contact Christine Klemme of my staff, at (312) 886-3715, if you have any questions.

Sincerely yours,

William E. Muno
Associate Director for RCRA
Waste Management Division

Enclosure

Printed on Recycled Paper

Minor Comments on Rules Package
Containing 9/1/89; 10/6/89; 12/11/89;
1/23/90; and 2/14/90 FR's

1) Page 4, Line 2, Minnesota Rule 7045.0120/EPA 261.4(b)(7). You list the last word in the sentence as "calcinizing." The correct word is calcining.

2) Page 5, Line 15, Minnesota Rule 7045.0135/EPA 261.31. The fifth word in the line is written as "dessicant" wastes. The correct word is desiccant.

ENVIRONMENTAL DEFENSE FUND

1616 P Street, NW
Washington, DC 20036
(202) 387-3500

April 2, 1991

Mr. Glenn Skuta
Minnesota Pollution Control Agency
520 Lafayette Road, North
St. Paul, MN 55155

Dear Mr. Skuta:

Enclosed are the comments of the Environmental Defense Fund, the National Audubon Society, and the Mineral Policy Center on the U.S. Environmental Protection Agency's Report to Congress on Special Wastes from Mineral Processing. Please consider these comments during your proposed rule amendments governing mining wastes, lists of hazardous waste, out-of-state waste shipments, and mixtures of hazardous and non-hazardous wastes (all under Minnesota Rules Chapter 7045).

Thank you for this opportunity to comment on your state rulemaking.

Sincerely,

Lois N. Epstein

Lois N. Epstein, P.E.
Environmental Engineer

National Headquarters
257 Park Avenue South
New York, NY 10010
(212) 505-2100

1405 Arapahoe Avenue
Boulder, CO 80302
(303) 440-4901

5655 College Avenue
Oakland, CA 94618
(415) 658-8008

1108 East Main Street
Richmond, VA 23219
(804) 780-1297

128 East Hargett Street
Raleigh, NC 27601
(919) 821-7793

1800 Guadalupe
Austin, TX 78701
(512) 478-5161

RECEIVED
APR 05 1991
MPCA, HAZARDOUS WASTE DIVISION

100% Recyled Paper

COMMENTS OF THE
NATIONAL AUDUBON SOCIETY,
THE ENVIRONMENTAL DEFENSE FUND,
AND THE MINERAL POLICY CENTER
ON THE ENVIRONMENTAL PROTECTION AGENCY'S
REPORT TO CONGRESS
ON SPECIAL WASTES FROM MINERAL PROCESSING

October 19, 1990

Introduction

The National Audubon Society, the Environmental Defense Fund, and the Mineral Policy Center hereby submit comments on the U.S. Environmental Protection Agency's (EPA's) "Report to Congress on Special Wastes From Mineral Processing," published in July 1990.

The National Audubon Society (NAS) is a national, non-profit membership organization dedicated to the protection of the environment and wildlife, and to the conservation of natural resources. NAS has more than 550,000 members affiliated with over 500 chapters located throughout the United States and in several foreign countries. NAS members and staff engage in a broad range of scientific studies, research projects, and conservation education programs aimed at improving the understanding and appreciation of wetlands, wildlife habitat, clean air, hazardous waste control, and other environmental concerns. Members of NAS live and own property in areas where solid wastes from the processing of ores and minerals are generated, stored, and disposed.

The Environmental Defense Fund (EDF) is a national, non-profit environmental organization with more than 200,000 members dedicated to the protection of human health and the environment by eliminating unnecessary exposure to toxic chemicals. In pursuit of its members' interests, EDF employs scientists, attorneys, and economists who undertake legislative, judicial, and administrative actions to protect human health and the

environment. EDF maintains a longstanding interest in a comprehensive hazardous waste regulatory program. Toward this end, EDF has brought a significant number of successful lawsuits against EPA for its failure to promulgate hazardous waste regulations mandated by the Congress, and as explained further below, EDF was one of several parties who initiated the successful litigation leading to the instant Report. Members of EDF live and own property in areas where solid wastes from the processing of ores and minerals are generated, stored, and disposed.

The Mineral Policy Center (MPC) is a national non-profit organization dedicated to reducing the impacts of mineral development. MPC is based in Washington, and provides assistance to the members of many local citizen groups around the country concerned with the environmental impacts of existing or proposed facilities. Members of MPC live and own property, and recreate, in areas which are or may be affected by the mining and processing of ores and minerals.

In 1980, Congress amended the Resource Conservation and Recovery Act (RCRA) to exempt certain wastes from the federal hazardous waste regulatory program.[1] The exemptions remain in effect until the U.S. Environmental Protection Agency (EPA) studies these wastes and subsequently issues determinations as to whether the wastes should be regulated as hazardous. One

---

[1] The provision of RCRA providing the exemptions is often referred to as the Bevill Amendment, and is discussed in further detail below.

category of the exempt wastes is "solid wastes from the extraction, beneficiation, and processing of ores and minerals, including phosphate rock and overburden from the mining of uranium ore." See Section 3001(b)(3)(A)(ii) of RCRA.

Shortly after Congressional enactment of this provision, EPA amended its hazardous waste regulations to provide for this mining waste exemption, and in so doing interpreted the exemption extremely broadly to include "solid wastes from the exploration, mining, milling, smelting, and refining of ores and minerals". See 45 Fed. Reg. 76619 (November 19, 1980). In other words, wastes from the "processing" of ores and minerals was interpreted to include all smelting, refining and other processing wastes. As a result of this position, the Agency deleted six smelting wastes from the list of wastes already deemed hazardous by EPA. In addition, processing wastes that would otherwise be regulated as hazardous because they exhibit one or more of the characteristics of hazardous waste (i.e., corrosivity, ignitability, reactivity, or toxicity), were not subject to hazardous waste regulation.

Although the Agency acknowledged this interpretation of the exemption was made in haste, and EPA pledged to revisit the issue within the next 90 days (see 45 Fed. Reg. 76618), the 1980 interpretation remained in effect for almost nine years. In 1985, EPA proposed a substantial narrowing of the exemption, by limiting the term "processing" wastes only to "large volume wastes from processing ores". Under the 1985 interpretation,

only four processing wastes would remain exempt from RCRA regulation: phosphogypsum from phosphoric acid plants, slag from either primary smelting of metallic ores or phosphorus production, and muds from bauxite refining. Annual waste generation for these wastes is at least two million metric tons. See 50 Fed. Reg. 40292, 40294 (October 2, 1985).

However, the 1985 proposal was withdrawn by EPA approximately one year later. See 51 Fed. Reg. 36233 (October 9, 1986). As a result of the withdrawal, the extremely broad 1980 interpretation remained in effect.

The withdrawal was challenged by the Environmental Defense Fund and the Hazardous Waste Treatment Council, and was ultimately determined to be arbitrary and capricious by the U.S. Court of Appeals. See EDF v. EPA, 852 F.2d 1316 (D.C. Cir. 1988), cert. denied, 109 S. Ct. 1120 (1989). Simply stated, the Court found that EPA had improperly exempted a large number of mining wastes from RCRA regulation. The Court held that the term "processing" in the RCRA exemption can include only those wastes that are "high volume, low hazard" wastes, since the statutory exemption was based on the category of "special wastes" EPA had proposed in 1978. Accordingly, the Court ordered EPA to determine which wastes are properly excluded as "high volume, low hazard" processing wastes, and to study those wastes to determine whether they should be regulated as hazardous. Processing wastes not meeting EPA's definition of special wastes become subject to hazardous waste regulation without additional study, provided

they exhibit one or more of EPA's hazardous waste characteristics.

In response to the Court's opinion, EPA proposed criteria for determining whether processing wastes can be considered special wastes, and proposed a list of wastes that it had determined met those criteria and should remain excluded from hazardous waste regulation pending additional studies. See 53 Fed. Reg. 41288 (October 20, 1988).

The Agency proposed as a volume criterion that "high volume" wastes must either be generated on an industry-wide basis in quantities greater than or equal to two million metric tons in any calendar year from 1982 through 1987, or generated on an average rate per facility basis in quantities of more than 50,000 metric tons per year in any calendar year from 1982 through 1987. Under this interpretation of special wastes, EPA identified 15 processing wastes it would consider high volume wastes, as opposed to the four waste streams it had identified as high volume wastes in 1985.

With respect to the "low hazard" criterion of special wastes, EPA simply chose not to apply it. Rather than comply with the Court's mandate and propose a quantitative or qualitative methodology for determining which processing wastes pose a relatively low hazard, EPA summarily concluded the implementation of a "low hazard" criterion was not feasible.

In response to public comments and the possible initiation of contempt proceedings by petitioners in EDF v. EPA, on April

17, 1989, EPA reproposed its methodology for defining the scope of the processing wastes exemption, this time including a proposed "low hazard" criterion . However, due to the weak nature of the proposed criteria, EPA's proposal would have excluded up to 39 waste streams, as compared to four excluded waste streams proposed in 1985 and 15 excluded waste streams proposed in October 1988.

On September 1, 1989, EPA promulgated final criteria for identifying wastes that are not high volume or low hazard. In response to public comments, the volume criterion was strengthened. Under the final rules, high volume is defined as an average annual generation rate greater than 45,000 MT/yr/facility for nonliquid wastes, and an average annual generation rate greater than 1,000,000 MT/yr/facility for liquid wastes.

The final hazard criterion consists of two components. In the corrosivity component of the hazard criterion, which applies only to liquid wastes, EPA defines wastes that are not low hazard as wastes exhibiting a pH less than 1.0 or greater than 13.5. In the toxicity component of the hazard criterion, EPA does not consider wastes low hazard if the extracts of such wastes, using a new specified extraction procedure (EPA Method 1312), contain concentrations of one or more of eight specified metals in excess of 100 times the drinking water standard (MCL) for the constituent. Based upon the final criteria, EPA determined that 20 processing wastes are high volume, low hazard wastes, and

therefore eligible for the exemption from hazardous waste regulation pending a Report to Congress and a subsequent regulatory determination as ordered by the Court of Appeals. See 55 Fed. Reg. 2322 (January 23, 1990). Processing wastes other than these 20 were permanently removed from the scope of the Bevill Amendment, and are therefore subject to hazardous waste regulation if they exhibit one or more of the hazardous waste characteristics.

In the Report to Congress, EPA concludes that four of the 20 mineral processing wastes "might tentatively" warrant Subtitle C regulation as hazardous wastes. Those four wastes are calcium sulfate wastewater treatment sludge from primary copper processing, slag from primary lead processing, process wastewater from hydrofluoric acid production, and chloride process waste solids from titanium tetrachloride production. Significantly, EPA also proposes an approach whereby none of the studied wastes would be regulated as hazardous. The Agency claims the latter approach would facilitate the development and maintenance of strong state mineral processing waste regulatory programs.

As discussed in greater detail below, at least seven other wastes in addition to the four identified by EPA warrant hazardous waste regulation. The inherent toxicity of the wastes, the potential risks to human health and the environment from their mismanagement, and the documented damage incidents associated with these wastes conclusively demonstrate the wastes warrant hazardous waste regulation. Furthermore, the cost of

regulating these wastes as hazardous is not substantially greater than the compliance costs associated with the alternative of an upgraded solid waste regulatory program.[2]

Equally important, irrespective of whether the number of wastes which warrant hazardous waste regulation is four or a larger number, EPA's position that it may choose not to regulate any of the wastes as hazardous based upon the potential for improved state mineral processing waste programs sometime in the future is contrary to law and factually unsupportable. As discussed immediately below, there is simply no evidence in the Report to Congress or elsewhere that states will adequately regulate mineral processing wastes in the immediate future, nor

---

[2] At the October 17, 1990 public hearing, the American Mining Congress alleged EPA had underestimated the costs associated with Subtitle C regulation by ignoring or minimizing expenses that would result from compliance with Subtitle C corrective action requirements. Indeed, AMC claims Subtitle C corrective action costs "dwarf" the other Subtitle C expenses identified by EPA in the Report to Congress, and if such costs are considered, the Agency would conclude none of the 20 mineral processing wastes should be regulated as hazardous. This argument is fundamentally flawed for several reasons. First, AMC assumes similar corrective action costs would not be incurred under a Subtitle D program. Such an assumption is premature since corrective action requirements under a Subtitle D program are not yet in place, and inactive units at active sites may be included within the corrective action portion of the Subtitle D program. Moreover, since EPA recently proposed a risk-based, site-specific corrective action program under Subtitle C of RCRA, corrective action requirements under Subtitle C and D may be quite similar in scope and effect. Indeed, Section 3004(x) of RCRA authorizes the Administrator to modify the corrective action requirements of Section 3004(u) of RCRA to take into account site-specific characteristics. Finally, insofar as the mineral processing facilities would incur very substantial corrective action costs under either a Subtitle C or D program, this is an indication of the very substantial risks and potential threats to human health and the environment posed by these facilities. Such threats cannot be ignored.

is there evidence that a hazardous waste determination would substantially impair the development of strong state mineral processing waste programs. In fact, the opposite is true. The statutory exemption from hazardous waste regulation has perpetuated weak state controls over the mineral processing wastes covered in the Report. Furthermore, this hypothetical link belatedly imagined by EPA between future state mineral processing waste programs and EPA's regulatory determination is not even a factor the Agency may consider in issuing its regulatory determination.

Factors to Consider for EPA's Regulatory Determination

In the Report to Congress, EPA proposes two approaches for the upcoming regulatory determinations on mineral processing wastes. Under the first approach, four wastes "might" warrant hazardous waste regulation because of the substantial risks to human health and the environment associated with the management of these wastes and the small (if any) cost differential resulting from regulating those wastes as hazardous.[3] Under the second approach, none of the wastes would be regulated as hazardous, even if otherwise warranted, allegedly to facilitate the development and maintenance of strong state regulatory programs.

For the reasons explained in this portion of the comments,

---

[3] For the reasons outlined elsewhere in these comments, at least eleven mineral processing wastes warrant hazardous waste regulation.

EPA's second approach is not authorized by statute and lacks a factual basis. Moreover, it is obvious from the total lack of discussion in the body of the Report on this point that the second approach is little more than an afterthought intended to justify the Agency's generalized reluctance to regulate any of the special wastes as hazardous. Accordingly, NAS, EDF and MPC vigorously oppose the second approach.

The Bevill Amendment to RCRA, as it applies to mining wastes, essentially consists of two components. The first component is the provision outlining the contents of the required Report to Congress. This provision, Section 8002(p) of RCRA, specifies that the Report to Congress include an analysis of the following eight factors:

1. The source and volumes of such materials generated per year;

2. Present disposal and utilization practices;

3. Potential danger, if any, to human health and the environment from the disposal and reuse of such materials;

4. Documented cases in which danger to human health and the environment has been proved;

5. Alternatives to current disposal methods;

6. The costs of such alternatives;

7. The impact of those alternatives on the use of phosphate rock and uranium ore, and other natural resources; and

8. The current and potential utilization of such materials.

Section 8002(p) of RCRA also provides that the Report to Congress be conducted in conjunction with a similar study of

mining wastes mandated under Section 8002(f) of RCRA.[4] The Section 8002(f) study is required to include an analysis of many of the same factors specified in Section 8002(p), albeit those factors are worded in a slightly different manner. The six Section 8002(f) study factors are as follows:

1. The sources and volume of discarded material generated per year from mining;

2. Present disposal practices;

3. Potential dangers to human health and the environment from surface runoff to leachate and air pollution by dust;

4. Alternatives to current disposal methods;

5. The cost of those alternatives in terms of the impact on mine product costs; and

6. Potential for use of discarded material as a secondary source of the mine product.

A comparison of the Section 8002(f) and Section 8002(p) study factors reveals the Section 8002(f) study factors are largely subsumed by the broader study factor descriptions contained in Section 8002(p) of RCRA.

The second component of the Bevill Amendment is Section 3001(b)(3) of RCRA. Under subparagraph (A) of this section, mining wastes are exempted from hazardous waste regulation until at least six months after completion of the Section 8002(f) and (p) studies and after completion of the required regulatory

---

[4] Section 8002(f) of RCRA was enacted in 1976, four years prior to the enactment of the Bevill Amendment. Since the Section 8002(f) study was not conducted prior to the enactment of the Bevill Amendment, Section 8002(p) provides for the coordination of the two reports.

determination. Under subparagraph (C) of this section, EPA is required to determine whether hazardous waste regulation is warranted within six months of the publication of the Section 8002(f) and (p) studies.

As the Court of Appeals noted in EDF v. EPA, 852 F.2d 1309 (D.C. Cir. 1988), Congress did not expressly define the grounds under which EPA should determine whether hazardous waste regulation is warranted. In that case, the Court upheld EPA's interpretation of the statute that the Agency may base its regulatory determination on the study factors enumerated in Section 8002(p) of RCRA. The Court upheld EPA's interpretation as a permissible construction of RCRA because:

> 1. Section 3001(b)(3)(C) of RCRA expressly provides that EPA's regulatory determination shall be based upon the information in the Report to Congress, therefore Congress must have intended for the information gathered regarding each of the study factors to be relevant for the regulatory determination; and
>
> 2. The legislative history of the Bevill Amendment indicates Congress sought the consideration of the study factors in the regulatory determination.

However, EPA now proposes to base its regulatory determinations for mineral processing wastes on the impact a determination may have on the potential development of strong state mineral processing waste regulatory programs, and the hypothetical controls such programs might impose, factors not enumerated in either Section 8002(f) or (p) of RCRA.[5] Indeed,

---

[5] Of course, an analysis of present disposal practices must take into account any state requirements under which such disposal is conducted and an evaluation of whether those requirements are adequate. However, such an analysis is quite different than the

the Agency acknowledges in the Report there is no linkage between the statutory study factors and its proposed second approach.[6]

---

analysis EPA proposes under the second approach. Even if the present state disposal requirements are inadequate, EPA suggests another level of inquiry may be appropriate before determining hazardous waste regulation is warranted. In this level of inquiry, EPA would attempt to ascertain what requirements may be imposed sometime in the future under state mineral processing waste regulatory programs, and would attempt to ascertain whether and to what extent the development of such programs may be affected by EPA's regulatory determination. Significantly, there is no language in the Bevill Amendment that remotely suggests Congress considered the potential development of improved state solid waste programs as a relevant factor for consideration in the regulatory determination. To the contrary, the focus on "present disposal and utilization practices" in Section 8002(f) and (p) of RCRA indicates Congress did not intend for the Agency to engage in conjecture as to what requirements may be imposed on the regulated community in the future. The sponsor of the Bevill Amendment discussed state regulations only in the context of the application of existing non-RCRA state and federal regulations to the Bevill wastes while EPA was preparing the required Reports to Congress. See 126 Cong. Rec. H1101 (daily ed. February 20, 1980)(Statement of Rep. Bevill).

[6] EPA could hardly suggest otherwise. The only language in Section 8002(p) of RCRA mentioning states at all is the portion of the provision that requires the Administrator "to review studies and other actions" of federal and state agencies, to avoid duplication of effort in preparing the Report to Congress. As the legislative history of the Bevill Amendment makes clear, through this language the sponsor of the Amendment intended for EPA to "build on" earlier studies performed by other parties rather than simply repeating earlier efforts. See 126 Cong. Rec. H1102 (daily ed. February 20, 1980)(Statement of Rep. Bevill). A Congressional exhortation to avoid duplication of effort in preparing the Report to Congress is a far cry from withholding hazardous waste regulation where it is otherwise warranted, particularly since supporters of the Bevill Amendment expressly disavowed any intention of delaying regulation deemed necessary to protect human health and the environment as a result of information obtained through the preparation of the Report. See 126 Cong. Rec. H1104 (daily ed. February 20, 1980)(Statement of Rep. Rahall).

Furthermore, even assuming arguendo that the phrase "review other actions" can be construed more broadly than a permissible interpretation of the statute and legislative history would allow, the use of the term "actions" still signifies that any state requirements and initiatives which may be considered must be concrete and in effect, not vague hypothetical improvements that may occur at some future date. See note 4, supra.

Instead, the Agency seeks to rely upon "factors relating to the broader goals and objectives of the Agency".[7]

Accordingly, because EPA does not aver that the authority for its proposed second approach arises from the statutory study factors in Section 8002(p) of RCRA, the legality of EPA's second approach is governed by Hazardous Waste Treatment Council (HWTC) v. EPA, 861 F.2d 270 (D.C. Cir. 1988), not EDF v. EPA. In the former case, EPA argued that its decision not to list used oil as a hazardous waste, based upon the alleged stigma effect of the listing, could be justified as a means of furthering the general purpose of RCRA to protect human health and the environment. However, the Court held that the general objectives of RCRA cannot override the intent of Congress expressed in specific provisions of RCRA, and since the specific RCRA provisions could not be permissibly construed as incorporating stigma as a relevant factor in the listing decision, the Court ruled EPA acted contrary to law.

Just as in HWTC v. EPA, EPA's regulatory determination for mineral processing wastes is governed by the specific provisions of the Bevill Amendment. Since EPA correctly acknowledges there is no basis in the Bevill Amendment for the second approach, it is unlawful.

Moreover, insofar as RCRA's general objectives are relevant to the regulatory determination for mineral processing wastes, EPA's second approach is based upon only one of RCRA's

---

[7] See Report to Congress at 16.

objectives, the development of state regulatory programs. Significantly, RCRA contains other relevant objectives, and it is arbitrary and capricious of the Agency not to consider these other objectives as well. Upon consideration of all the relevant RCRA objectives, EPA could not justify a continued deferral of hazardous waste regulatory controls.

As provided in Section 1003 of RCRA, two of the principal objectives of the law are: (1) ensuring hazardous waste is properly managed so that human health and the environment is protected and corrective action is not required at a future date; and (2) minimizing the generation and land disposal of hazardous waste. Since EPA acknowledges the mineral processing wastes at issue warrant hazardous waste regulation upon consideration of the Section 8002(p) study factors, these two objectives of RCRA are as relevant to the Agency's regulatory determination as any other objectives of RCRA upon which EPA relies.

By delaying regulation further under EPA's second approach, EPA would substantially undermine these two RCRA objectives. Specifically, EPA would allow the continued management of hazardous mineral processing wastes in unlined units. Releases from the units are already documented or are extremely likely to occur. Until controls are imposed that will prevent or reduce substantially waste releases, migration of contaminants from the waste management sites will continue, resulting in the need to perform more substantial and expensive corrective action at some future date.

In addition, a principal mode of managing mineral processing wastes is land disposal, even where there are available treatment or recycling alternatives (i.e., treatment of hydrofluoric acid production process wastewater, recycling of slag from primary lead processing, recycling of iron blast air pollution control dust/sludge). By deferring regulatory controls on the land disposal of these mineral processing wastes, EPA would fail to minimize land disposal and encourage treatment and recycling.[8]

Finally, and perhaps most importantly, even assuming arguendo that EPA's proposed second approach is authorized by statute, the Agency has failed to demonstrate that:

> 1. A determination not to regulate any mineral processing wastes as hazardous, even where hazardous waste regulation is otherwise warranted, will facilitate the development and maintenance of substantially improved state regulatory programs; and
>
> 2. A determination resulting in hazardous waste regulation for mineral processing wastes would not result in improved state controls within a shorter period of time.

Simply stated, EPA has proposed an approach based upon rhetoric rather than facts.

In support of the second approach, EPA contends in the Summary and Findings of the Report to Congress that "many states" have recently expanded or are now expanding mineral processing waste management controls. However, the information in the body

---

[8] Significantly, EPA's recently proposed pollution prevention policy also includes a hierarchy of waste management alternatives. In the proposed policy, the Agency seeks to promote source reduction and recycling in lieu of treatment, control, and disposal. See 54 Fed. Reg. 3846 (January 26, 1989). Therefore, EPA's second approach would conflict with Agency policy as well.

of the Report indicates this EPA contention is a grossly misleading overstatement of the current status of state regulatory programs. For example, at least 12 of the 29 states with mineral processing waste facilities exempt such facilities from either crucial management requirements or the entire state waste regulatory programs. Those states and their exemptions are as follows:

> Texas - Facilities which dispose of wastes within 50 miles of the generation location are exempt from state permitting requirements[9]
>
> Arizona - The state has not imposed waste regulations on mining or mineral processing operations[10]
>
> Utah - Mineral processing wastes are excluded from all hazardous and solid waste regulations[11]
>
> New Mexico - Mineral processing wastes are excluded from state waste regulations[12]
>
> Montana - Mineral processing wastes are exempt from state waste regulations if disposed onsite[13]
>
> Ohio - Some mineral processing wastes are exempt from regulation when stored onsite for recycling; others are subject to "limited" controls and state officials are unaware of where these wastes are currently disposed[14]
>
> Indiana - Some mineral processing wastes are exempt from regulation when stored for reuse; others are

---

9 Report to Congress, at 3-12.

10 Id. at 6-43.

11 Id.

12 Id.

13 Id. at 7-24.

14 Id. at 8-35.

subject to controls not yet specified[15]

Missouri - Although a statute authorizing regulation of wastes from primary lead smelting was recently enacted, no waste regulations applicable to lead slag have been promulgated, therefore "the nature and extent of environmental controls cannot be predicted with confidence at this time"[16]

Nebraska - Lead slag is exempt from state waste management regulations[17]

Mississippi - All mineral processing wastes are exempt from state waste management regulations[18]

North Carolina - All mineral processing wastes are exempt from state waste management regulations[19]

Idaho - State waste management regulations do not apply to phosphoric acid production wastes[20]

A substantial number of the mineral processing waste facilities studied in the Report to Congress are located in these states, including eight in Texas alone.

In contrast to this reality, EPA hypothesizes that states may be ready to break new ground. The Agency specifically refers to Florida and Pennsylvania where regulations have been proposed or are under development. While we applaud these states for taking some initiative, the proposals are not yet final, and therefore offer no basis for predicting the controls that would

---

15 Id. at 8-36.

16 Id. at 10-27.

17 Id.

18 Id. at 12-34.

19 Id.

20 Id.

be imposed upon mineral processing facilities in the absence of hazardous waste regulation. Furthermore, EPA acknowledges elsewhere in the Report that Florida's regulations, as they apply to existing facilities, currently allow off-site contamination of groundwater.[21] EPA also suggests Missouri's recent statutory changes authorizing stronger regulations may justify regulating lead slag wastes as nonhazardous, but as mentioned above, EPA admitted it is impossible for the Agency to predict at the present time whether the state controls will be sufficient to protect human health and the environment. Similarly, EPA notes Delaware, Ohio, and Tennessee recently revised solid waste regulations covering mineral processing wastes, but with respect to at least Ohio and perhaps the other two states as well, the regulations have not been applied to mineral processing waste facilities. Therefore, once again, the actual impact of the revised regulations cannot be predicted at the present time.

Accordingly, the information in the Report to Congress indicates that while a small number of states are improving their waste management controls, progress is uneven, uncertain, and impossible to assess at the present time. Equally important, the absence of substantial mineral processing waste management controls in many states over the past decade of EPA inaction signifies that a nonhazardous waste designation is not the catalyst necessary for improved state programs. In fact, the opposite is true. Without a hazardous waste designation, states

---

21 Id. at 12-59.

have not regulated mineral processing wastes adequately on a nationwide basis. As the Agency acknowledges in the Report:

> Additionally, because mineral processing special wastes are not regulated under Subtitle C of RCRA, many states do not regulate solid waste management at mineral processing facilities. Indeed, some states have passed legislation specifically forbidding the responsible state regulatory agency to impose regulations on solid waste management at mineral processing facilities that are more stringent than the federal regulations.[22]

Thus, the linkage EPA purports to establish between the facilitation of improved state regulatory programs and a negative regulatory determination simply does not exist.

Furthermore, even if this linkage existed and could be proven, the development of improved state regulatory programs would be <u>better</u> facilitated in a <u>shorter</u> period of time with a hazardous waste designation for those wastes otherwise warranting such regulation. Once mineral processing waste facilities are considered hazardous wastes, and Subtitle C controls are promulgated for these facilities, the state authorization process establishes enforceable schedules for upgrading state hazardous waste programs. In contrast, the federal program for nonhazardous mining wastes has not been developed. There is presently insufficient statutory authority for EPA to administer or enforce a nonhazardous waste regulatory program, there is no administrative structure in place for EPA to ensure state nonhazardous waste programs adequately regulate mineral processing wastes, minimum federal management standards are years

---

22 <u>Id</u>. at 2-19.

from promulgation, and under the approach recently presented to the public by the Agency, those standards would not be imposed upon existing facilities until the next millennium. EPA simply cannot ignore the advantages posed by the existing Subtitle C framework both in terms of certainty and speed in implementation.[23] Accordingly, in the final analysis, the stated objective of EPA's second approach would be better served through the regulation of mineral processing wastes as hazardous.

Assessment of Offsite and Future Risks

EPA's Report to Congress fails to satisfy the statutory study factors, and substantially understates the risks associated with the mineral processing wastes studied in the Report. Accordingly, for this reason and others explained in the remaining portions of these comments, at least eleven mineral processing wastes warrant hazardous regulation.

As the Agency candidly admits, the Report to Congress does not assess the risks posed by offsite disposal of mineral processing wastes, even where the wastes are currently managed offsite. For example, at least five facilities generating iron blast and/or steel furnace air pollution control dust/sludge

---

[23] See Strawman II - Recommendations for a Regulatory Program for Mining Waste and Materials Under Subtitle D of RCRA, Office of Solid Waste, EPA, May 21, 1990; and Draft Environmental Response to Strawman II, prepared by Coordinating Committee of the Environmental Mining Network, September 21, 1990. These two documents are hereby incorporated into these comments by reference.

dispose of their wastes offsite, including one of the five facilities EPA identified as generating characteristic hazardous waste.[24] Yet the risks posed by these offsite disposal practices were not even identified, let alone assessed. The Agency asserts the diversity of the very few onsite disposal facilities where non-confidential information was provided adequately reflect the risks posed by offsite management, but this bald assertion lacks any factual basis.

Similarly, at least one of five facilities generating slag from primary lead processing disposes of the waste offsite.[25] Incredibly, EPA assessed the risks posed by the environmental setting of the processing facility rather than the unidentified site where the waste is actually disposed. Thus, the Agency's assertion that the risks posed by this facility are relatively small are not dispositive, and since the facility is one of only five studied, the Agency may vastly underestimate the actual risks of lead slag disposal by ignoring the offsite disposal site.

In the case of slag from primary zinc processing, the waste is often used offsite as railroad ballast and road rock. The Agency acknowledges these offsite uses pose significant present and future risks, particularly from airborne releases of slag dust. EPA's failure to assess these risks results in an understatement of the risks posed by the slag discussed in the

---

[24] Id. at 8-41.

[25] Id. at 10-8.

Report.[26]

A more frequent and perhaps fundamental flaw of the Report is its failure to assess potential future risks posed by the disposal of mineral processing wastes. This shortsightedness is particularly egregious in the context of mineral processing wastes, in which the toxic constituents of concern are primarily metals that lose none of their toxicity with the passage of time. Neverheless, throughout the Report, EPA analyzed risks only in terms of current human and environmental receptors. Therefore, if groundwater is not currently used as a drinking water source, or if no humans presently live within a certain distance of the facility, low risks were typically assigned to the waste streams at these facilities. These low risk assertions were made without regard to whether the groundwater is a potential drinking water source or populations could reasonably be expected to locate nearer to the facilities sometime in the future.

For example, the risks of human exposure to contaminated groundwater posed by a disposal facility for copper slag (Hayden) are minimized in the Report because there are no drinking water wells currently located near the facility. Significantly, EPA does not assert that engineering controls will limit groundwater contamination at this facility, since the facility is unlined and precipitation is moderate at 50 cm/yr.[27] Similarly, the high groundwater contamination potential associated with process

---

[26] Id. at 14-19, 14-26.

[27] Id. at 6-12.

wastewater from hydrofluoric acid production is minimized in the Report because the groundwater near the three facilities generating this waste is not currently used for drinking water.[28] The high potential for groundwater contamination at the Pascagoula phosphoric acid plant in Mississippi is also minimized because there are no residences or public water supply wells within 1,600 meters downgradient of the facility, even though groundwater occurs at a depth of 1.5 meters in the area and is therefore potentially available for future uses.[29] The "moderate to high" potential for groundwater contamination at one facility managing slag from primary lead processing is deemed less significant because EPA's model predicts the contaminants will not reach the water table for 340 years.[30]

As noted above, Section 8002(p) of RCRA requires EPA to study the "potential danger" to human health and the environment from the disposal and reuse of mineral processing wastes. By focusing exclusively on present risks posed to human and environmental receptors, and not assessing the risks posed by offsite disposal, the Agency fails to satisfy the statutory mandate of Section 8002(p) of RCRA in three respects.

First, the risks posed by offsite management practices are certainly relevant to the "potential danger" from the disposal of mineral processing wastes. The omission of these risks in the

---

28 Id. at 9-11.

29 Id. at 12-14, 12-15.

30 Id. at 14-10, 14-12.

Report is contrary to law.

Second, the use of the term "potential" signifies a Congressional desire for EPA to study reasonably predictable present and future impacts. Congress used the term "present" elsewhere in Section 8002(p), therefore if Congress sought the limited scope of work performed by the Agency, it was capable of crafting the provision accordingly.

This Agency failure is particularly important since additional facilities will be managing mineral processing wastes very shortly, due to documented growth in the domestic copper industry and anticipated growth in the demand for hydrofluoric acid.[31] But even in those instances where the prospect for additional waste management facilities are likely, the Report to Congress only considers the risks posed by mineral processing waste management at selected present day locations.

Third, Congress required EPA to study the potential danger of mineral processing disposal practices to human health and the environment. However, as discussed above, EPA's consideration of the potential risks to the environment posed by waste management practices is narrowly construed where groundwater is concerned. Specifically, EPA appears unconcerned about groundwater contamination unless it is a current source of drinking water. No importance is attached to protection of groundwater as an environmental resource, to be preserved as a resource for future generations. There is simply no basis in RCRA or in the Bevill

---

[31] Id. at 6-1, 6-2, 9-2.

Amendment for such a narrow reading of the term "environment", and the reading is contrary to existing Agency policy. For example, EPA establishes groundwater standards for hazardous waste facilities based on both the current and potential future uses of groundwater in the area. See 40 CFR 264.94(b)(1)(v).

In addition to the legal considerations, the recent demographic history of the United States indicates the Agency's lack of consideration of potential future impacts of mineral processing disposal and utilization practices is extremely unwise and shortsighted.

EPA attempts to justify its failure to examine risks to potentially exposed populations in the future based on "a lack of data adequate to predict future conditions," see 10-9. However, while data on specific conditions may be scarce, even a brief examination of historical trends indicates that future population patterns will differ from those of the present. As a result, the paucity of data on future conditions mandates a protective approach; it does not support EPA's tacit assumption that future exposures will be limited to those occurring at present. Indeed, pretending that additional future exposures will not occur is an abdication of the Agency's responsibilities and of its own pollution-prevention objectives.

Even a cursory analysis of U.S. population patterns over the past ten decades readily reveals extremely significant changes. As noted above, particularly in the context of mineral processing wastes -- which tend to contain high concentrations of toxic

heavy metals that are not subject to biodegradation and lose none of their toxicity over time -- selection of regulatory strategies must reflect the possibility that changes of equally great magnitude may occur in the decades and centuries to come.

For example, a comparison of the list of the 10 most populous states in 1890 vs. 1990 reveals dramatic changes:

	1890			Projected For 1990	
1.	New York	6,003,000	1.	California	29,126,000
2.	Pennsylvania	5,258,000	2.	New York	17,773,000
3.	Illinois	3,826,000	3.	Texas	17,712,000
4.	Ohio	3,672,000	4.	Florida	12,818,000
5.	Missouri	2,679,000	5.	Pennsylvania	11,827,000
6.	Massachusetts	2,239,000	6.	Illinois	11,612,000
7.	Texas	2,236,000	7.	Ohio	10,791,000
8.	Indiana	2,192,000	8.	Michigan	9,293,000
9.	Michigan	2,094,000	9.	New Jersey	7,899,000
10.	Iowa	1,912,000	10.	North Carolina	6,690,000

Source: Bryant Robey, "200 Years and Counting; The 1990 Census," Population Bulletin, Vol. 44, April 1989, p. 9, from U.S. Census data.

Population changes have been particularly notable in the states in which mineral processing facilities are predominantly found:

	No. of Facilities per state	1900 population	1970 population
Florida	12	529,000	6,789,000
Texas	8	3,049,000	11,197,000
Ohio	8	4,158,000	10,652,000
Pennsylvania	7	6,302,000	11,794,000
Louisiana	6	1,382,000	3,641,000

Sources: No. of Facilities: Report to Congress, p. 2-22; population data, U.S. Dept. of Commerce, 1980 U.S. Census of Population, Vol. 1, pp. 11-5, 45-5, 37-5, 40-5, & 20-5 (Dec. 1981).

Population growth is even more notable on a regional basis. For example, between 1950 and 1980, growth occurred as follows (1990 regional data not yet available):

	1950 Pop. (millions)	1980 Pop. (millions)	Increase
Northeast	39.5	49.1	24%
New England	9.3	12.3	32%
Middle Atlantic	30.2	36.8	22%
North Central	44.5	58.9	32%
E. North Central	30.4	41.7	37%
W. North Central	14.1	17.2	22%
South	47.2	75.3	60%
South Atlantic	21.2	36.9	74%
E. South Central	11.5	14.7	28%
W. South Central	14.5	23.7	63%
West	19.6	43.2	120%
Mountain	5.1	11.4	124%
Pacific	14.5	31.8	119%

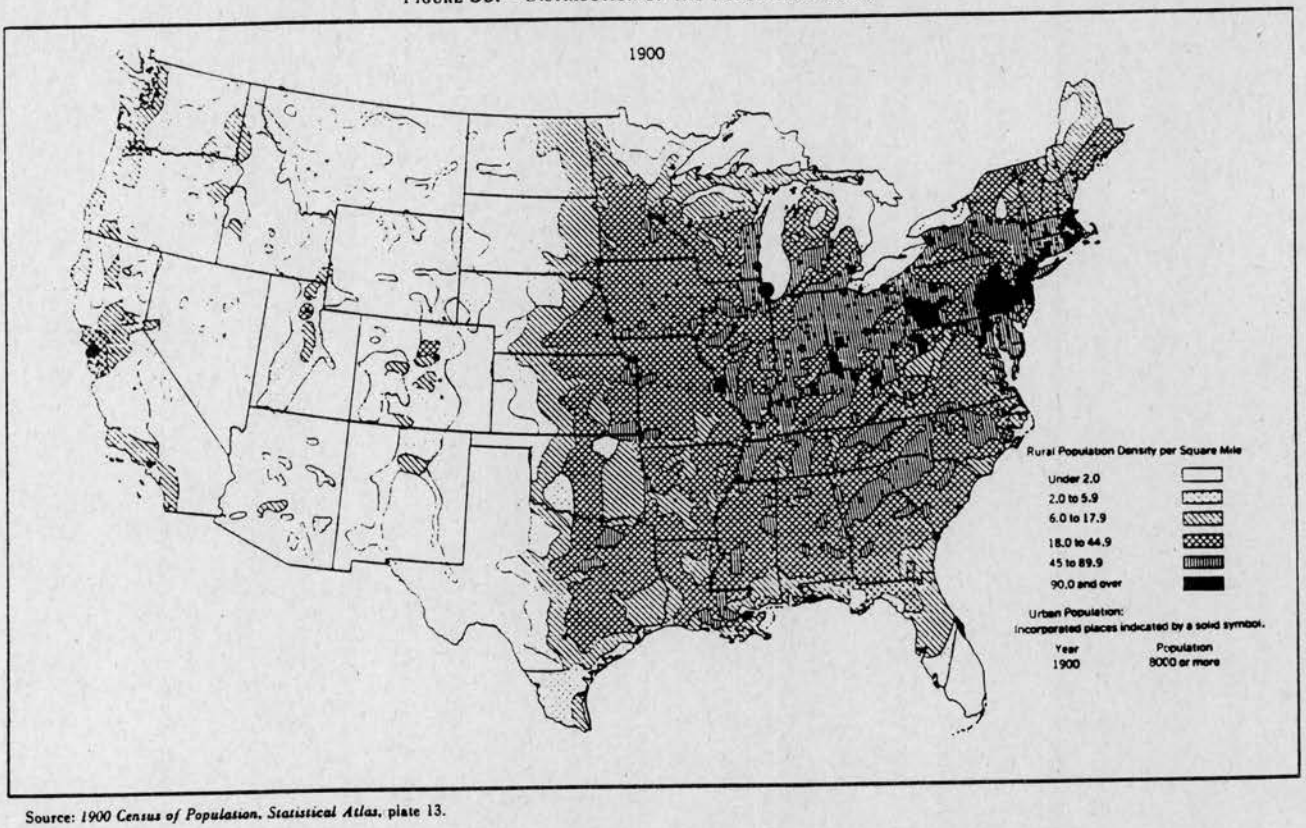
Key: New England = ME, VT, NH, MA, CT, RI; Middle Atlantic = NY, NJ, PA; E. North Central = MI, OH, WI, IL, IN; W. North Central = MN, IO, MO, ND, SD, NB, KA; South Atlantic = DE, MD, VA, WV, NC, SC, GA, FL; E. South Central = KY, TN, AL, MS; W. South Central = AR, OK, LA, TX; Mountain = MT, WY, CO, NM, ID, UT, NV, AZ; Pacific = WA, OR, CA, HA, AK.

Source: Population Reference Bureau Inc., "U.S. Population: Where We Are, Where We're Going," Population Bulletin, Vol. 37, June 1982, pp. 26-27.

Similarly, the disparity between population distribution maps for 1900 and 1950 indicates significant shifts over that half-century, as shown in Figure 1. And while overall U.S. population growth rates are likely to lower in the future than they have been to date, additional shifts in population patterns are a virtual certainty.

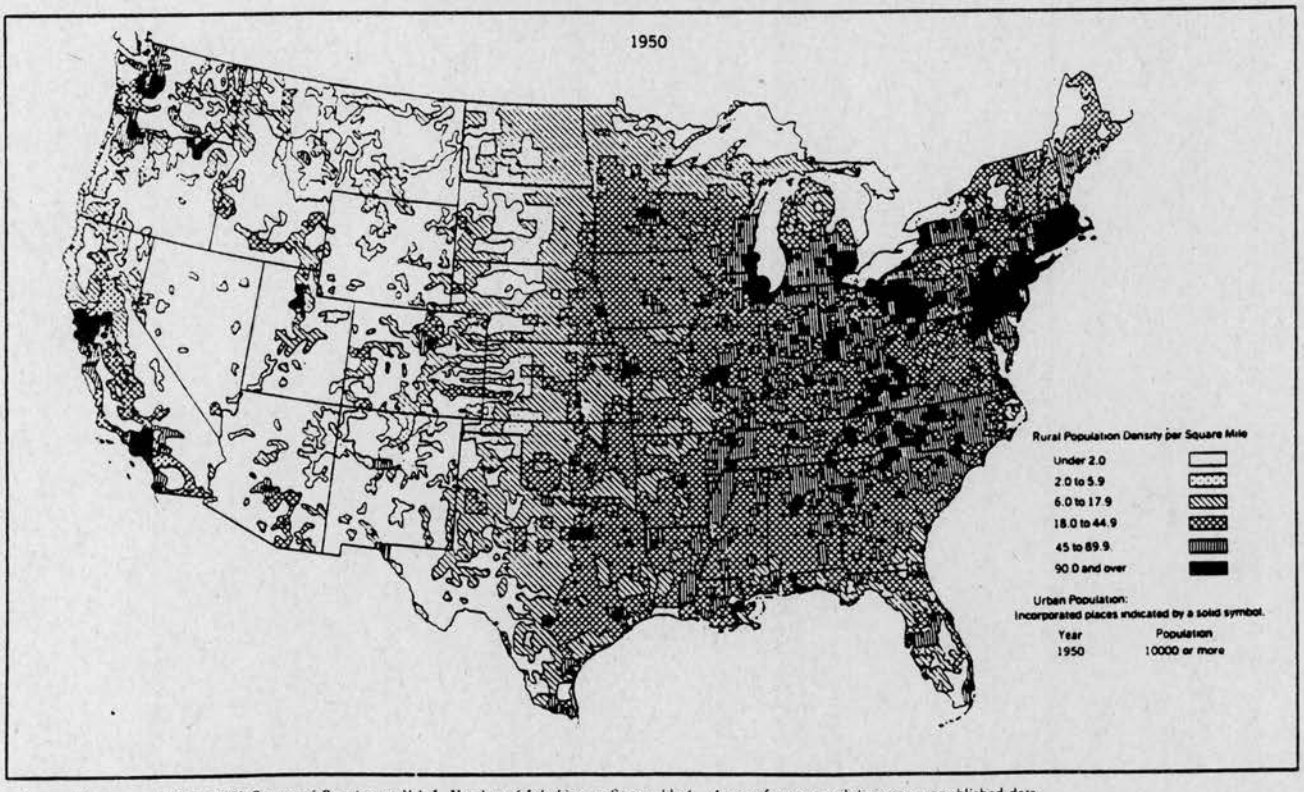
The importance of recognizing the inevitability of future population pattern changes locally and regionally is particularly

FIGURE 3b.—DISTRIBUTION OF THE POPULATION: 1900



Source: *1900 Census of Population, Statistical Atlas*, plate 13.

FIGURE 3c.—DISTRIBUTION OF THE POPULATION: 1950



Source: Data compiled from *1950 Census of Population*, Vol. I, *Number of Inhabitants*, State table 6. Areas of minor civil divisions, unpublished data.

Conrad Taeuber & Irene B. Tauber, Changing Population of the United States (Census Monograph Series), John Wiley & Sons, New York, NY (1958)

acute where mining is involved. The boom and bust nature of the industry can result in the siting and subsequent abandonment of entire towns. For example, the Town of Conda near a phosphoric acid production plant in Idaho is now abandoned, but 300 people lived there as recently as 1983-4. It is highly possible that people will live there sometime in the future if a mine is reopened or another catalyst lures people to the area. Therefore, while only four residences are currently located within a one-mile radius of the facility, it is far from certain that this population density will remain the same indefinitely.[32]

EPA's Risk Modeling

As this portion of the comments demonstrates, EPA's risk modeling of contaminant transport also underestimates the potential hazard posed by mineral processing wastes. This portion of the comments refers to the technical background documents RMPA-S0008 (Methodology for Estimating Multimedia Exposures to Soil Contamination); RMPA-S0009 (Human Health and Environmental Risk Modeling); Chapter 2 of the main document (Methods and Information Sources); and Appendix C of the main document (Risk Assessment Criteria and Model). Most of the discussion will focus on the inadequacy of the groundwater modeling section of the multimedia exposures methodology.

---

[32] See Damage Case Investigation Technical Background Document, Report on Nu-West Facility, Caribou, Idaho.

1. General Limitations of the Model

The abstract for Technical Background Document RMPA-S0008 expressly describes the limitations of EPA's risk modeling: "The methodology can be used to provide an estimate of health risk for a specific site but the uncertainty of the estimated risk may be quite large (depending on the site characteristics and available data) and this uncertaintly must be considered in any decision making process." ... "The models are relatively simple analytical models...selected primarily because the required input parameters are readily available." ... "The multimedia model is intended for use as a screening tool...the key phrases...are screening and relative comparison" ... "At best, the model predicted concentrations are order of magnitude estimates which are entirely dependent on the conceptualization of the physical system and the definition of input parameters".

When discussing the application of the model to a small lake, the Technical Background Document states that "several orders of magnitude of uncertainty could be expected unless specific data characterizing sediment concentrations are available (pg. 61). In almost all instances, the only site-specific input data were the constituent concentration data for the leachate and waste solids.Similarly, many of the bioaccumulation input parameters, if estimated instead of measured, are valid within "about 2 orders of magnitude" (pg. 111). As these quotations demonstrate, the intent of the model's use was violated by EPA when it was used as a basis for proposed

regulatory determinations without adequately considering existing and/or requesting additional monitoring and waste characterization data. This in turn indicates that the output data estimating the concentrations of contaminants at exposure points can only be used for relative comparisons among different sites and different chemicals at the same site, but cannot be used to quantify potential risk at a given location.

EPA's model was adapted from one originally used to predict the transport of pesticides at an agricultural site, and was further adapted to model contaminant transport at a Superfund site. It is severely limited in many regards, especially in its lack of consideration of groundwater and aquifer chemistry, as discussed below. In addition, it is "based on flow and dispersion through an idealized homogeneous, uniform porous media. This type of a conceptual model is not appropriate for representing flow through karst terrains..." (pg. 7, RMPA-S0008), which is found at a significant number of mineral processing sites. It is also inadequate for representing flow through any other kind of medium that is not homogeneous, uniform, and porous, precisely the conditions present at other mineral processing sites.

2. Missing Transport Pathways and Environmental Impacts

EPA's modeling ignores a significant exposure scenario for birds and other wildlife. A common and important mechanism that will increase concentrations of contaminants in non-flowing surface waters is evaporation. When non-liquid wastes are stored

or disposed of in impoundments and uncovered tanks, especially after storm events, precipitation can accumulate in these waste management units and leach contaminants from the wastes. In addition, liquid wastes are frequently managed in impoundments and uncovered tanks. Especially in arid environments, evaporation of these liquids can cause high concentrations of contaminants to accumulate. The liquid in these units can attract birds, especially in arid areas, that will ingest the contaminated waters and be adversely affected (this has occurred at cyanide leaching operations, and oil/gas exploration and production operations, for example).

Ironically, when EPA considers wildlife impacts in the Report, by comparing leachate concentrations to screening criteria for aquatic life, the Agency includes a 100 fold dilution factor. In the exposure scenario described above, contaminants are concentrated over time rather than diluted, therefore the Agency grossly underestimates potential impacts to wildlife by ignoring this scenario.

The fact that storm events are not considered (only annual average precipitation and wind velocities are included in the model) has enormous implications for the validity of the model. Much of the contamination at mining sites in the west has occurred as a result of storm events: the lining of the Clark Fork River for 200 kilometers downstream with contaminated sediments occurred during one or two storm events [J.N. Moore and S.N. Luoma, 1990. Environmental Science and Technology, vol. 24

#9, 1279-1285]; and many of the overtoppings of gold leaching units which resulted in contamination occurred during storm events [I.M. Nautch, 1990. in: Mining and Mineral Processing Wastes, F.M. Doyle, ed. SMME, Littleton, CO, 21-29].

Similarly, many of the uncapped waste piles in the midwest are susceptible to catastrophic atmospheric transport during tornados, which occur with regularity in this part of the country. When storm events are not considered in the model, these types of occurrences are ignored, and atmospheric and surface water migration of contaminants can be severely underestimated. Since it is incumbent upon the Agency to be reasonably conservative in modeling contaminant transport at these sites -- particularly because there are very few site-specific data to check the model against -- it is imperative that events such as tornados and 100-year floods be modeled as reasonable worst-case scenarios. In fact, the surface water pathway only "considers erosion of contaminants adsorbed to the soil and the discharge of contaminated groundwater into the stream" (RMPA-S0008, pg. 54). Contaminated surface runoff is not considered, yet this pathway is probably the most common transport route to surface waters.

In the groundwater pathway, the only geochemical processes considered are leaching (through extraction procedure results) and adsorption. Processes that can enhance mobilization of contaminants in groundwaters, such as metal-organic complexing and colloidal transport of metals are not considered. These

processes will be discussed in more detail below.

3. Improper Use of Distribution Coefficients

As noted above, the Agency is using a model that was adapted from one that simulated migration of organic contaminants at an agricultural site, and then adapted again to model transport of contaminants at Superfund sites. The second version of the model was field tested. It was then adapted by Battelle for its present use, but no field testing of its present use was conducted. Phone conversations with members of the ICF team that applied the model to mineral processing wastes revealed that no site-specific K_d values were determined, no actual data on soil composition were collected (the most site-specific values were collected from county soil surveys), no actual measurements of organic carbon content of the soils were conducted ("national default values" were used), and no groundwater pH values were measured or used in the model. ICF chose K_d values for the saturated zone (the K_d groundwater input parameter) from the internal (and not externally peer reviewed) Battelle publication [D.L. Strenge and S.R. Peterson, 1989. Chemical Data Bases for the Multimedia Environmental Pollutant Assessment System (MEPAS): Version 1, PNL-7145/UC-602,603]. This methodology is grossly deficient in several respects. First, incorrect distribution coefficiencies were employed. Second, assuming arguendo correct distribution coefficiencies were employed, they cannot be applied in this manner.

As Table 1 (columns 2 and 3) shows, the Agency contractor

chose values that often did not correspond to the assumed soil composition. ICF chose K_d values for the vadose zone based on the equation:

$K_d = 0.0001 (K_{oc}) (SS)$, where

SS = (57.73)(% Organic Matter) + (2.0)(%Clay) + (0.4)(%Silt) + (0.005)(%Sand).

The K_{oc} value is the only input parameter from this equation that was used in the model. The K_{oc} value was arrived at by choosing a K_d from the Battelle report, inputting an "SS" value based on estimated soil compositions, and solving for K_{oc}. The K_{oc} values arrived at are often enormous: values of 3,368 for arsenic; 606,215 for lead; and 26,943 for nickel were used for modeling migration at the ASARCO site in Hayden, Arizona. It is quite clear that the K_d equation above is designed for organic constituents. It is questionable whether K_d values designed for soil/water mixtures (groundwater conditions) can be applied to use in the unsaturated zone where there is a very low ratio of water to soil.

Perhaps more importantly, of the many inadequacies in the risk assessment model, the misuse of K_d's is possibly the most troubling because it can severely underestimate the migration of contaminants in the subsurface at these sites. Distribution coefficients are not thermodynamic quantities, yet they are being used as such in this report. Inorganic K_d's are a very strong function of groundwater chemistry, pH, soil chemistry, dissolved organic carbon concentration and composition, the redox state of

Table 1: Comparison of Kd and Koc Values for ASARCO site, Hayden, AZ

Element	Koc	Kd (GW)	Battelle Kd's/neutral pH * <10%	10-30%	>30%	Conc. on Soil, ppm	Conc. in Leachate, mg/l
Aluminum	76,249	15,000	35,300	35,300	35,300	3,710	269.
Antimony	7,490	45	2.0	6.0	15.9	2,400	79.2
Arsenic	3,368	5	5.86	19.4	19.4	57,000	3,800
Cadmium	4,378	6.5	14.9	423.	567.	4,600	35.5
Copper	23,575	35	41.9	92.2	336.	33,300	1,753
Lead	606,215	900	234.	597.	1,830	10,300	9.4
Manganese	43,782	65	16.5	25.3	36.9	10	0.353
Mercury	1,664	10	322.	580.	5,280	1.5	0.112
Nickel	26,943	40	12.2	58.6	650.	100.	13.7
Selenium	3,368	5	5.91	14.9	14.9	33.4	4.58
Silver	7,490	45	0.4	4.0	40.0	4,450	278.
Zinc	8,243	40	12.7	939.	1,460	24,700	2,940

* <10% = sandy soils
  10-30% = loamy soils
  >30% = clayey soils

The soils at this site were assumed by EPA to have 80% sand, 10% silt, and 10% clay.

The pH of the groundwater was not measured, and a neutral pH was assumed by EPA for use in selection of Kd values.

the water, the valence state of the element of interest, the organic carbon composition of the soil (and coatings on grains), etc. In other words, they are very site specific and have no meaning outside of the the very site specific conditions for which they are determined.

Distribution coefficients are only valid under conditions of steady-state chemical evolution where the adsorption sites on a soil are in equilibrium with the way in which groundwater evolves chemically due to mineral dissolution/precipitation, redox reactions, etc. during groundwater flow. They are also only valid when the ions of interest are present in trace amounts. In dynamic chemical evolution these conditions do not hold, and the distribution coefficient will vary at different locations in the flow system over time. The literature abounds with warnings about the use and misuse of distribution coefficients. "Subsurface contaminant migration problems which confront hydrogeologists invariably are of the dynamic chemical evolution type and the notion of a constant distribution coefficient or K_d to describe reversible sorption processes cannot be entertained." [E.J. Reardon, 1981. Ground Water, vol. 19 #3, 279-286]. "Note that K_d is a function of the other ions in solution (M), so that a distribution coefficient measured for a particular ion on a particular clay in a particular solution cannot be used for calculations involving other solutions or other clays" [J.I. Drever, 1982. The Geochemistry of Natural Waters. Prentice-Hall, Inc., p. 83]. Even the authors of the

Batelle article note that the distribution coefficients cannot be universally employed and particular site conditions can lead to lower distribution coefficients.

In addition to often using the same K_d value for an element under widely varying conditions, all these values are estimates based on generalized chemical properties of the elements in question, often failing to take into account the oxidation state of the element, which can strongly affect its migration. As discussed above, not one distribution coefficient was a site-specific measurement.

It is a small wonder that, even though groundwater contamination was detected at several of the sites, no groundwater contamination was predicted based on the model. See e.g. Report to Congress, p. 10-25. The conceptual misuse of K_d's and the actual numbers used account for this discrepancy. As a result, the model presently serves as a wholly inadequate basis for making reasonable predictions regarding contaminant migration potential. Conservative estimates of the potential migration of contaminants at mineral processing sites require that the use of K_d's should be abandoned, at least to predict a reasonable worst-case scenario for each site.

A truly conservative estimate of contaminant migration distances and times would be one where no distribution coefficients were used in the modeling. This would result in the travel times for contaminants being the same as those for water, and would be a reasonably conservative estimate of the extent of

transport of contaminants at the sites studied in this report. The simulation of mixing of groundwater with wastewater (using site-specific measurements) through use of a geochemical model such as SOLMNEQ could be performed to take precipitation and dissolution into account. In order to find the other end of the range (the shortest distance a contaminant could travel in a given time), distribution coefficients, groundwater chemistry and soil composition should first be measured on site. Alternatively, columns of soil material from different soil horizons/rock types could be packed, and leachate from the leaching tests could be passed through these columns to determine actual K_d values for the constituents of interest. A field testing of the model, including performing tests to determine site-specific K_d's is especially important considering the potential health threats associated with these wastes.

4. Groundwater/Aquifer Chemistry and The Importance of Metal-Organic Complexing and Colloidal Transport

Geochemical processes exert important controls on the mobility or attenuation of contaminants in aquifers. Processes that can attenuate migration include precipitation and adsorption, while metal-organic complexing, transport on colloids, desorption, and leaching can cause mobility of contaminants to run more apace with groundwater flow. The only processes considered in the risk assessment model were adsorption (through use of K_d's) and leaching (through use of leaching procedure results). As mentioned above, adsorption was not

considered on a site-specific basis and is therefore meaningless in terms of predicting contaminant transport at the facilities examined.

All geochemical processes are functions of groundwater and aquifer chemistry, including the composition of the aquifer material (organic and inorganic constituents, percent clay/silt/sand, grain coatings), groundwater pH and composition, and the redox state of the groundwater. It is our understanding that no groundwater or aquifer chemistry from any of the sites was used in the risk assessment model. When groundwater and aquifer chemistry and transport modes are not considered, it is impossible to evaluate the mobility or attenuation of constituents of concern. Even though none of these parameters were measured and used in EPA's risk assessment model, very specific estimates of travel times were arrived at and used to determine whether or not wastes from a facility poses significant risk to human and ecological health. It is especially important to consider processes that can increase the mobility of contaminants, such as complexing of metals by dissolved organics and colloidal transport of metals. Otherwise, the model's results will not be accurate, and policy decisions will fail to be reasonably conservative.

Many of the metals of concern for contaminant transport at mining facilities form very strong complexes with dissolved organic compounds. These metal-organic complexes often have very low affinities for solid surfaces, and consequently their

presence can greatly increase the mobility of metals in contaminated groundwaters and surface waters [J.L. Means, T. Kucak and D.A. Crerar, 1980. Science, vol. 200, 1477-1481; J.M. Cleveland and T.F. Rees, 1981. Science, vol. 212, 1506-1509]. A study of the dissolution of lead smelter dust compounds by humic acids, which are common in many natural waters, showed that humic acid increased lead complexing [K.J. Law and J.B. Hiskey, 1990. in: Mining and Mineral Processing Wastes, F.M. Doyle, ed. SMME, Littleton, CO, 61-67], and consequently can render lead more mobile in the environment. Not taking metal-organic complexing into account can severely underestimate the migration of metals from these wastes. As stated by Strenge and Peterson in the Battelle report that was used as the source for K_d values, "The complexation of inorganic and radioactive constituents with organic material can significantly increase the mobility of a given element. If the migrating solution contains significant quantities of organic material, it is recommended that the K_d value be set to zero."

Similarly, transport of metals by colloids was also not considered. Colloids can form under the geochemical conditions present at the facilities examined. "Colloidal-sized precipitates can form in the aqueous phase if gradients in geochemical parameters such as groundwater pH, ion composition, redox potential, or CO_2 partial pressure induce supersaturation with respect to readily precipitable solid phases...Geochemical gradients are common between contaminant plumes and associated

uncontaminated groundwaters because plumes often are of different pH, DOC concentrations, and inorganic ion composition." [J.F. McCarthy and J.M. Zachara, 1989. Environmental Science and Technology, vol. 23 #5, 496-502]. Colloids can travel in groundwater aquifers and enhance migration of metals and other contaminants. Although few data exist on the chemistry of colloids isolated from groundwater, there are a number of examples of colloidal transport of contaminants in groundwaters, both in the saturated and the unsaturated zones [R.W. Buddemeier and J.R. Hunt, 1988. Applied Geochemistry, vol. 3, 535-548; S.A. Short, R.T. Lowson, and J. Ellis, 1988. Geochimica et Cosmochimica Acta, vol. 52, 2555-2563; D.R. Champ et al., 1984. Water Pollution Research Journal of Canada, vol. 19, 35-54; J.I. Kim, G. Buckau, and W. Zhuang, 1987. Proceedings Symposium Material Science Research, vol. 84, 747-756; W.R. Penrose, W.L. Polzer, E.H. Essington, D.M. Nelson, and K.A. Orlandini, 1990. Environmental Science and Technology, vol. 24, 228-234; H.R. Von Gunten, U.E. Waber, and U. Krahenbuhl, 1988. Journal of Contaminant Hydrology, vol. 2, 237-247]. As stated by McCarthy and Zachara (cited above), "Attempts to describe and predict contaminant transport cannot succeed if major pathways and mechanisms for transport are not defined." Ignoring this potentially important transort mode, as well as the transport of metal-organic complexes, can result in a severe underestimation of the extent of contaminant migration at a site.

Precipitation was considered only in a cursory and

inaccurate fashion in the model. Solubility limits for an arbitrary mineral that contains the contaminant of interest were included. Again, precipitation is so strongly dependent upon water pH and chemistry, which were not measured, that for all practical purposes this process was not addressed in the model.

5. Modeling Conclusions

In conclusion, the model used by the Agency severely underestimates human and ecological risk by underestimating the potential for migration of contaminants at the facilities examined in this study. This is very clearly reflected in the lack of corespondence between actual concentrations of contaminants in groundwaters, where they are monitored, and predictions of contaminant transport based on modeling. The following issues must be addressed before the model can be considered to simulate reality in any kind of a meaningful manner: evaporation and subsequent concentration of metals in small surface water bodies; storm events; transport of contaminated runoff to surface water bodies; field verification of the model; use of more site-specific data; measurement of site-specifc K_d values; and the inclusion of groundwater chemistry, including metal-organic complexing and colloidal transport. If EPA is unable to conclude such work before making its regulatory determination, it would be arbitrary and capricious to rely upon this fundamentally flawed model as a basis for determining hazardous waste regulation is unwarranted for any mineral processing wastes.

Shortcomings in Determining Intrinsic Hazard

The techniques used to evaluate whether the 20 mineral processing wastes present a human or ecological health threat are summarized in Chapter 2 of the main document (pg. 2-7). The first step evaluates the "intrinsic" hazard of the waste by comparing concentrations in the solid or liquid (leachate) waste with screening criteria (pg. 2-12). The criteria for liquid/leach test samples reflect benchmark concentrations (RfD's, MCL's, AWQC's, etc. -- see Appendix C-1, pg. C-1-2 - C-1 4) that have been multiplied by either a factor of 10 or 100 for dilution in groundwater and surface water, respectively. The dilution factor for surface water is not warranted if the waste is being discharged in any way to an ephemeral stream, which could be a very common occurrence in the arid west. The dilution factor can also not be applied to waste in an impoundment or tank where evaporation can concentrate constituents of concern.

The numbers used for human health criteria are often less stringent than those used for resource damage. Barium, beryllium, boron, cadmium, chromium (VI), lead, manganese, mercury, nickel, nitrate, nitrite, phenol, selenium, silver, vanadium and zinc all have less stringent screening criteria set for human health than for resource damage, by factors ranging from 1.4 to 210. Chosen human health screening levels, which are often below MCLs, for chromium (VI), beryllium, cadmium, lead, mercury and selenium are particularly alarming considering the known human health effects associated with their ingestion

(Appendix C, pg. C-1-2). Considering that the relevant exposure pathway is drinking contaminated water, and that MCL's are not even strictly health-based numbers (they factor in cost and best available technology), using them as the benchmark numbers for human health criteria is, if anything, unduly lenient.

The other problematic part of Step 1 is the evaluation of persistence and mobility. Even if leachate concentrations are found to exceed the screening criteria, risks from the wastes are considered negligible if the constituents are not persistent and mobile. The Agency correctly notes that most metals do not degrade in the environment (pg. 2-14); however, the use of K_d values as a screening tool is inappropriate, as discussed previously. The Agency considers inorganic constituents with K_d values less than 20 ml/g to be mobile in groundwater, while those with values greater than 20 are "immobile". This assumption is based on "results of previous modeling exercises" (pg. 2-14) instead of on actual site-specific data. The use of K_d values so early on in the risk assessment evaluation underestimates risk by artificially rendering the metals less mobile than they may be in the environment.

Damage Cases

EPA's assessment of the potential hazard posed by at least several of the mineral processing wastes is lowered due to the lack of damage cases. However, the lack of damage cases can be attributed to deficiencies in EPA's methodology for identifying

damage cases and/or the lack of monitoring information at many facilities. Therefore, contrary to the Agency's position, the absence of damage cases is not a reliable indicator of the absence of potential hazard from the wastes studied in the Report.

As noted above, many of the mineral processing wastes are exempt from regulation or inadequately regulated in most, if not all, states. "As a result, monitoring and, thus, detection of problems at mineral processing facilities has occurred on a very limited basis, if at all, in some states. Therefore, while damages similar to those identified in states where mineral processing special waste management activities are monitored may exist in states that do not have an environmental monitoring or regulatory program for mineral processing wastes, these damages could not be identified for this report."[33] Accordingly, based upon EPA's own findings, the absence of damage cases is more a reflection of state program inadequacies than the potential hazard of a waste.[34]

EPA and the states often lack data on closing and bankrupt facilities as well, because they are poor candidates for enforcement actions. However, those sites may pose the largest potential hazards. See The RCRA Implementation Study, OSWER,

---

[33] Id. at 2-19 (emphasis added).

[34] Indeed, groundwater monitoring is not conducted at half of the 52 facilities reported in EPA's data base for determining economic impacts. See Technical Background Document - Cost Impact Assessment Results, pp. 2-5, 2-6.

July 1990, Appendix D at 1.

Moreover, EPA's methodology for identifying damage cases is deficient in several respects. First, in its 1989 National Survey of Solid Wastes from Mineral Processing Facilities (SWMPF Survey), the Agency did not request copies of available environmental monitoring data or reports. Instead, the Agency relied upon secondary sources on information such as literature reviews and state files where such data is frequently not comprehensively maintained or easily retrievable.

Second, based upon EPA's methodology description in the Report, it appears that while the Agency reviewed the federal Superfund National Priorities List (NPL) for relevant damage cases, the Agency did not systematically review similar data on state Superfund sites, where many of the damage cases are likely to be documented. As the U.S General Accounting Office recently determined, "only a small percentage of the nation's hazardous waste sites will be placed on the NPL for cleanup through federal action. Cleanup of the non-NPL sites, to the extent it is accomplished, will come from state, local, and private action."[35]

Indeed, other nonfederal damage case lists also warrant a systematic review. For example, the "areas of concern" list developed by the International Joint Commission contains 42 locations around the Great Lakes where water pollution problems

---

35 "State Cleanup Status and Its Implications for Federal Policy", GAO/RCED-89-164, 1989, p. 10.

are so severe they impair beneficial uses of the areas and remedial actions are planned or underway. For at least two of these Great Lakes locations, active facilities reviewed in the Report to Congress have contributed to the environmental degradation at the site, potentially through releases of ferrous metal production wastes covered in the Report and discussed in Appendix C.

In summary, documented damage cases exist that are not discussed in the Report due to deficiencies in the manner the Report was prepared, and a widespread lack of monitoring requirements or data prevent documentation of additional cases. Under these circumstances, the absence of damage cases cannot be considered very significant when evaluating the potential hazard of a waste.

Use of EP Leaching Procedure

At the October 17, 1990 public hearing, a represenative of the American Mining Congress argued that EPA's use of EP leach test data in the Report was inappropriate because the leaching procedure is intended to mimic codisposal in a municipal landfill, an unlikely mismanagement scenario for mineral processing wastes according to AMC. However, this argument is flawed in several respects.

First, some mineral processing wastes are managed offsite, and since they are often exempt from state regulation, codisposal in a municipal landfill is a reasonable mismanagement scenario

for those wastes. In addition, many of the mineral processing wastes are liquid wastes, therefore the choice of leaching procedure is largely irrelevant for these wastes.

Third, a significant number of non-liquid mineral processing wastes are comanaged with acidic liquid wastes or are at facilities where such acidic wastes are managed. Indeed, the acidic wastes at many of the mineral processing facilities exhibit a pH far below the pH of the EP leaching medium. Therefore, as discussed in the Appendices below, the EP leaching procedure may vastly underestimate the leaching potential of some mineral processing wastes under reasonable mismagement scenarios for those facilities, not overestimate the potential as AMC suggests.

Finally, use of the EP data is also reasonable insofar as when the Agency' sampling was conducted, this procedure would determine if a mineral processing waste would be regulated as hazardous once the Bevill exemption no longer applied.

Wastes Warranting Subtitle C Regulation

As stated above, at least 11 of the mineral processing wastes studied in the Report to Congress warrant hazardous waste regulation. In addition to the four EPA tentatively identified, the following seven warrant hazardous waste regulation based upon the inherent toxicity of the wastes, the potential risks to human health and the environment from their mismanagement, the documented damage cases associated with these wastes, and the

limited cost differential between Subtitle C and D regulation:

1. Slag from primary copper processing
2. Slag from elemental phosphorous production
3. Air pollution control dust/sludge from iron blast furnaces
4. Air pollution control dust/sludge from basic oxygen furnaces and open hearth furnaces from carbon steel production
5. Phosphogypsum from phosphoric acid production
6. Process wastewater from phosphoric acid production
7. Slag from primary zinc processing

In Appendices A-H to these comments, these seven wastes and the four identified by EPA are discussed in detail, including the bases for determining hazardous waste regulation is warranted.

Conclusion

EPA's Report to Congress vastly underestimates the risks posed by many mineral processing wastes. Consequently, at least 11 mineral processing wastes warrant hazardous regulation, as opposed to the four EPA "might" regulate as hazardous. Equally important, there is no legal or policy justification for not regulating any of these wastes as hazardous based upon state nonhazardous waste regulatory program improvements that the Agency believes "may" take place sometime in the future. No further delays in regulating mineral processing wastes adequately can be tolerated in light of the substantial documented and potential health risks and environmental degradation associated with these wastes.

Respectfully submitted,

Melinda Taylor
Deputy General Counsel
National Audubon Society

Ann Maest
Staff Scientist
Environmental Defense Fund

Karen Florini
Senior Attorney
Environmental Defense Fund

David J. Lennett
Consultant
National Audubon Society

Lois Epstein
Environmental Engineer
Environmental Defense Fund

Daniel M. Horowitz
Research Director
Mineral Policy Center

APPENDIX A

PRIMARY COPPER PROCESSING WASTES

Introduction

EPA studied three wastes from primary copper production: slag, slag tailings, and calcium sulfate sludge from wastewater treatment (hereafter called sludge). Slag and sludge are perceived by the Agency to pose a greater threat to human and environmental health than slag tailings. EPA recommended that only sludge be considered for management under Subtitle C, even though all the damage cases associated with mismanagement of these wastes are from copper slag. The cost differential between Subtitle D and Subtitle C waste management for both slag and sludge is minimal. Considering the intrinsic hazard of the sludge, the reported damage cases for copper slag, the small differential in cost between D and C management, and proposed increases in copper production, we recommend that both these wastes be managed under a Subtitle C scenario.

Waste Toxicity

Because of the greater toxicity of slag and sludge, only these two wastes will be addressed in the comments.

Copper slag solids exceeded human health screening criteria for arsenic, copper, lead, chromium, antimony, silver, and nickel. None of these

constituents degrade in the environment. Arsenic, copper, and lead were detected in 73-98 percent of the samples analyzed. Arsenic, copper, lead, antimony, and silver concentrations exceeded the ingestion criteria; if ingested, arsenic would pose a lifetime cancer risk of greater than $1x10^{-5}$. Arsenic, chromium, and nickel exceeded inhalation screening criteria and would pose a cancer risk greater than $1x10^{-5}$ if wind-blown dust from copper slag was inhaled.

Copper slag leachate concentrations exceeded screening criteria for lead, copper, arsenic, molybdenum, and cadmium. Maximum lead, copper, and arsenic concentrations exceeded the criteria by more than a factor of 100, and maximum concentrations of molybdenum, cadmium, and mercury exceeded the criteria by more than a factor of 10. Cadmium (in 1 of 70 samples) and lead (in 1 of 68 samples) exceeded EP toxicity levels. An earlier draft Report to Congress (Solid Waste from Selected Metallic Ore Processing Operations, July 15, 1988) reported that copper smelting slag leachate levels for lead exceeded AWQC criteria by up to 15,000 times (pg. A-5-25).

Sludge solids exceeded human health screening criteria for arsenic, lead, cadmium, antimony, silver, and copper. Arsenic, lead, and cadmium exceeded the criteria by 20 to 25,000 times. Arsenic, lead, cadmium, antimony, silver, and copper could cause adverse human health effects if ingested, while arsenic and cadmium could pose a cancer risk exceeding $1x10^{-5}$ if inhaled. The surface crust formed on these wastes was assumed by the Agency to minimize the risk posed by airborne dust.

Sludge leachate concentrations, based on the EP test, exceeded screening criteria for 12 constituents: arsenic, selenium, lead, cadmium, copper, mercury, nickel, silver, zinc, antimony, aluminum, and manganese. Arsenic

exceeded the screening criteria by up to a factor of 350,000. Arsenic, selenium, and cadmium also exceeded EP regulatory levels in the leachate. An earlier draft Report to Congress (cited above, July 15, 1988, pg. A-5-25) reported that sludge leachate levels for lead exceeded AWQC criteria by up to 21,667 times.

Clearly, both wastes present intrinsic human and environmental health threats.

SPLP Test Results

When the SPLP test was performed on sludge wastes, there were no exceedences of toxicity characteristic regulatory levels for any of the constituents of concern. However, for the reasons explained below, the Agency has appropriately decided to use the EP toxicity test for these wastes, and therefore levels from the EP test are more important when discussing potential human and environmental health threats.

Two of the contaminants that showed exceedences of the EP levels in the sludge leachage were arsenic and selenium. These elements form oxyanions under nearly all pH conditions, and are therefore negatively charged in solution. As pH increases, solid surfaces -- such as sludge solids -- become more and more negatively charged and therefore will repel oxyanions of arsenic and selenium instead of attracting them. The mobility of both arsenic and selenium in higher pH environments is very well documented in the geochemical literature [A.H. Welch, M.S. Lico, and J.L. Hughes, 1988. Groundwater, pg. 333-347; S.J. Deveral and J.L. Fio, 1990. USGS Open-File Report 90-136, 23pp.] The pH of the SPLP test is lower than that of the EP test; therefore it would be expected

that both arsenic and selenium would be less likely to exceed levels in the test with the lower pH, the SPLP test. This is especially true for calcium sulfate sludge where arsenic and selenium are probably loosely attached to the surface of sludge solids instead of incorporated in the structure of the solid, and therefore the "leaching " procedures are most likely adsorbing/desorbing instead of actually leaching contaminants. Under the even higher pH conditions in the impoundments (neutral to slightly alkaline), arsenic and selenium would be expected to be even less likely to adhere to sludge and other solids, and would therefore be more likely to be mobile and cause human and environmental harm.

Potential and Documented Risks and Damages

Slag

Based on the intrinsic hazard and release potential of copper slag, the Agency ranked copper slag as having a relately high potential to cause human health and environmental risks. Therefore, in the next step in the risk assessment, modeling was conducted. EPA modeled potential releases of arsenic, cadmium, chromium, lead, and molybdenum to groundwater and found that these constituents were two orders of magnitude or more below the relevant criteria at the exposure points. However, arsenic and cadmium were predicted to migrate to the water table within 200 years. As discussed in the main body of these comments, the misuse of K_d values results in severe underestimations of the migration of all constituents. Worse case scenarios, where K_d's are set to zero, should be modeled and considered as part of the risk assessment. This is

especially important because engineered groundwater controls are very limited for management of copper slag.

For assessing surface water risks, the Agency did not include over-land transport to a surface water body, which could be likely at facilities during storm events (which also were not modeled); only groundwater seepage and erosion were considered in the surface water pathway. According to the modeling results, only the erosion of fine particles (not groundwater seepage) from the slag pile resulted in exceedances in surface waters -- again, the misuse of K_d's will account for this conclusion. Estimated concentrations of arsenic, copper, lead, iron, and molybdenum exceeded at least one of the criteria, and mercury was present at levels of 0.7 times the AWQC. As acknowledged by the Agency, these exceedances could result in both human and aquatic life health threats if no stormwater run-off controls are employed. Air risks were expected to be low from copper slag piles.

Contrary to the "low risk" conclusions that EPA draws from these exercises, there are documented damage cases that have resulted from copper slag mismanagement. At the ASARCO/El Paso facility, overland releases to the Rio Grande River that have contaminated stream water, surrounding soil and sediment have been documented. Heavy metal contamination of soil, surface water, groundwater and biota have been documented at Commencement Bay in Tacoma, Washington. Elevated concentrations of heavy metals in groundwater, surface water, soils, and air were caused by slag wastes from the Anaconda smelter at Anaconda, Montana. In Midvale, Utah, slag has resulted in contaminated soil and groundwater and possibly contamination of surface water and air. There is also at least one damage case that was not included in the Report to Congress: contamination from the Douglas smelter slag in Arizona

(see attached letter from Dick Kamp at the Border Ecology Project). This site has international implications because much of the contamination has crossed the border into Mexico: arsenic and cadmium exceeded MCL values in Mexican streams by up to 18 times.

Throughout this section, the Agency fails to consider the future use of groundwater and surface water for drinking. As discussed in the main body of these comments, population centers have shifted dramatically in the past and will most likely continue to do so in the future. Any potentially potable water should be protected from contamination, especially groundwater because of the difficulties associated with its remediation. In addition, the emphasis on human health at the Garfield, Utah facility is shortsighted. Overland releases to Great Salt Lake may not affect human health because its waters are not used as a drinking source; however, heavy metal inputs to the lake would severely affect the food web in this ecosystem.

Sludge

Only two facilities manage sludge: Garfield, Utah and Hayden, Arizona. No damage cases were reported as a result of sludge management; however, the Agency felt that the intrinsic hazard of these wastes warranted modeling using the risk assessment methodology. Of the 12 constituents mentioned above that exceeded the screening criteria, only arsenic, selenium, cadmium, and mercury were considered to pose a potential human health and groundwater resource damage threat. Again, contaminants that could pose a significant human and environmental health threat, especially lead and copper, were not modeled because they were not considered "mobile" -- through misuse of K_d's. The

water table at the Garfield facility is only 8 meters deep. Through misuse of K_d's in its modeling exercise, the Agency predicted that the four primary contaminants will remain bound up in the unsaturated zone for over 200 years. Not only did the Agency misuse the distribution coefficient, but it also was not consistent in choosing which K_d values it used (see Table 1). K_d values used for antimony, lead, manganese, nickel, silver, and zinc are greater than the values recommended by Battelle (which should not be applied in the first place) for sandy soil under neutral pH conditions. Use of K_d's in general and of these values in particular will underestimate migration of these contaminants in groundwaters. At both facilities, EPA concluded that even if there were releases, the potential for adverse human health impacts is low because the groundwater is not currently being used for drinking water. This is a very shortsighted conclusion, as discussed above.

In modeling surface water risks, the Agency only considered groundwater seepage and erosion of fine particles at the Hayden facility to the Gila River. Overland transport of contaminants was not considered. Again, this occurrence would be likely during a storm event. Under the chosen conditions, arsenic and silver were predicted to be potential concerns. Arsenic was predicted to pose a cancer risk of 2×10^{-4}, which is quite high. Silver exceeded the AWQC by a factor of almost three and could adversely affect biota in the Gila River.

As discussed in the main body of these comments, the exposure scenario of birds and other wildlife ingesting high concentrations of contaminants from liquids in impoundments was not considered. All constituents of concern will concentrate through evaporate of liquids in these impoundments in arid areas, as discussed in the Report to Congress, and could therefore reach elevated

concentrations. Especially for constituents that biomagnify, such as selenium, a significant risk to wildlife is possible even if the predicted concentrations are below the screening criteria. Selenium was one of the constituents that exceeded EP levels in sludge leachate. For this exposure scenario it is, of course, not valid to figure in a dilution factor for surface waters, because the opposite is occurring as a result of evaporation. This exposure scenario should be included as part of the risk evaluation and modeling.

Waste Management Alternatives

The possibility of recycling and reuse is discussed as one of the waste management options, especially for copper slag. Although recycling slags to a concentrator can reduce the volume and copper content of the slag, it also creates new waste management problems: disposal of process wastewaters that contain flotation reagents. The Agency also suggests that improved beneficiation techniques, or improvements in smelting technology may lead to reduced slag volumes (pg. 6-44). The reuse of copper slag has resulted in documented contamination at two sites: the ASARCO facility in Tacoma, Washington, and the Anaconda facility in Anaconda, Montana (pg. 6-35- 6-38). At the Tacoma facility, contamination is associated with runoff from slag that was reused for ballast at the log sort yards. At the Anaconda facility, contamination was related to runoff from roads that were sanded with reused slag sands. This same reused slag is now being sold as sand blasting material, and one worker has formally complained of skin and throat irritations. These damage cases strongly warn against continued reuse of this

material under conditions that would result in these and other health threats. This further warrants considering all slag wastes for regulation under Subtitle C.

Cost Impact Assessment

The major difference between Subtitle C and D waste managment for a facility that has a low potential to contaminate groundwater is the requirement of groundwater monitoring under the Subtitle C scenario. The compliance costs as percent of sales (CC/VOS -- pg. 6-58) is only slightly higher for Subtitle C (0.3%) than for Subtitle D (0.1%) waste management. Considering the relatively high potential for copper slag to cause human and environmental harm (discussed above), this small difference in compliance cost/sales ratio between managing these wastes under Subtitle C and Subtitle D is well justified.

The main difference between Subtitle C and Subtitle D waste management scenarios for calcium sulfate sludge is that groundwater monitoring is required under the Subtitle C scenario and not under Subtitle D for facilities with low potential to contaminate groundwater. Again, the difference between the compliance cost as percent of sales (CC/VOS -- pg. 6-59) for the Kennecott facility in Garfield, Utah is only slightly higher for Subtitle C (0.3%) than for Subtitle D (0.2%). For the ASARCO facility in Hayden, Arizona, this ratio is identical for both D and C management schemes (0.1%). Given the very high intrinsic hazard of this waste, Subtitle C managment is well warranted.

Conclusion

The planned expansions of existing facilities and the opening of new primary copper processing facilities, the intrinsic hazard associated with both copper slag and sludge, and the high potential for human and environmental damage from these wastes all argue strongly for managing these wastes under Subtitle C. Reported damage cases from copper slag management also argue that this waste be managed in Subtitle C, not Subtitle D facilities. The small differences in cost between Subtitle C and Subtitle D management make this an option that will both protect human and environmental health and be affordable to the industry.

Border Ecology Project

Box 5 · Naco, Arizona 85620 (602) 432-2688 | 432-

October 15, 1990

Dr. Ann Maest
Environmental Defense Fund
1616 P St NW
Washington, DC 20036

FAX: 202-234-6049,
confirm: 202-387-3500

Re: Douglas Smelter slag; Analyses of surfacewater and groundwater contamination in Whitewater Draw/Agua Prieta River and Agua Prieta, Sonora, Mexico: evidence of transboundary contamination.

Dear Dr. Maest:

The Phelps Dodge Douglas Smelter complex operated continually from 1904-87 leaving behind about a square mile of slag butting up against the international boundary. The west edge of the slag has a reasonably perennial stream flowing north-south into Mexico along the western edge of the borderTown of Agua Prieta, Sonora. On the Arizona side it is known as Whitewater Draw and south of the border as the Rio Agua Prieta. In April, 1988, Prescott College and Border Ecology Project took samples of surface water in WW Draw-Agua Prieta River along both sides of the border with the cooperation of COAPAES, the Sonoran water and sewage authorities. Students from Prescott College also sampled potable water from municipal wells in Agua Prieta that are "downstream" in the Douglas-Agua Prieta aquifer. Following the release of this data, Arizona Department of Environmental Quality (DEQ) began sampling Whitewater Draw immediately before (north) and after the slag heaps. The Cochise County Health Dept.(CCHD)--through Arizona Dept Health Services Lab--conducted a one-time analysis of municipal potable water quality in Agua Prieta on November 29, 1989.

The Prescott analyses indicated levels of arsenic from 5 to 18 times potable MCL and cadmium from 1 to 11 times MCL in water and sediment at 3 surfacewater sampling points in an area about 2 river miles downstream of the border. Iron in sediment ranged from 130 to 285 times drinking water MCL and copper was also very high in sediment. Sulfates were not tested.

Agua Prieta potable water had substantial amounts of arsenic--.023-.024 mg/l. (about half the MCl) and cadmium at levels of about 36-38% MCL. The wells were located from 1 1/2 to 3 miles "downstream" of the tailings and the Agua Prieta River. Cadmium is rarely found in water in our area (and did not show up in

subsequent CCHD Agua Prieta potable water tests in Nov 89). Neither substance has been detected in Douglas potable wells, all of which are north--upstream--of the tailings. Arsenic appeared in the CCHD Nov. 89 sampling in the same 3 wells at levels of .011-.017.

The same CCHD 11/89 sampling encountered sulfates in excess of U.S. secondary standards at 2 wells and TSD at 3 wells in Agua Prieta.

DEQ TEST DATA IN WHITEWATER DRAW

The sulfates correlated to high levels of sulfates DEQ found after Whitewater Draw surfacewaters passed over the tailings. The before and after ratio varied from 2 to 12 times the amount of sulfates in samples taken Sep 12, Oct 27 and Dec 12, 1988. On these 3 days, water samples tested immediately north of the slag were 69, 128 and 341 mg/l chronologically and were elevated to 115, 997/1160, and 1270/1240 mg/l. after passing over the slag. Two subsequent sulfate analyses at the border immediately south of the slag on 2/28 and 4/25/89 were 1140 and 1110 --well above the potable MCL of 250 No tests were done at the north site. Refer to test sites WD1 for "before" and WD1A for "after" on the attached results.

Arsenic levels doubled after passing over the tailings on one test date--9/12/88-- but other samplings showed none detectible before or after. Cadmium levels rose substantially on the three dates comparative samples were made, in each case rising over the potable MCL of .01 mg/l--paralleling the sulfate analyses. Iron levels rose also.

DEQ's data provides a strong consistent indicator of slag surface water impacts--and the sulfate at least appears to have had a possible impact on groundwater quality in potable water on the Mexican side. Some of the concentrates processed in the smelter complex were high in arsenic and some not--all of course had a high sulfur content. Iron would also be an indicator of slag and cadmium a possible component if the slag were not inert. DEQ data for the 3 dates of comparative sampling also indicates that other elements consistently emanated from the slag on the dates mentioned including zinc, manganese, and strontium.

The combined data provides strong reason to doubt that slag is consistently inert. Smelting processes varied greatly in temperature and feed so it is to be presumed that slag would also in its capacity to breakdown in the environment.

ATTACH: SUMMARY PRESCOTT-BEP TESTS, DEQ DATA,
SELECTED CCHD ANALYSES

Sincerely,

Dick Kamp

APPENDIX B

Slag from Elemental Phosphorus Production

EPA has concluded that Subtitle C regulation is not necessary for the treatment, storage and disposal of furnace slag from elemental phosphorus production, though the material poses a "high risk" under certain circumstances, according to the Agency. The material is often radioactive, and therefore dangerous to human health and the environment. For the following reasons, NAS, EDF, and MPC recommend that EPA prohibit the use of furnace slag in construction and road materials. NAS, EDF, and MPC also recommend that the Agency reexamine the advisability of regulation under Subtitle C for disposal of the slag. NAS, EDF, and MPC disagree with EPA's conclusion that current means of handling and disposing of the material on-site pose only minimal risk to human health and the environment.

1. Substantial risks to human health have been documented from exposure to radioactive furnace slag in aggregate and construction material.

EPA has determined that furnace slag represents a "high risk" when used off-site in construction of roads and buildings, due to the radioactivity of the material.[1] EPA's research shows that significant (up to 1.4×10^{-3}) cancer risks exist in at least two areas -- Pocatello and Soda Springs, Idaho -- where the slag has

---

[1] See Report to Congress at 7-16.

been used in street paving and home foundations. Lifetime cancer risks for exposed individuals in those two cities are apparently at least as high as 6×10^{-3}.

EPA points out in the Report that only one of the three states where the waste is generated, Idaho, presently restricts the use of slag in building materials. None of the three states regulates its use as an aggregate in road construction. EPA recommends that the "radiation risks associated with the off-site use of elemental phosphorus slag should . . . be addressed at the national level."[2]

NAS, EDF, and MPC agree with EPA's recommendation, and request that the Agency prescribe regulations to prohibit the use of elemental phosphorus slag for construction and municipal (i.e., roads, sidewalks, etc.) purposes. EPA may promulgate such regulations pursuant to section 3001 of the Resource Conservation and Recovery Act, which provides the Agency with the authority to "prevent radiation exposure . . . from the use in construction . . . of (I) solid waste from the extraction, beneficiation, and processing of phosphate rock. . ." 42 U.S.C. § 6921(b) (3) (B) (iii).

2. On-site disposal of elemental phosphorus slag poses a substantial risk to human health and the environment.

The information that EPA has assembled regarding the impacts

---

[2]See Report to Congress at 7-23.

of on-site disposal of elemental phosphorus slag belies the Agency's conclusion that on-site disposal practices pose only a low to moderate risk to the environment. EPA reports that there is documented groundwater contamination at three of the five facilities where the slag is disposed of (one of which has been proposed for inclusion on the National Priorities List), and the potential for contamination at the two others.

All five facilities are located in fairly densely populated areas, and within a short distance of sources of drinking water. Three of the facilities are also located in sensitive environmental areas: the Silver Bow, Montana plant is in a national forest, the Soda Springs, Idaho plant is within 1.6 km of a wetland, and the Columbia, Tennessee plant is located in an area of karst terrain.

Groundwater Contamination

EPA's discussion of the potential for groundwater contamination from slag disposal is confusing, and it contradicts the available information about conditions at certain of the facilities. For example, with respect to the plant at Soda Springs, EPA writes that the possibility of contamination caused by the plant's stockpile of slag is remote because of the low net recharge in the area and the large depth to groundwater. But groundwater contamination has been documented at the plant, and EPA admits in the Report that the contamination may be attributable to slag management. Presumably the contamination is a danger to the drinking

water sources that are located only 60 meters downgradient of the facility.

Similarly, EPA states that the potential for contamination at the Pocatello and Silver Bow plants is even less than for the Soda Springs facility. However, there is known contamination at both facilities that may be related to slag disposal. Indeed, the area around the Pocatello plant has been proposed for inclusion on the National Priorities List pursuant to the Comprehensive Response, Compensation and Liability Act ("Superfund"), 42 U.S.C. § 9601 et seq., due to heavy metal contamination. According to EPA, the contamination may be related to slag management.

Given the presence of contamination at three of the five facilities, and EPA's assessment that it is likely to be present at the other two as well, the Agency's conclusion that current methods of slag disposal pose only low risk to human health and the environment is incomprehensible.

Air Exposure

EPA acknowledges that exposure to windblown dust from slag piles could pose a hazard to human health, and recognizes the need for "further study and possible control" of dust from elemental phosphorus slag piles. Report p. 7-14. Three of the facilities -- Soda Springs, Pocatello, and Columbia -- are located in areas with heavy agricultural land use, so airborne releases of slag

could enter the human food chain through exposure to the crops.[3] In addition, all five facilities are located in densely populated areas, so exposure from inhalation of windblown particles poses a potential danger.

Available data show that exposure to slag dust due to air transport poses a significant risk to human health and the environment.[4] NAS, EDF, and MPC urge the Agency to consider this information, and to reevaluate its decision not to recommend removing the RCRA exemption from Subtitle C for elemental phosphorus slag.

Nearby Residents

The close proximity of private residences to all five facilities makes the threat of drinking water and airborne contamination particularly serious. For example, at Soda Springs the nearest residences are only 60 meters from the facility, and Pocatello is within 300 meters of the closest residences. The populations around the five facilities are dense, as well, which also increases the potential for exposure to radioactive compounds or other contaminants.

---

[3] See Report to Congress at 7-14.

[4] See, for example, EPA's Environmental Impact Statement, NESHAPS for Radionuclides, Background Information Document Volume 1, September 1989, which includes an analysis of health risks caused by exposure to various radionuclides.

Sensitive Environments

EPA has given inadequate consideration to the fact that three of the five plants are located in sensitive environmental areas. The Report contains almost no discussion of the location of the Silver Bow plant in a national forest, an area of special environmental concern, for example. The Report notes that the Soda Springs facility is near (within 1.6 km) a wetland, and that any release from the facility could cause substantial damage to the wetland. However, the Report does not discuss whether the known contamination at the facility has already impacted the wetland.

Finally, the Report points out that the Columbia plant is in an area of karst terrain, which could result in a serious threat to surface and underground sources of water if contamination occurs. The Report acknowledges that potential releases are indicated by the high recharge in the area, yet it minimizes the hazards posed by such releases by concluding that they present "low risk."

3. Regulation under Subtitle C is appropriate for slag from elemental phosphorus production.

Based on the data that EPA has assembled on the potential risks to human health and the environment from current methods of disposal of slag from elemental phosphorus production, NAS, EDF, and MPC recommend that the Agency list the material as a hazardous waste. The slag meets EPA's criterion for listing waste as "toxic

wastes": it contains constituents that have been shown to have toxic, carcinogenic, mutagenic or teratogenic effects on humans and other life forms. None of the three states where the waste is currently generated regulate the material; therefore, federal regulation is necessary to protect human health and the environment.

Appendix C

FERROUS WASTES

Based on the extremely minimal data contained in the chapter on ferrous metals production and other information described below, wastes from iron blast and steel furnace air pollution control (APC) dusts/sludges should be regulated as Subtitle C hazardous wastes. The few samples tested by EPA show these materials are intrinsically hazardous, exceeding the EP toxicity levels for both lead and selenium, and exceeding several of the screening criteria (note that not all iron and steel production facilities were sampled). Data collected by EPA in the late 1970s also shows the intrinsic hazards of these wastes:

> The [aqueous] extract from air pollution dust and sludges was examined for many of the wastes. For each waste examined, the extract did not meet drinking water standards when only three metals were considered. This causes concern for the potential for groundwater endangerment. In some cases, however, the test results were inconclusive. Based upon these data, iron and steelmaking dust and sludges should be landfilled with leachate collection wherever the groundwater needs protection.[1]

Despite the intrinsic hazards of these wastes, EPA, unfortunately, concludes in its Report to Congress that these wastes need not be regulated under RCRA Subtitle C. EPA bases this conclusion on site-specific location and damage case data, but the data presented in the Report do not support this position. In addition, to enhance usage of the readily available

---

1. "Environmental and Resource Conservation Considerations of Steel Industry Solid Waste," EPA-600/2-79-074, April 1979, p. 95.

pollution prevention opportunities in ferrous metals production, Subtitle C regulation of these two waste streams is essential.

Analysis

The major reasons EPA downgraded the risk for iron blast and steel furnace APC dusts/sludges, from moderate to high intrinsic risk to moderate overall risk, are the site-specific conditions at 17 of the 28 facilities and the lack of damage cases (p. 8-32). The data presented in the Report on site-specific conditions, however, are insufficient to guarantee protection of human health and the environment at all relevant ferrous metals production facilities. In fact, the data show a high likelihood of multi-media pollution occurring, thus contradicting EPA's overall risk conclusion.

The EPA analysis of site-specific conditions addressed less than two-thirds of the active facilities, no inactive facilities which could be reactivated (as was recently done with a minimill (p. 8-3)), and no new or potential sites. This fact alone makes it problematic to rely on site-specific data to guarantee protection of human health and the environment near iron and steel production facilities nationwide.

Nevertheless, the site-specific data available show that all three environmental media and nearby sensitive environments have high potentials for contamination at certain ferrous metals production facilities. According to the Report to Congress:

* "the potential for ground-water release, transport, and exposure ranges from low to fairly high" (p. 8-24),

* "[t]he small size of dust/sludge particles...indicates a high potential for overland release of these wastes to surface waters" (p. 8-26),

* "there is also a relatively high potential for airborne releases and exposures at seven facilities" (p. 8-32), and

* "23 of 26 iron production facilities and 21 of 26 steel production facilities are located in or near environments that are vulnerable or environments that have high resource value" (p. 8-28).

These high likelihoods of contamination by toxic contaminant releases from iron and steel production APC wastes were dismissed by EPA as merely "theoretical conclusions about potential hazards" (p. 8-32). Such "theoretical conclusions about potential hazards," however, are the basis for extensive risk management decisionmaking by EPA and others. "High risk potential" conclusions clearly point to the need to manage these wastes under the Subtitle C regulatory program.

At the same time that EPA downplays "theoretical conclusions about potential hazards," the Agency highlights in its Report to Congress the site-specific conditions that, <u>theoretically</u>, decrease the hazards. For example, EPA states that contaminant releases to surface waters from all but four of the iron and steel production facilities "are likely to be readily assimilated by the [nearby] rivers' large flow (sic)" (p. 8-32). In drought years, theoretically large rivers may have quite small flows, however, particularly if climate change trends intensify. Moreover, EPA's use of the site-specific "dilution as the

solution to pollution" rationale directly contradicts RCRA's mandate to protect the environment, as well as human health.

The apparent lack of damage cases is an artifact of the inadequacy of EPA's documentation of damage cases and the difficulties of finding all relevant damage cases, as discussed in the body of these comments. As noted previously, however, EPA did not review all available lists of sites currently or potentially undergoing cleanups. For example, in Attachment C-1, the International Joint Commission (IJC) identifies the active USX iron and steel production facility in Lorain, OH as a major contributor to the pollution, including metals contamination, occurring in the Lower Black River. Likewise, the active LTV iron and steel production facility in Cleveland is a major contributor to the Cuyahoga River's contamination problems, another IJC "area of concern" where cleanup is planned. Unfortunately, Section 8.3.3 of the Report, which covers damage cases from ferrous metals production, does not discuss these two instances of extensive environmental pollution, which disposal of the iron blast and steel furnace APC dusts/sludges may have helped create.

Additionally, of the 14 inactive iron and steel production facilities whose files were reviewed by EPA looking for damage cases, 13 of the facilities were in Pennsylvania and one was in Indiana. Thus, in three of the states with the highest number of active facilities (Ohio, Illinois, and Michigan), no files on inactive sites were reviewed by EPA to identify relevant damage

cases. Attachment C-2 contains portions of Ohio's state list of unregulated sites that require corrective actions, which includes several active and inactive iron and steel production facilities, that should have been investigated for potentially relevant damage cases. To make matters worse, it appears that EPA did not even review its own report entitled, "Environmental and Resource Conservation Considerations of Steel Industry Solid Waste" (EPA-600/2-79-074, April 1979), a good, though incomplete, source of information for damages from iron and steel production wastes.[2]

In summary, in its conclusion of moderate overall risk from iron blast and steel furnace APC dusts/sludges, EPA improperly dismissed the site-specific conditions likely to enhance multi-media environmental contamination at active iron and steel production facilities. EPA also did an extremely poor job acquiring documentation of damage cases. In contrast with EPA's conclusion of moderate overall risk, a more comprehensive compilation and analysis of the data inevitably results in a conclusion of high overall risk, given the high likelihood of site-specific, multi-media contamination at certain facilities and the numerous damage cases, in combination with the high

---

2. See p. 101 for documentation of high levels of chromium in the groundwater at a Pennsylvania facility (though many other metals are not monitored) and Section 7.3.4, entitled "Groundwater Analysis From Iron and Steel Landfills," and Section 7.3.5, entitled "Descriptions of Selected Steel Industry Dump Sites," for documentation of damages from iron and steel dust and sludge disposal.

intrinsic waste hazards. Such a conclusion necessarily requires EPA to apply RCRA Subtitle C hazardous waste management standards to iron blast and steel furnace APC dusts/sludges.

Cost Impact Assessment and Other Regulatory Concerns

EPA's cost analysis further supports regulation of iron blast and steel furnace APC dusts/sludges under RCRA Subtitle C. According to the Report to Congress, "[o]nly two of 28 facilities that generate iron/steel APC dust/sludge would face potentially significant economic impacts under any regulatory scenario" (p. 8-47). Of these two facilities, the Bethlehem Steel Sparrows Point, MD facility "might be able to use feedstock cost advantages (related to its coastal location, allowing for lower feedstock transportation costs through use of ocean transport) to recover compliance costs" (p. 8-47) and the other facility, LTV Steel in East Cleveland, OH, has already filed for bankruptcy (Ibid.).[3] Recycling of APC dusts/sludges (see discussion below) would also provide significant cost advantages.

Current state regulatory programs for iron blast and steel furnace APC dusts/sludges are not adequate to protect human health and the environment, nor are these programs likely to be adequate in the near future. According to EPA, "[c]ontinuation of current management practices in the absence of more stringent

---

3. EPA's financial analysis shows no major cost differences between the Subtitle C and the Subtitle C-minus or D-plus scenarios, so the Subtitle C-minus and D-plus regulatory programs provide minimal cost advantages while at the same time they contain significant environmental protection disadvantages.

federal regulation will continue to pose risks to human health and the environment from APC dusts/sludges into the future" (p. 8-50). As the Report to Congress details, regulations for the ten states with iron and steel production facilities vary widely, but none of these states currently regulate these special wastes as hazardous wastes. Given the moderate to high intrinsic risk of APC dusts/sludges discussed in the Report to Congress and summarized above, and the minimal cost advantage of the Subtitle D regulatory program,[4] it is essential that EPA issue a regulatory determination that requires Subtitle C management of these wastes.

Finally, it is notable that the volumes of both iron blast and steel furnace APC dusts/sludges generated on a per facility basis just barely exceed the "high-volume" threshold defined in the September 1, 1989 final rule addressing the Mining Waste Exclusion. According to the Report to Congress, iron blast furnace APC dust/sludge generation averages less than 52,000 metric tons/facility annually (p. 8-6) and steel furnace APC dust/sludge generation averages less than 61,000 metric tons/facility annually (p. 8-7). Because the "high-volume" threshold is 45,000 metric tons/facility annually for non-liquid wastes, the amounts of iron blast and steel furnace APC dusts/sludges generated annually are roughly the same as wastes that do not qualify for the Mining Waste Exclusion using the

---

4. Ibid.

volume criteria. This fact, combined with the relatively high intrinsic hazard of these APC dusts/sludges, also argues for Subtitle C regulation of these wastes.

Pollution Prevention Opportunities

According to the EPA report, the ferrous metals sector includes many secondary processors who primarily use scrap as feedstock (p. 8-1). Because only facilities that use less than 50 percent scrap are covered by the Mining Waste Exclusion, facilities using more than 50 percent scrap and whose wastes demonstrate a hazardous characteristic must manage the wastes under the Subtitle C regulatory program. The 28 primary processors covered in this chapter on ferrous metals production, who use virgin materials, thus have an advantage over secondary processors, who reuse scrap materials, because the Mining Waste Exclusion now allows primary processing wastes to remain outside the RCRA Subtitle C system. Since pollution prevention places a higher priority on use of recycled materials than on use of virgin materials to produce identical products, it is essential to eliminate the Mining Waste Exclusion's incentive for use of virgin materials in the ferrous metals industry, since secondary processing alternatives are readily available.

EPA's Report to Congress reveals that both iron blast furnace APC dust/sludge and steel furnace APC dust/sludge can be recycled on-site. For iron facilities, the report states that one of the two most common APC dust/sludge waste management processes is "the return of the material to the production

process via the sinter plant operation or blast furnace" (p. 8-6). Similarly, for steel facilities, 20 percent of reporting facilities return APC dust/sludge "to the production process via the sinter plant operation" (p. 8-7)[5], and APC dust/sludge can also be recycled to the beneficiation process via the blast furnace (p. 8-39). As EPA acknowledges in its report, regulation of these APC wastes under the Subtitle C regulatory program "might serve to promote even greater recycling than has occurred in the recent past" (p. 8-51), a desirable outcome from the perspective of pollution prevention, as long as all necessary worker and environmental safeguards are employed. Lastly, recycling of APC dusts/sludges at iron and steel production facilities, if technically feasible, would result in no significant economic impacts under any regulatory scenario (pp. 8-47, 8-48).

Conclusion

A comprehensive review of the data available shows high risks of multi-media environmental contamination associated with active iron and steel production facilities and documentation of several damage cases associated with iron and steel production processes and their APC wastes. This information, combined with

---

5. We understand that there may be some worker health and environmental (esp. air) hazards associated with recycling wastes to the sinter plant that need to be addressed, however. According to a personal communication with Larry Davis of Bethlehem Steel (Burns Harbor Plant, IN), there are closed-loop recycling technologies for iron and steel production currently available in Europe (Oct. 13, 1990).

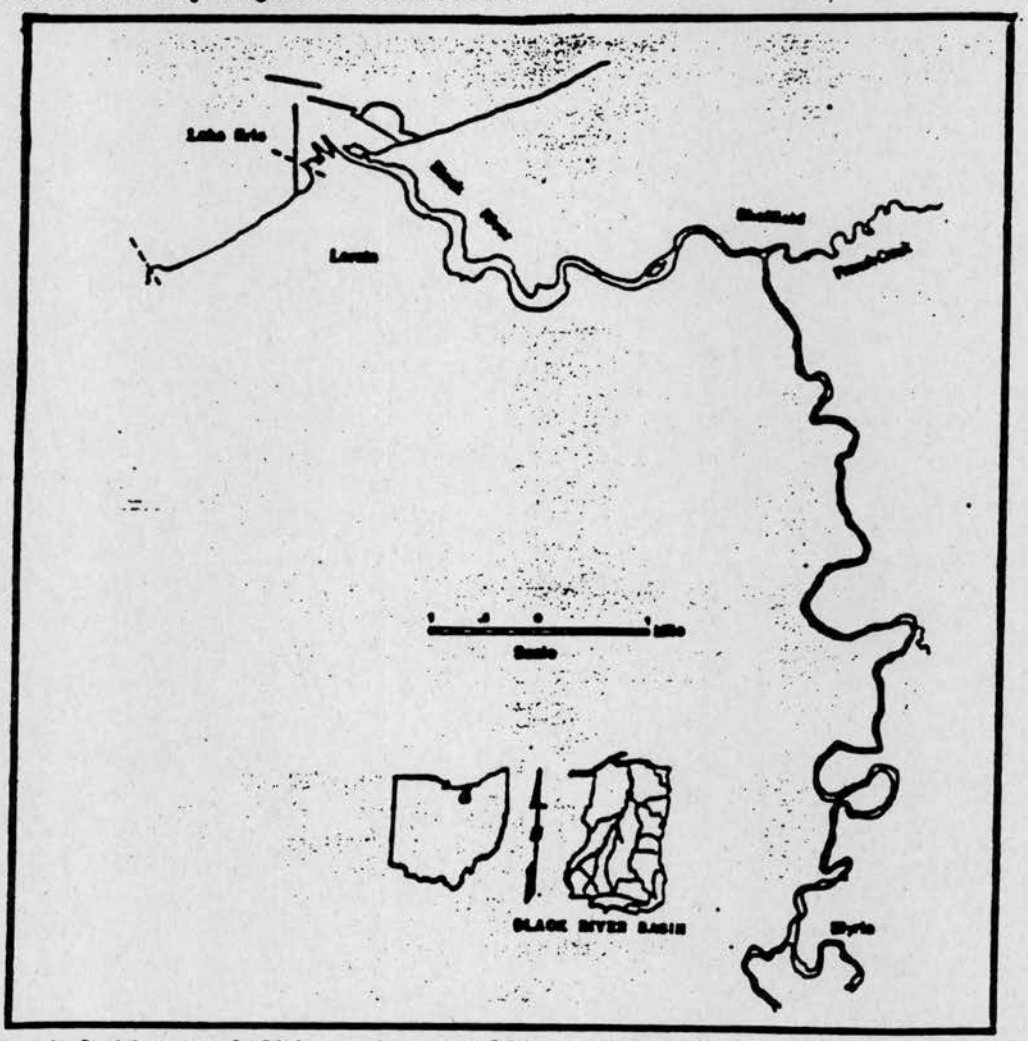
the high intrinsic hazards of iron blast and steel furnace APC dusts/sludges, argues compellingly for RCRA Subtitle C management of these wastes.

EPA's own analysis shows that the costs associated with hazardous waste management of iron blast and steel furnace APC dusts/sludges are definitely not likely to have a significant impact on the ferrous metals production industry as a whole. Finally, in the area of pollution prevention, as long as these two wastes qualify for the Mining Waste Exclusion, primary processors have a financial advantage over secondary processors, and the maximum recycling potential of these two wastes will never be realized.

OhioEPA

FACT SHEET: BLACK RIVER AREA OF CONCERN

The Lower Black River is one of 42 areas of concern identified by the Water Quality Board of the International Joint Commission (IJC). The areas of concern are locations around the Great Lakes where water pollution problems are so severe that they impair the beneficial uses of the area. The IJC has requested that each state develop a remedial action plan (RAP) for each of its areas of concern that will address the pollution problems and outline a plan for restoring the beneficial uses. The area of concern has been tentatively identified as the Black River from Elyria to the mouth, including the harbor and the immediately adjacent nearshore.



Frequent violations of Ohio water quality standards for the protection of warmwater habitat are experienced within and downstream from the city of Elyria, and are attributed to the industrial and municipal dischargers, combined sewer overflows, sanitary sewer bypasses and overflows and nonpoint runoff. The major source appears to be the Elyria WWTP and the associated bypasses and overflows. Water quality improves somewhat further downstream, but again falls in the harbor area and vicinity of the Lorain WWTP. Violations of Ohio water quality standards are noted for dissolved oxygen, ammonia, fecal coliform, iron, lead, phenol, cyanide, cadmium and copper. Elevated concentrations of BOD, total phosphorus and zinc are common.

Sediments in the harbor are heavily polluted with metals, oil and grease and oxygen-consuming materials. The harbor is dredged annually for commercial navigation and all of the dredged sediment must be confined disposed. Further upstream, in the vicinity of the USX (formerly U.S. Steel) outfalls, the sediment has been found to be heavily polluted with metals and polynuclear aromatic hydrocarbons (PAH). Sediment concentrations of PAH ranged from 4.8 to 390 mg/kg.

The degraded water quality and the contaminated sediments have impacted the biological community. Both fish and benthic populations were indicative of communities associated with poor water quality. Fish composite indices calculated in 1982, based on species diversity and numbers of fish, revealed only fair rankings for most of the area of concern. The PAH contaminated sediments are believed to be the cause of a high incidence of tumors in the bottom dwelling brown bullhead population in the river. Carp and brown bullhead had high body burdens of PAH and PCB (PAH were greater than 1 mg/kg and PCB were close to or exceeding the FDA action level of 2 mg/kg); and small amounts of DDT and several other pesticides. The discovery of fish tumors and the contamination of fish tissue resulted in the issuance of a health advisory in 1983 for the lower 5 miles of the river, warning people not to consume the fish. This advisory will remain in effect until the total recovery of the health of the fish population has been demonstrated.

The major sources of problems in the AOC have been identified as polluted sediments contaminated by historical industrial discharges and the current inputs from the Elyria WWTP and combined sewer overflows. The Lorain WWTP contributes to a lesser degree. Remedial actions to correct all of these problems are currently underway.

The Ohio EPA recognizes the importance of public involvement in the success of completing the RAP for the Black River, particularly in determining what the goals of the RAP should be. If you have comments or would like to learn more about the RAP process, please contact the Ohio EPA at the following address.

Ohio Environmental Protection Agency
Public Interest Center
P.O. Box 1049, 1800 WaterMark Drive
Columbus, OH 43622-0149
614-481-2165

Ohio EPA
Corrective Actions Section
Unregulated Sites Master List
Alpha by County

U.S. EPA ID / OHIO EPA ID	SITE NAME AND ADDRESS	PRIORITY / FIT
OHD004218673 218-0665	REPUBLIC STEEL CORP CLEVELAND DIST 3100 E 45TH ST CLEVELAND 44127	PRIORITY = L FIT = L
OHD981198146 218-0691	ROCKSIDE HIDEAWAY LDFL OFF CANAL RD BTWN ROCKSIDE RD GARFIELD HEIGHTS 44125	PRIORITY = M FIT = L
OHD000383653 218-0692	ROCKSIDE LDFL 5661 CANAL RD CLEVELAND 44125	PRIORITY = M FIT = L
OHD980611867 218-0693	ROCKSIDE ROAD LDFL ROCKSIDE RD INDEPENDENCE 44131	PRIORITY = L FIT = L
OHD055823512 218-0696	ROLA CO 21010 MILES PKWY CLEVELAND 44128	PRIORITY = L FIT = L
OHD000810069 218-0700	ROYALTON ROAD SAN LDFL 3401 E ROYALTON RD BROADVIEW HEIGHTS 44147	PRIORITY = L FIT = 0
OHD980704563 218-0718	SCHLOSS PAVING CO 13700 MCCRACKEN GARFIELD HEIGHTS 44125	PRIORITY = L FIT = L
OHD000609149 218-0729	SHELL OIL CO MARKETING 2201 W 3RD ST CLEVELAND 44113	PRIORITY = L FIT = L
OHD074552258 218-0733	SHERWIN-WILLIAMS CO 601 CANAL RD CLEVELAND 44113	PRIORITY = L FIT = L
OHD980679237 218-0742	SKILJAN RESIDENCE/DIAL SERV MFG CO 18028 NOTTINGHAM RD CLEVELAND 44119	PRIORITY = _ FIT = _
OHD038090767 218-0746	SOHIO 4850 E 49TH ST CLEVELAND 44125	PRIORITY = L FIT = 0

Ohio EPA
Corrective Actions Section
Unregulated Sites Master List
Alpha by County

U.S. EPA ID OHIO EPA ID	SITE NAME AND ADDRESS		PRIORITY FIT
OHD081290611 125-0790	SYSTECH LIQUID TRMT CTR 4350 EDGEWYN AVE COLUMBUS	43026	PRIORITY = 0 FIT = 0
OHD042316679 125-0800	TEXACO INC TEXACO USA DIV 580 PHILLIPI COLUMBUS	43228	PRIORITY = 0 FIT = 0
OHD004292041 125-0808	TIMKEN CO 1025 CLEVELAND COLUMBUS	43216	PRIORITY = _ FIT = _
NOT ASSIGNED 125-1017	UNICO ALLOYS 1555 JOYCE AVE COLUMBUS	43219	PRIORITY = FIT =
OH6210020222 125-0861	US DOD DEFENSE CONSTRUCTION SUPPLY CTR 3990 E BROAD ST COLUMBUS	43215	PRIORITY = L FIT = L
OH1170090004 125-0866	US NAVY NAVEL WEAPONS IND RESERVE PLT 4300 E 5TH AVE COLUMBUS	43216	PRIORITY = L FIT = L
OHD980510549 125-0896	WELCH LDFL 2910 REFUGEE RD COLUMBUS	43227	PRIORITY = M FIT = L
** COUNTY = FULTON			
NOT ASSIGNED 326-1030	EAGLE PICHER P.O. BOX 37 DELTA	43515	PRIORITY = FIT =
OHD980510036 326-0317	FULTON COUNTY LDFL LOCKPORT YORK CTR DELTA	43515	PRIORITY = L FIT = L
OHD000720599 326-0871	US STEEL CORP SWANTON PLT 413 E BROADWAY SWANTON	43558	PRIORITY = 0 FIT = 0

Ohio EPA
Corrective Actions Section
Unregulated Sites Master List
Alpha by County

U.S. EPA ID / OHIO EPA ID	SITE NAME AND ADDRESS		PRIORITY FIT
OHD004222030	US STEEL CORP LORAIN PLT		PRIORITY = M
247-0868	1807 E 28TH ST		FIT = M
	LORAIN	44055	
OHD980510416	WOODFORD ROAD QUARRY PIT		PRIORITY = _
247-0914	NEAR 231 WOODFORD AVE		FIT = _
	ELYRIA	44035	
OHD097615322	XERXES FIBERGLASS INC		PRIORITY = M
247-0923	34250 MILLS RD		FIT = Y
	AVON	44011	
** COUNTY = LUCAS			
OHD980678379	ALLEN CHARLES WASTE REMOVAL		PRIORITY = L
348-0024	ADDRESS UNREPORTED (TRANSPORTER)		FIT = L
	TOLEDO	99999	
NOT ASSIGNED	ALLIED AUTOMOTIVE TOLEDO STAMPING		PRIORITY =
348-1027	525 HAMILTON ST		FIT =
	TOLEDO	99999	
OHD980823801	ANDERSON'S		PRIORITY = L
348-0045	439 ILLINOIS AVE		FIT = M
	MAUMEE	43537	
NOT ASSIGNED	CHAMPION SPARK PLUG		PRIORITY =
348-1029	ADDRESS UNREPORTED		FIT =
		99999	
OHD980611636	CITY OWNED DUMP (AMC, NORTH COVE)		PRIORITY = H
348-0175	FOOT OF DREXEL DR I-75 & COVE		FIT = _
	TOLEDO	43610	
OHD000816843	COMMERCIAL OIL SERV INC		PRIORITY = _
348-0197	3600 CEDAR POINT RD		FIT = _
	OREGON	43616	
OHD980826119	CONSAUL STREET LDFL		PRIORITY = L
348-0200	2510 CONSAUL ST		FIT = 0
	TOLEDO	43624	

Ohio EPA
Corrective Actions Section
Unregulated Sites Master List
Alpha by County

U.S. EPA ID / OHIO EPA ID	SITE NAME AND ADDRESS		PRIORITY FIT
OHD093931038 250-0664	REPUBLIC HOSE MFG 1350 ALBERT YOUNGSTOWN	44505	PRIORITY = M FIT = M
OHD980568968 250-0676	REPUBLIC STEEL 1290 POLAND AVE YOUNGSTOWN	44509	PRIORITY = L FIT = 0
OHD018478149 250-0737	SHUBERT PLASTIC CTR 895 E INDIANOLA AVE YOUNGSTOWN	44502	PRIORITY = L FIT = L
OHD000674515 250-0782	SUNOCO SERV STA 146 ROBINSON RD CAMPBELL	44405	PRIORITY = 0 FIT = 0
OHD004169678 250-0793	TEE-NEE TRAILER CO 215 E INDIANOLA AVE YOUNGSTOWN	44507	PRIORITY = 0 FIT = 0
OHD059047233 250-0797	TEXACO INC 12575 ELLSWORTH RD ELLSWORTH	44416	PRIORITY = L FIT = L
OHD074548694 250-0870	US STEEL CORP OHIO WKS 912 SALT SPRINGS YOUNGSTOWN	44509	PRIORITY = L FIT = L
OHD094487394 250-0908	WILLOW ST LDFL 620 WILLOW ST YOUNGSTOWN	44506	PRIORITY = L FIT = L
OHD018482125 250-0924	YOUNGSTOWN BARREL & DRUM CO 1043 MARBLE ST YOUNGSTOWN	44502	PRIORITY = L FIT = L
OHD004470357 250-0925	YOUNGSTOWN SHEET & TUBE BRIARHILL WKS STATE ST RT 422 YOUNGSTOWN	44510	PRIORITY = L FIT = L
OHD980704761 250-0926	YOUNGSTOWN SHEET & TUBE BRIER HILL WKS SALT SPRINGS RD YOUNGSTOWN	44509	PRIORITY = L FIT = L

Ohio EPA
Corrective Actions Section.
Unregulated Sites Master List
Alpha by County

U.S. EPA ID / OHIO EPA ID	SITE NAME AND ADDRESS		PRIORITY / FIT
OHT400010054 278-0322	GENERAL ELEC CO MAHONING GLASS PLT 403 N MAIN ST NILES	44446	PRIORITY = L FIT = L
OHD000817346 278-0339	GMC PACKARD ELEC DIV N RIVER RD & LARCHMENT NE WARREN	44483	PRIORITY = L FIT = L
OHD980704373 278-0465	LIBERTY TWP DUMP SR 304 & I-80 HARTFORD	44424	PRIORITY = L FIT = L
OHD018232702 278-0510	MELMOR ASSOC INC 840 ANN ST NILES	44446	PRIORITY = L FIT = L
OHD980611172 278-0522	MIDWEST MACHINERY CO BRACEVILLE RD NEWTON FALLS	44444	PRIORITY = M FIT = L
OHD980616023 278-0566	NILES CONDUIT PROD PLT MCKEES LN NILES	44446	PRIORITY = M FIT = L
OHD980611289 278-0567	NILES WORK SALT SPRING & MINERAL RIDGE RD NILES	44446	PRIORITY = M FIT = L
OHD004470597 278-0593	OHIO CORRUGATING CO 1301 PINE AVE SE WARREN	44483	PRIORITY = L FIT = L
OHD980704498 278-0595	OHIO EDISON CO AERIAL #373 1047 BELMONT NILES	44446	PRIORITY = L FIT = 0
OHD980510424 278-0666	REPUBLIC STEEL CORP CLOSED PLT RTE 169 & HEATON RD NILES	44446	PRIORITY = M FIT = L
OHD060409521 278-0671	REPUBLIC STEEL MAHONING VALLEY WARREN 1040 PINE AVE SE WARREN	44481	PRIORITY = M FIT = L

APPENDIX D

Process Wastewater from Hydrofluoric Acid Production

EPA has "tentatively" concluded that Subtitle C regulation may be warranted for process wastewater from hydrofluoric acid production. NAS, EDF, and MPC agree with that conclusion and urge the Agency to require that hydrofluoric acid process wastewater be treated, stored and disposed of as a hazardous waste.

The Agency's conclusion was based on its analysis of the potential and documented damage to human health and the environment posed by the wastewater, and its assessment that requiring that the material be managed as hazardous would not impose significant additional cost impacts on the generating facilities.[1] All nine samples of the process wastewater that EPA analyzed exhibited the hazardous waste characteristic of corrosivity; indeed, EPA determined that the pH of the wastewater analyzed from the facilities fell within the "high hazard" range defined by the Agency for Bevill wastes. See 54 Fed. Reg. 36,592 at 36,600 (1989). The wastewater also contains six constituents of concern in elevated levels.

For the following reasons, NAS, EDF, and MPC believe that the environmental risks posed by current methods of storing and

---

[1] See Report to Congress at 9-27 through 9-29.

disposing of the wastewater are even greater than EPA estimates, and regulation under Subtitle C is appropriate and legally required.

1. Process wastewater from hydrofluoric acid disposal fails to satisfy EPA's "low hazard" criteria, so it would be contrary to law for the Agency to retain the waste within the Bevill exclusion.

As discussed in the body of these comments, only "high volume, low hazard" processing wastes are entitled to the Bevill exemption from the hazardous waste requirements. EPA promulgated its criteria for identifying wastes that are not high volume or low hazard in September 1989, and determined that liquid wastes with a pH less that 1.0 or greater than 13.5 cannot be considered "low hazard." 54 Fed. Reg. at 36,599.[2]

The wastewater samples from the three plants that currently produce hydrofluoric acid were consistently corrosive, according to EPA, with the pH at the Geismar, Louisiana and Calvert City, Kentucky facilities being as low as 1, and at the LaPorte, Texas plant as high as 14. By the Agency's own criterion the wastewater

---

[2]Indeed, the Agency wrote that "the proposed standard identifies wastes that are so corrosive that it would not be credible to consider them "low hazard" regardless of the industrial process used to generate the waste or the location of the facility." 54 Fed. Reg. at 36,599 (emphasis added). In response to comments on its proposal, EPA declined to adopt a greater pH range to ascertain the hazard of processing wastes on the ground that "any further increase in the pH range may result in wastes that are clearly not low hazard remaining in the Bevill exclusion, which may in turn compromise the protection of human health and the environment." 54 Fed. Reg. at 36,600.

is a high hazard waste. Therefore, EPA should remove the wastewater from the exclusion immediately.

2. Current disposal practices at the three plants that produce hydrofluoric acid pose an immediate threat to underground water supplies.

EPA has underestimated the threat to groundwater posed by current methods of handling and disposing of process wastewater at the three plants that produce hydrofluoric acid. At each of the facilities, process wastewater is stored in unlined ponds, though the water table is very shallow at each location. Contamination has been documented at the Calvert City, Kentucky plant, which is the only facility that performs groundwater monitoring. At Calvert City the ponds are roughly nine meters deep, and an aquifer that supplies drinking water is only five meters below the surface. Therefore, the unlined ponds are located below the top of the water table at Calvert City.

Groundwater monitoring at the plant has revealed elevated levels of cadmium, fluoride, iron, manganese, pH, and total dissolved solids in excess of EPA's drinking water standards. EPA notes in the Report that process wastewater is a "possible contributor" to the contamination. Because the nearest drinking water well is approximately two miles from the facility, however, EPA glosses over the potential impact of the contamination by stating in the Report that drinking water wells are not likely to be "significantly affected" by the contaminants.

Similarly, EPA unjustifiably minimizes the potential risk to groundwater posed by the disposal of process wastewater at the Geismar, Louisiana and LaPorte, Texas plants. The groundwater table is only three meters and six meters below the surface at the Geismar and LaPorte facilities, respectively, and EPA acknowledges that contamination from the wastewater ponds at both plants is "possible."

Despite its own evidence to the contrary, EPA concludes that the potential risks to human health posed by any contamination from the facilities are not "significant." NAS, EDF, and MPC disagree with that conclusion.

EPA has not given adequate consideration to the future impacts of current disposal practices at the three facilities. The Agency improperly assumes that the population density and current land uses around all three plants are not likely to change in the future. For example, since the nearest drinking water well is presently over two miles downgradient from the Calvert City facility, EPA writes that the levels of contamination from the plant's ponds will be sufficiently diluted by the time it migrates to the well so as not to present a health risk. EPA does not address the possibility of additional drinking water wells being installed closer to the source of the contamination in the future, perhaps because of changing demographics.

Similarly, EPA notes that the shallow aquifers at the Geismar

and LaPorte facilities are not currently used for drinking water, so contamination is of less concern. EPA states that the shallow aquifer at Geismar is "unusable," and seems to dismiss any contamination that the plant may be causing as being of no consequence. Since the deeper aquifer at the location is used for livestock watering, rather than drinking water, it is entitled to a lower degree of protection, according to the Agency. But EPA seems to assume that the use of the lower aquifer for livestock needs is not likely to change in the future; i.e., that there will be no development in the area where the plant is located. EPA provides no information to support that assumption. Neither does EPA provide information on the potential health impacts on the livestock that depend on the possibly-contaminated deeper aquifer, or on the humans that consume its milk or meat.

EPA's discussion of the potential for contamination of the lower aquifer at Geismar is incomplete. EPA writes that the lower aquifer is "more protected" that the upper aquifer, but presents no information regarding the likelihood of migration of contaminants from the upper to the lower aquifer, such as an analysis of the geology of the area, including the permeability of the native soils and the substructural distance between the aquifers.

The Agency dismisses any potential harm from groundwater contamination at the LaPorte plant on the ground that the plant is located in a highly industrialized area where the groundwater is

already unsuitable for domestic use. By "writing off" the groundwater in the Houston Ship Channel area, the Agency seems to be designating the area a "dead zone," an area less entitled to environmental protection than others. That approach is unjustified, and contrary to law.

The potential for contamination to impact drinking water sources depends on the direction and rate of the groundwater flows, which EPA has not adequately considered. The Report includes only limited information on the direction of groundwater movement at the Geismar facility, and no data on the other two plants.

2. Contamination at each of the three plants poses a serious threat to the sensitive environments in which the plants are located.

EPA points out that each of the three plants is located in a sensitive environment. All three facilities are situated less than one mile upgradient of a wetland; in addition, the Geismar, Louisiana and Calvert City, Kentucky plants are located in a 100-year floodplain, and the Calvert City plant is located in a fault zone. All three of the plants are located in close proximity to major bodies of surface water, as well. The Geismar facility is approximately 600 meters from the Mississippi River, the Calvert City facility is roughly 1,040 meters from the Tennessee River, and the LaPorte plant is only 50 meters from the San Jacinto Bay, which empties into the Houston Ship Channel. EPA has not given adequate consideration to the potential harm that may be caused by the

plants' current disposal methods at these facilities, particularly contamination of the wetlands and surface water bodies that may be threatened by current disposal practices.

Wetlands

Wetlands perform a variety of vitally important ecological functions. For example, wetlands provide essential habitat for a number of aquatic, avian and terrestrial species, including nearly one-third of the nation's endangered and threatened species. Wetlands support commercial and recreational fisheries; they also help reduce flood damage, and abate water pollution. In recognition of their unique and critical importance to the nation's ecosystems, President Bush announced last year a national goal of "no net loss" of wetlands. Though all three facilities are within close proximity to a wetland, and each has experienced releases of wastewater, EPA's Report gives practically no consideration to the potential impacts of disposal practices on wetlands.

Surface Water

EPA discusses the potential of hydrofluoric acid process wastewater being released into the surface water bodies near the three plants, and concludes that potential releases pose no great risk. EPA's conclusion is based on the large assimilative capacity of the Mississippi and Tennessee Rivers, and the San Jacinto Bay.

NAS, EDF, and MPC disagree with EPA's conclusion. For example, the Report mentions the large episodic releases that have

occurred at the Geismar plant. Such large releases are extremely damaging to the environment; they can result in fish kills, damage to vegetation, "spikes" in contaminant levels in drinking water, accumulation in sediments and the like. Indeed, the Case Study for the Geismar facility includes documentation of fish kills caused by releases from the plant and extensive "vegetation kills."[3]

Given the highly corrosive nature of the material, and the plants' histories of spills and releases, it is illogical for EPA to conclude that the potential for harm to the large surface water bodies near the plants is only minimal. The Mississippi and Tennessee Rivers and the San Jacinto Bay already suffer from excessive pollution that is attributable to both large and relatively small industrial and other sources. The rivers are both vital to the nation for their commercial and recreational values, and they are of critical importance to the humans and wildlife that depend on the ecosystems through which they flow. The San Jacinto Bay empties into the Houston Ship Channel, which in turn flows to Galveston Bay, one of the nation's largest and most important estuaries. It seems unlikely that the water bodies will ever be cleaned up if the Agency's approach to pollution control is ignore the effects of discharges that they claim are relatively small, as

---

[3] See Mineral Processing Waste Management Case Studies, Allied-Signal, Geismar, Louisiana, pp. 7-10.

they have in this Report.

3. Increased demand for hydrofluoric acid is likely to lead to additional plants in the future.

EPA discusses the fact that the demand for hydrofluoric acid is likely to increase in the future due to its usefulness as a substitute for chlorofluorocarbons (CFCs), which will be phased out of use over the next 10-15 years. An increase in world demand for the product is apt to lead to the construction of additional production facilities in the U.S., and/or the expansion of existing capacity. With increased production of hydrofluoric acid and the resultant increase in the volume of process wastewater generated, the environmental harm that could result from the current methods of treatment and disposal would become even more substantial.

The Agency's mention of the potential for increased production of hydrofluoric acid underscores the inadequacy of its risk assessment of current waste disposal practices. In particular, since it is impossible to predict with certainty where additional capacity would be sited, EPA's discussion of land uses around the existing facilities falls far short of an evaluation of potential harm from the wastewater.

In light of the potential for continuing and additional contamination in the future, it is critical that the Agency require that the industry treat, store, and dispose of the material as a hazardous waste.

Appendix E
Primary Lead Processing

Introduction

As EPA acknowledges, primary lead slag can pose a significant risk if mismanaged. EPA's conclusion rests on the intrinsic hazard of lead slag, as indicated by the presence of high levels of lead, mercury, arsenic, and other toxic constituents in both leachable form and on a total-content basis; potential for further contamination of ground and surface water; and documented cases of water contamination associated with lead slag. Of particular note are elevated concentrations of heavy metals in surface water and ground water samples collected downstream of lead slag piles at the Glover, Boss, and E. Helena facilities, as discussed in the Technical Background Document.

In light of these factors, NAS, EDF, and MPC strongly believe that lead slag warrants regulation as a hazardous waste. This conclusion is buttressed by several additional factors.

First, these areas are already significantly contaminated with lead, a toxicant that is not subject to biodegradation and that is thus cumulative in the environment. For example, as noted in EPA's background document, most of the Helena Valley -- about 100 square miles -- is already contaminated by lead from the ASARCO plant in East Helena. Technical Background Document: Damage Case Investigation: Lead/ASARCO/East Helena, MT, p. 11. All future releases from slag piles (or any other source) will simply cause increased levels of contamination.

The severity of the nation's existing lead contamination problem has been expressly acknowledged by Agency decision makers. For example, in recent testimony, the Deputy Assistant Administrator for Pesticides and Toxic Substances stated "EPA considers lead to be one of the nation's most toxic multi-media contaminants. . . . [I]t is a significant health problem in this country, especially because of its impacts on infants and children. EPA is also concerned about environmental contamination from lead." Testimony of Victor Kim before the Subcommittee on Toxic Substances of the Senate Committee on Environment and Public Works, June 27, 1990, at 1. Mr. Kim also stated that "EPA is committed to yet more aggressive activity to address this serious risk to our children. The Administrator and Deputy Administrator have made it a high priority within the Agency." Id. at 4. Mr. Kim further noted that EPA is developing a comprehensive cross-media lead strategy to control lead pollution, with particular emphasis on pollution-prevention initiatives. Id. at 4-5.

Significantly, lead exposures for children who reside near smelters are already unacceptably high. For example, according to lead industry data, the mean (i.e., average) blood-lead level for children under seven at the Herculaneum smelter is 9.9 ug/dl (micrograms of lead per deciliter of blood) in 1990, while the corresponding level for the East Helena smelter was 8.6 in 1988. Statement of Jeffrey L. Zelms, Chairman, Lead Industries Association, Inc., Before the Subcommittee on Toxic Substances of

the Senate Committee on Environment and Public Works, June 27, 1990, p. 15.

Such levels are of considerable concern given lead's ability to cause neurotoxic effects in children at extremely low dose. As noted by EPA's Clean Air Scientific Advisory Committee, "blood-lead levels above 10 ug/dl clearly warrant avoidance, especially for development of adverse health effects in sensitive populations. The value of 10 ug/dl refers to the maximum blood-lead level permissible for all members of these sensitive groups [i.e., children], and not mean or median values." Review of the OAQPS Lead Staff Paper and ECAO Air Quality Criteria Document Supplement, Doc. No. EPA-SAB-CASAC-90-002, Jan. 1990, p. 1 (emphasis added). Yet, given that the mean blood-lead level is 9.9 ug/dl at the Herculaneum smelter, it is extremely likely that a significant fraction of those children have blood-lead levels above 10 ug/dl. As the CASAC also noted, "there is no discernible threshold for several lead effects and . . . biological changes can occur at lower levels." Id. The need to eliminate all further lead releases at smelter sites is thus evident.

In making a regulatory determination on management of lead slag wastes, EPA has a stellar opportunity to transform its rhetoric on lead "pollution prevention" into reality. The factual record regarding the risks to human health and the environment posed by lead slag wastes abundantly supports regulation under Subtitle C of RCRA. Further, the minor cost

savings associated with Subtitle D regulation -- about $1.1 million annually, see p. 10-37 -- are demonstrably outweighed by the increased risk of environmental releases of this persistent toxin.

One final introductory point requires mention. EPA's analysis seems to presume that any limitations on "utilization" of slag attendant upon Subtitle C regulation would be a drawback, rather than an benefit, of such regulation. See p. 10-31 to p. 10-33. To the contrary, the controls that are adopted (under whatever rubric) must be crafted to preclude "utilization" of slag, particularly in dispersive fashions. The history of lead use in gasoline and paint teaches only too clearly that dispersive uses create long-term hazards that are extraordinarily difficult to abate and that are entirely independent of leaching potential. Such risks are posed to the populace as a whole as well as to subgroups such as children and workers. Thus, use of lead slag in portland cement should be restricted, lest the history of asbestos -- which continues to present a significant environmental risk during building demolition or renovation -- is repeated with lead-containing materials. Even more troubling is the use of ground lead slag as an air-blasting abrasive, a practice that seems virtually guaranteed to maximize worker exposure to toxic constitutents in the slag and to promote environmental dispersion of lead. Far from being a disadvantage, Subtitle C regulations for lead slag should be expressly drawn so as to bar these "beneficial uses" of slag.

Specific Comments

Because EPA's analysis overlooks several factors, it understates risks from lead slag mismanagement. These omissions are described below.

-- Accumulated Dust Contamination

EPA's analysis fails to assess quantitatively the exposure route that is potentially most significant for lead exposures: contaminated dust. Rather, EPA appears to have focused its analysis on "whether lead concentrations could be high enough to cause an excedence of the NAAQS for lead if slag dust is blown into the air," p. 10-8. However, as the Agency knows full well, the primary exposure pathway of concern for lead dust is not ambient inhalation, but rather exposure to the accumulated reservoir of lead deposited over time in dust and surface soils. EPA has recognized as much for at least the better part of a decade, since it noted that lead in gasoline was "a significant contributor to this [major health] problem through its presence in the air, dirt and dust." 47 Fed. Reg. 38078 (Aug. 27, 1982) (emphasis added) (lead-gas phasedown regulations).

More recently, EPA issued a document captioned "Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites," and setting a soil cleanup level for lead of 500 to 1000 ppm. Id., dated Sept. 9, 1989, OSWER Directive #9355.4-02. EPA's stated rationale for setting this cleanup level was that "'lead in soil and dust appears to be responsible for blood levels in children increasing above background levels when the

concentration in the soil or dust exceeds 500 to 1000 ppm.'" Ibid., quoting "Preventing Lead Poisoning in Young Children," January 1985, U.S. Department of Health and Human Services, Centers for Disease Control, Doc. No. 99-2230. Within the next several weeks, CDC's expert ad hoc committee on childhood lead poisoning is expected to significantly lower the diagnostic threshold for childhood lead poisoning, in response to recent data showing neurotoxic effects at lower lead levels than previously recognized. Logic dictates that the interim cleanup level should decline in tandem with the CDC's new lower levels of concern. Moreover, there are substantial reasons for questioning whether the 500-1000 ppm soil level is adequate to ensure that blood-lead increases will be avoided. See generally, PL Reagan and EK Silbergeld (1990), "Establishing a Health Based Standard for Lead in Residential Soils," DH Hemphill & CR Cothern, eds., Trace Substances in Environmental Health, supplement to Volume 12 of Environmental Geochemistry and Health (copy appended as Attachment 1 to this Appendix).

Although EPA asserts that slag is composed of "relatively large" particles exceeding 0.2 mm in size, p. 10-11, and that this factor "limits the potential for release of airborne dust," p. 10-12, these assertions are inconsistent with observations elsewhere in the Report. For example, the Report states that the Omaha facility uses dust-suppression techniques, p. 10-11, and that ASARCO at one point sprayed its slag pile with water "for the purpose of dust control," p. 10-19. Similarly, the Report

states that an EPA regional inspector listed "blowing dust from the slag pile" as part of the "Hazardous Conditions and Incidents" at a 1984 inspection of the Doe Run facility, p. 10-22. Thus, at three of the five facilities, the presence of nontrivial amounts of dust at the slag piles has been documented. Moreover, it is not clear how EPA arrived at the conclusion that all slag particles exceed 0.2 mm in size. Was sampling conducted? If so, at how many facilities and how many samples were analyzed? Or is this conclusion simply a guess?

Even if this datum is in fact correct, normal weathering processes will inevitably produce smaller particles over time. Because lead and the other constitutents of concern in slag are elemental metals, their toxicologic potency will not decrease one whit during that process. These smaller particles will be more readily transportable. This prospect cannot be ignored in light of the proximity of residences to several of these facilities (i.e., 15 meters at Herculaneum, 60 meters at Glover, p. 10-17 n.15), and of relatively dense population clusters near the Herculaneum, East Helena, and Omaha facilities (which respectively have 25,000, 12,000, and 224,000 residents within a 8 km area). Further, EPA's focus on average wind speed obscures the fact that Missouri and Nebraska are in regions of the country that routinely experience violent thunderstorms and tornadoes; storms capable of relocating automobiles will also disperse lead slag particles above 0.2 mm in size.

-- Other Exposure Pathways

The factors discussed in Exhibit 10-5 clearly indicate the need for management controls on lead slag, particularly in light of potential harm to surface water.* The predicted excedences -- by up to 19-fold -- of the ambient water quality criteria for both lead and zinc at the Boss and Glover sites, and lead (though not zinc) at the E. Helena site, compellingly demonstrate a need for stringent controls.

Indeed, EPA's analysis may well understate long-term risks, as suggested by the fact that the model predicts less damage than has been found in the damage cases, p. 10-25. This under-predictiveness again underscores the need for a preventive approach. In part, this may reflect the model's inability to take into account dolomitic formations that enhance contaminant migration, p. 10-26. It may also reflect EPA's assumption that "neutral pH conditions are expected" in the vicinity of lead slag wastes, despite the fact that groundwater samples from at least

---

#/ Contrary to the assertion made on p. 10-15, however, the fact that the methodology does not account for removal of pollutants via drinking water treatment does not necessarily produce an overstatement of risk, for the constituents of concern here are metals -- which generally are <u>not</u> removed by ordinary drinking water treatments. For example, although lead in its simple ionic form has a high affinity for certain surfaces under certain chemical conditions, it is inaccurate to say that drinking water treatment will effectively remove lead from solution. Removal is a function of pH, suspended sediment concentration, composition of the raw and treated water, and the extent of lead organic complexing. Thus, no generalizations can be made about whether or to what degree treatment of drinking water removes heavy metal contaminants.

one facility (Glover) have at times exhibited a pH of less than one. See Technical Background Document/Lead/ ASARCO-Glover, p. 8. Such acidic conditions greatly enhance the solubility of lead. As a result, results using the EP toxicity test are more germane to assessing the hazards of lead slag than those of using the SPLP test (see p. 10-23).

EPA's conclusions about the groundwater hazard potential for individual facilities also contain numerous limitations. According to the Technical Background Document on Cost Impact Assessment Results, p. 2-5, the degree of potential risk to groundwater for a facility's location is low at the Omaha and Herculaneum facilities, moderate at the E. Helena and Boss facilities, and high at the Glover facility. Remarkably, however, the same source reports that the depth-to-groundwater at Omaha is only 2 meters, at Herculaneum only 8 meters, and at E. Helena only 4 meters. Moreover, groundwater contamination -- specifically, excedence of the primary drinking water standards for lead, cadmium, and arsenic -- has been detected in on-site wells at the Glover, E. Helena, and Boss facilities.

EPA's classification of the Omaha facility posing a low (category 1) risk to groundwater is especially troubling. That conclusion is apparently based on three factors: current management practices (i.e., use of concrete pits for slag storage), low net recharge rate of 5 cm/year, and the fact that groundwater in the area is not currently used, p. 10-9. Here as elsewhere, EPA's focus on current uses of groundwater is the

antithesis of a pollution-prevention approach. Moreover, the low net recharge rate of 5 cm/yr is offset by the moderate rainfall (76 cm/yr).

As a technical matter, the existing concrete liners provide no guarantee of impermeability to water; concrete is readily subject to fracture, as a causal inspection of a city sidewalk makes plain.

More generally, basing an intrinsic hazard evaluations on consideration of present management practices is inappropriate. In the absence of regulatory mandate there is no assurance whatsoever that current practices will be continued. Even assuming that current management intends to do so, managements change; new managers may adopt policies that are less environmentally beneficial than those of their predecessors. For example, following the acquisition of Pacific Lumber by New York financier Charles Hurwitz, the company more than doubled its logging rate and switched from selective cutting to clearcutting. See JC Ryan, "Wall Street Goes Wild," Worldwatch, Nov.-Dec. 1989, p. 7. Or, changing economic conditions may prompt managers to alter their policies -- a particular concern in the context of lead, the real (inflation-adjusted) price of which has changed by a factor of almost four during the past dozen years. See Bureau of Mines (1989), Nonferrous Metal Prices in the United States through 1988, (Washington, DC: U.S. Dept. of Interior), pp. 55-57 (1979 price of $0.789 vs. 1985 price of $0.202, adjusted for inflation).

Risks may be further underestimated because the Report's estimates for surface water impacts are based on constituent concentrations after "complete mixing in the receiving water body," p. 10-17. These estimates thus implicitly presume that the total water level will remain similar in the future. However, some climate-change models suggest that rainfall in some areas of the United States may change markedly if climate-stabilization efforts are not successful. See generally, EPA Office of Policy, Planning and Evaluation (Dec. 1989), "The Potential Effects of Global Climate Change on the United States: Report to Congress," Executive Summary, pp. xxviii, xlvi. As a result, the "very large flows of the Mississippi and Missouri Rivers adjacent to" the Herculaneum and Omaha facilities may cease to "effectively dilute any contaminants released from the on-site slag piles," p. 10-15, particularly in summer. These uncertainties again reinforce the need for an protective approach founded on pollution prevention principles.

Likewise, EPA understates risk by implicitly assuming no change in land and water use patterns. For example, existing cobalt contamination at the Glover and East Helena lead smelters is dismissed as being of "little practical significance at present," because surrounding lands are not currently farmed and groundwaters are not now used for irrigation, p. 10-15. But cobalt and other constituents of concern in lead slag are, as noted above, toxic heavy metals -- substances that never degrade

or lose their toxicity, and that will remain hazardous for the indefinite future.

Finally, it should be noted that failure to regulate lead slag from primary lead processing indirectly subsidizes primary lead over secondary lead, for secondary slag must be managed pursuant to subtitle C to the extent that it exhibits a characteristic (which it often does). While secondary lead production is currently occurring at a relatively high level -- with over 80 percent of lead-acid batteries being recycled -- the remaining non-recycled batteries contribute 138,000 tons of lead to the solid waste stream. EPA (1989), Characterization of Municipal Solid Waste in the United States: 1990 Update (Washington, DC: EPA Doc. No. EPA/530-SW-90-042), pp. 1 & 81. Moreover, lead-acid battery recycling is itself a polluting enterprise; to the extent that recycling faces a competitive disadvantage in waste disposal requirements, recyclers will be less able to invest in pollution control equipment.

In sum, EPA's analysis is likely to understate significantly the hazards posed by lead slag. Even based solely on EPA's own analysis, however, the risks posed by mismanagement of lead slag clearly indicate that regulation of lead slag as a hazardous waste is abundantly warranted.

Attachment 1 to Appendix E
NAS/EDF/MPC comments on RTC-MPW

Trace Substances in Environmental Health

Supplement to Volume 12 (1990) of
Environmental Geochemistry and Health
Proceedings of a conference held
in the Hotel Westin in Cincinnati, Ohio, USA
May 29 – June 1, 1989

EDITED BY

Delbert H. Hemphill
Environmental Trace Substances Research Center
University of Missouri
Columbia, Missouri, USA

C. Richard Cothern
US Environmental Protection Agency
Science Advisory Board
Washington, DC, USA

Trace Substance Environmental Health 23: 199-238

1989

Establishing a Health Based Standard for Lead in Residential Soils

Patrick L. Reagan
The Lead Coalition, 1051 S. McKnight Road, St. Paul, MN 55119, USA

Ellen K. Silbergeld
Environmental Defense Fund (EDF), 1616 "P" Street NW, Washington, DC 20036, USA

Abstract

The literature, as a whole, shows that the child Pb problem is of greater severity than originally thought. Adverse health effects of Pb occur in children at blood Pb levels at least as low as 10 μg dL^{-1}, though no threshold can be determined for many health effects. Further, blood Pb levels exceeding 10 μg dL^{-1} are commonly found in the industrialized world. Current sources of Pb exposure for all populations are multiple and complex. Consequently, any standard to protect children from Pb exposure via soil must be based upon a health goal of preventing any increase in body burden of Pb, particularly during critical periods of neurological development.

New research now confirms that Pb in dusts, particularly soil dust, are a significant vector of exposure for children. For the majority of children, exposure to Pb via soil and dust plays a greater role than that associated with ingestion of lead-based paint (a very high risk source, but one that is relatively limited in prevalence).

The purpose of establishing a standard for Pb in residential soils is to prevent Pb exposure by identifying risky situations and guiding their remediation. A soil Pb standard to protect children should apply to both residential and other areas where children have ready access. The standard could be limited to bare soils, if and only if, ground cover can be perpetually maintained on existing covered areas. Its definition must be based on a statistically based soil sampling survey in an area large enough to be reliably reproduced and allow distinctions by sample type (houseside, mid-yard and streetside). Moreover, for clean up purposes, there is a need for a soil replacement standard. This paper presents the case for a standard of 100 μg Pb g^{-1}.

Introduction

The American Academy of Pediatrics (AAP, 1987

"Lead remains a significant hazard to the health of American children... Lead has no biologic value. Thus, the ideal whole blood Lead level is 0 μg dL^{-1}... Neuropsychological dysfunction, characterized by reduction in intelligence and alteration in behavior has been shown conclusively to occur in asymptomatic children with elevated blood Pb levels."

In contrast to this ideal, median blood Pb levels for children under six in the US are approximately 8 μg dL^{-1} (ATSDR, 1988a). Thus, in order to move towards this ideal blood Pb level, all sources of Pb exposure to children must be identified and controlled. As numerous expert committee reports have concluded, soil-dust Pb is a major contributor to the child Pb problem (CDC, 1985; ATSDR, 1988a; RSC, 1986 and RCEP, 1983). Lead in soil represents the cumulative impacts of both past and ongoing releases of Pb. In order to address this source in the US, a legal limit or standard must be promulgated. The promulgation of such a standard requires that a compelling case, which clearly demonstrates the need for and factual basis of such a standard, be made. The case must address factors relating to both the health effects of Pb and the role of soil-dust in the child Pb problem. Further, the case must present a compelling argument for the standard itself, addressing both the rationale for the soil Pb limit and the nature and scope of the standard. The purpose of this paper is to present argument and evidence for a soil-dust Pb standard. Others have also proposed soil Pb standards; their conclusions will be discussed below.

The Child Lead Problem

Lead poisoning is a widespread, serious, and preventable disease. Its causes are so well known that the only reason the disease continues to exist is a lack of will on the part of society to control its sources (Needleman, 1988). Unfortunately, most efforts to control Pb poisoning have focussed upon finding and treating victims of the disease rather than preventing exposure to Pb. Because of this approach, society has been using children as bio-indicators of Pb exposure even though the effects of Pb are often irreversible and preventable (Angle and McIntire, 1982). The only way to prevent Pb poisoning is either to remove the child from the Pb source or remove the Pb source from the child's environment (CDC, 1985).

The health effects of lead exposure

Much has been written on the health effects of Pb over the past decade. The literature as a whole has demonstrated that Pb is a contributing factor in the incidence of mental retardation, learning disabilities, and other adverse effects in young children. Coupled with this is much information on the nature and extent of Pb exposure in children in the US (ATSDR, 1988a). Millions of children are exposed to Pb at levels known to cause learning disabilities and other significant health problems. Needleman's work describes the significance of chronic, moderate Pb exposure. He found that children whose blood Pb levels were greater than 30 μg dL^{-1} were three times more likely to have an IQ below 80 and none had an IQ greater than 125, although it would be expected that 5% would

have an IQ of 125 (Needleman *et al.*, 1979). This population IQ shift is not limited to high blood Pb levels. Three different prospective studies show 2-8 IQ point decrements for each 10 μg dL^{-1} increase in blood Pb (see below). An overall downward shift of four population IQ points results in 50% more children with an IQ below 80 (Davis and Svendgaard, 1987). This means that, given existing mean population blood Pb levels, a downward shift in population IQ has already occurred with the greatest effect occurring in the inner-city areas where blood Pb levels are highest. A review of the health effects literature, as a whole, paints a bleak picture for our children. Unless we intervene to control sources of exposure, children will continue to suffer harm for generations (Needleman, 1988).

A growing concern is the possibility of subtle toxic effects on the fetus that are not evident at birth, particularly on cognitive ability. Animal experiments have demonstrated behavioral and learning deficiencies as well as delay in brain development following intrauterine exposure to Pb (Silbergeld, 1983). Several epidemiological studies show a 5 to 10 point decrease in IQ scores in children (ages 2-6 years) associated with maternal blood Pb levels during pregnancy (Bellinger *et al.*, 1984, 1985, 1986, 1987a,b, 1989; Dietrich *et al.*, 1986, 1987, 1989; Vimpani,1985; Emhart *et al.*, 1985, 1986, 1988; Wolf *et al.*, 1985 and Winneke *et al.*, 1985a,b, 1989). EPA (1986a) concluded that these studies [1986 and earlier] show that "neuro- behavioral deficits, including declines in Bayley [MDI] scores and other assessments of neurobehavioral function, are associated with prenatal blood Pb exposure levels on the order of 10-15 μg dL^{-1} and possibly even lower, as indexed by maternal or cord blood Pb concentrations." The draft 1989 supplement to the EPA (1986a) report maintains this conclusion (EPA, 1989a). Indeed, the mean blood Pb levels in both the control and experimental groups in some of these studies were below 10 μg dL^{-1}. Further, the prospective epidemiological studies indicate that some of the effects of Pb on the developing nervous system are *permanent*, similar to the persistence of deficits reported earlier in electrophysiological assessments (Benignus *et al.*, 1981; Otto *et al.*, 1981, 1982, 1985).

Beside IQ, there are other low level adverse effects of Pb that are of concern when evaluating children's health. Schwartz *et al.* (1986) provided strong evidence that Pb exposure is associated with decreased stature with no threshold observable down to the lowest measured blood Pb of 4 μg dL^{-1}. In a separate study, Schwartz and Otto (1987) used the NHANES II database to evaluate the effects of Pb on children's hearing thresholds and found that as blood Pb levels rise, hearing thresholds also rise at 1,000, 2,000, and 4,000 Hertz in both ears; the effect of Pb on hearing was found at the lowest level measured (5 μg dL^{-1}). No threshold was found for the effects of Pb on blood pressure down to the lowest observed level (7 μg dL^{-1}) (Harlan *et al.*, 1985, Pirkle et al. 1985).

There is no consensus for what an "absolutely safe" level ought to be, given our present state of knowledge; though, as noted, the American Academy of Pediatrics has concluded that "the ideal whole blood Pb level is 0 μg dL^{-1}" (AAP, 1987). The consensus that does exist is that blood Pb levels at least as low

as 10 μg dL^{-1}, and possibly lower, pose a risk to children. Many of the toxic effects of Pb exhibit no clear threshold for dose-response, a finding confirmed by mechanistic studies in animal models. Specifically, the National Center for Health Statistics (NCHS, 1984) has concluded that blood Pb levels between 10 and 20 μg dL^{-1} are toxic to the brain and such effects are of significant public health concern. The EPA Scientific Advisory Committee on Pb (SAC) has stated its concern about Pb effects on hypertension at "levels below 10-15 μg dL^{-1}" and inhibition of heme synthesis "starting around 10-15 μg dL^{-1}" (Flaak, 1986). The Addendum to EPA's *Air Quality Criteria For Lead* concluded that perinatal blood Pb levels "at least as low as 10 to 15 μg dL^{-1} clearly warrant concern for deleterious effects on early postnatal as as prenatal development" (EPA, 1986a). The Royal Society of Canada concluded that "it would be wise to ensure that no child has a blood lead above [20 μg dL^{-1}]" (RSC, 1985).

The extent of low Pb exposure (blood Pb levels at 10-15 μg dL^{-1}), which results in significant reductions in IQ and learning disabilities is very great in the US. The NHANES II dataset for children under six (reflecting the distribution of blood Pb levels in 1978) showed that 55% to 88% of the children may be exposed to Pb at these levels and, hence, may be at risk for measurable cognitive deficits (NCHS, 1984). The ATSDR (1988a) report, which examined Pb screening data from 318 SMSAs for children 6 months to six years for the year 1984, found that 13.2% had blood Pb levels greater than 15 μg dL^{-1} (figures for those greater than 10 μg dL^{-1} were not provided). In high risk inner-city areas of large cities, 20% or more of the children have blood Pb levels greater than 15 μg dL^{-1} (Mielke *et al.*, 1989). Clearly, an epidemic of excessive Pb exposure exists in the US.

Too often, society fails to address a problem until it is monetized. During the last decade, several studies have attempted to calculate the social costs of Pb poisoning. With regard to children, the estimated total monetized social costs for medical care and compensatory education in the US ranged from $1 billion in 1978 (Provenzano, 1980) to $5.75 billion in 1986 (EPA, 1986b). In addition, nationally, another $10+ billion was estimated to be lost to the affected children through reduced future earnings (EPA, 1986b). On a state level, the Conservation Law Foundation of New England (CLF, 1987) estimated that Massachusetts spent $11 million in 1986 alone on direct costs for Pb poisoning. Maryland's Department of Health and Mental Hygiene (SHAG, 1984) estimated that it spends $3.5 million per year for medical and educational costs of childhood Pb poisoning. Finally, the projected cost estimates based on a survey of blood Pb levels in three Minnesota cities (Twin Cities and Duluth) ranged from $11.5 to $13.1 million per year for medical and educational costs and reduced future earnings (Reagan and Mielke, 1989).

The role of soil and dust

The literature shows that soil and dust exposure constitute a principal source of Pb for many children, particularly those under six years of age without contact with Pb paint in dilapidated housing or specific point sources. Lead is a naturally occurring element in the earth's crust and is also produced as an end-product of

radon released from geologic sources. However, without anthropogenic disturbance, surface soils do not contain more than trace amounts of Pb. Actual background Pb levels do vary. Levels approaching 100 μg g^{-1} or more are routinely found in soils near ore bodies (Nriagu, 1978). In other areas many so-called "background" levels have been contaminated, since many samples were collected near highways. Estimates of the average world wide Pb content of soils range from 17 μg g^{-1} (Nriagu, 1978) to 20 μg g^{-1} (Warren *et al.*, 1971). It should be noted that mean soil Pb levels less than 10 μg g^{-1} have been found in many areas of the world (Mielke *et al.*, 1985; RSC, 1986; Dickinson *et al.*, 1987 and Nriagu, 1978). It is critical to understand that soil is a sink for many anthropogenic Pb inputs into the environment, including deposits from 1) exhaust from vehicles fueled with alkyllead additives; 2) flaking or sandblasting of exterior lead-based paints; and, 3) emissions from point sources such as Pb smelters and municipal solid waste (MSW) incinerators. Both local and long-range inputs result in accumulations of Pb in surface soils. The correlations between emissions from both mobile and stationary sources and soil Pb concentrations have been well demonstrated. Children ingest soil and dust through hand-to-mouth activity, a normal developmental behavior. As a consequence of this behavior, children who ingest dust and soil contaminated with Pb will ingest a substantial amount of Pb. This is why hand-lead levels strongly correlate with blood Pb levels. Roels *et al.* (1980) found that hand Pb contributes 2-4 times more than does air Pb to blood Pb. Charney *et al.* (1980) found that hand Pb, housedust Pb, soil Pb and pica explained 4[illegible] differences in blood Pb levels in two groups of children consistent with the many hand Pb studies, *i.e.* the greater [illegible] the more frequent the rate of hand-to-mouth activity, the greater the blood Pb levels (Sayre *et al.*, 1974; Vostal *et al.*, 1974; Charney *et al.*, 1980; Sayre, 1981; Brunekreef *et al.*, 1981, 1983; Gallacher *et al.*, 1984; Bornschein, 1986; Davies *et al.*, 1987).

Inner-city neighborhoods in most if not all of our major urban cities have mean or median soil Pb concentrations in excess of 1,000 μg g^{-1} (*e.g.* Angle *et al.*, 1974; Johnson *et al.*, 1975; Bornschein, 1986; Mielke *et al.*, 1989 and Madhavan *et al.*, 1989). The EPA (1986a) has developed a baseline exposure model of the relative contribution of various sources of Pb for a two year old child living in a rural area and computed the baseline differences between the rural and urban child. The key EPA conclusions about the baseline assessment and the role of soil and dust are: 1) ingestion, rather than inhalation, of dust particles appears to be the greater problem in the baseline environmental exposure, especially ingestion during meals and playtime activity by small children; 2) 44% of baseline daily consumption of Pb by children is estimated to result from consumption of dust; 3) 90% of this dust Pb is of atmospheric origin; 4) dust Pb also accounts for more than 90% of the additional Pb exposure attributed to living in an urban area or near a smelter; and, 5) this route of exposure probably affects 90% of the American population.

The literature clearly shows that there is a geographic component to the

distribution of the concentrations of Pb in soil, dust, air, and, blood. Several studies have shown that soil-dust Pb and blood Pb decrease together as a function of distance away from a highway, or downtown, or by city size (Cohen *et al.*, 1973; Angle *et al.*, 1974; Johnson *et al.*, 1975; Brunekreef *et al.*, 1983; Roels *et al.*, 1980 and Mielke *et al.*, 1989). Other studies, examining blood Pb levels alone, have shown that blood Pb levels can vary as a function of distance away from the center of large cities or as a function of city size (Hasselblad *et al.*, 1975; Tsuchiya *et al.*, 1977; Okubo *et al.*, 1978; Richardson *et al.*, 1982; NCHS, 1984; Skerfving, 1986 and ATSDR, 1988a). Additional studies, examining soil Pb alone, have shown that soil Pb concentrations vary as a function of traffic levels, distance away from the center of large cities, or city size (Wheeler and Rolfe, 1975; Elias and Croxdale, 1980; Lau and Wong, 1982; Mielke *et al.*, 1983, 1984, 1985; Hamilton *et al.*, 1984 and Mielke, 1989). With regard to air Pb levels, EPA (1986a, at 6-29) concluded that, during the period of intensive use of alkyl Pb in gasoline, air Pb levels decreased 2-3 times from the center of a city to a city's edge, and that soil Pb concentrations are a direct function of air deposition. This is the case even in foundations soils near buildings; only rarely is leaded paint the principal contributor to Pb in soil, streetdust or housedust. In fact, the principle source of Pb in housedust or streetdust is Pb in soil (Linton *et al.*, 1980; Fergusson and Ryan 1984; Fergusson *et al.*, 1985, 1986; Sturges and Harrison,1985; Thorton *et al.*, 1985).

Substantial reductions in the allowable concentrations of Pb in gasoline have been mandated in the US, Canada, and many western European countries since 1980. However, soil Pb concentrations still reflect patterns of former use, because Pb does not readily leach into the ground, and because soil accumulates very slowly in urban areas, about one to two inches every 1,000 to 2,000 years (Chadzynski, 1986). Therefore, recent decreases in Pb additives and in urban air Pb concentrations will not quickly change the existing concentrations of Pb in urban dusts and soils.

It should also be noted that, whenever soil Pb concentrations are high, absorption of Pb by children will not be readily influenced by reductions in air exposure. In Pb industry communities, blood Pb levels in children near the emission source do not fall after the installation of pollution control equipment, whereas children living farther away do show a net reduction in blood Pb levels (Angle and McIntire, 1979; Roels *et al.*, 1980). Further, an analysis of the relationship between air Pb, soil Pb, and blood Pb shows that soil Pb and housedust Pb contribute much more to blood Pb than does air Pb. In areas of high soil Pb contamination a change in air Pb of 1 $\mu g\ m^3$ will result in an increase in blood Pb levels of 4-5 $\mu g\ dL^{-1}$ (Angle *et al.*, 1984). Of this total increase, about 2 $\mu g\ dL^{-1}$ is associated with the inhalation of air Pb and 3 $\mu g\ dL^{-1}$ is a consequense of ingesting the deposition from Pb in air (Angle *et al.*, 1984).

The lack of a uniform effect on blood Pb, due to changes in air Pb levels, is not limited to Pb industry communities. Annest (1983) reported that the decline in blood Pb levels, attributed to the reduction in the Pb content of gasoline, was

not evenly distributed throughout the population. While rural areas and sm cities experienced a reduction in blood Pb of 33.0 and 40.1 percent, respectivel large urban areas experienced only a 19.1% decline in blood Pb levels. Anne concluded that, due to the large contribution ingested Pb makes to children blood Pb levels, the large quantity of Pb-rich dust contaminating inner- ci communities, due to the use of leaded gasoline, explains the difference in mea blood Pb levels by degree of urbanization. These findings are supported by th Royal Society of Canada, who concluded that the elimination of Pb in gasolir will not solve the problem of urban "hotspots," which was defined as areas high soil Pb (RSC, 1985).

Epidemiological studies: In order to determine the level at which Pb in soil-du presents a risk to children, it is necessary to examine the observed relationshi between environmental Pb concentrations and body Pb burdens in your children. Table 1, which summarizes the dose-response relationships of mar studies, is divided into four groups: urban communities, Pb industr communities, mining communities and reviews. Obviously, every communit and, indeed, every study reflects a different range of soil Pb concentrations an blood Pb levels. It is common in the literature (when evaluating the effect of so Pb concentrations on blood Pb levels) to express the result as a dose-respons relationship reflecting a *change* in blood Pb levels to the *change* in soil P concentrations (assuming a linear relationship between the two) *scaled* to standard unit of soil Pb concentration (either 1,000 $\mu g\ g^{-1}$ or 100 $\mu g\ g^{-1}$).

Urban communities clearly show a dose-response relationship between bloo Pb levels and soil Pb concentrations between 0.5 and 1.0+ $\mu g\ dL^{-1}$ per 100 μ g^{-1}. All of these studies have examined populations encompassing a norma range of hand-to-mouth activity, not sub-populations with habitual pica for soil A closer examination of these studies reveals a consistent dose- respons relationship as soil Pb concentrations increase from 100 $\mu g\ g^{-1}$ to 600 $\mu g\ g^{-1}$. O the many studies which included soil as a parameter, four studies involved mea soil Pb levels less than 500 $\mu g\ g^{-1}$ and all four showed a strong positiv correlation between relatively low soil Pb concentrations and blood Pb level (Brunekreef *et al.*, 1981, 1983; Angle *et al.*, 1975; Angle and McIntire, 1982) Detailed modeling of these low soil Pb studies by the authors, independently resulted in the calculation of nearly identical slopes expressing the soil Pb t blood Pb relationship. Brunekreef *et al.* (1981) showed an increase in blood P levels of 6.3 $\mu g\ dL^{-1}$ as soil Pb concentrations rose from 100 to 600 $\mu g\ g^{-1}$ Angle and McIntire (1982) showed an increase in blood Pb of 5.2 $\mu g\ dL^{-1}$ as soi Pb rose from 100 to 500 $\mu g\ g^{-1}$. These studies demonstrate that, at relatively lo soil Pb concentrations, exposure to Pb in soil is associated with biologically significant increases in blood Pb levels. Indeed, Bornschein's (1986) work in Cincinnati demonstrates that low level soil-dust Pb exposure results in dramatic increases in blood Pb levels, with further increases occurring more gradually as soil Pb concentrations rise.

There appears to be a difference in the dose-response relationship between urban and industrial communities and Pb mining

Table 1 *Dose-response relationships between soil Pb concentrations and blood Pb levels (μg dL^{-1}) per 1,000 or 100 μg g^{-1}).*

Study	Dose-response relationships[a] Change in blood Pb per 1,000μg g^{-1}	Change in blood Pb per 100 μg g^{-1}
Urban communities		
Angle and McIntire (1982)	15.5 *	1.6
Brunekreef *et al.* (1983)	11.3 *	1.1
Stark *et al.* (1982)	10.2 *	1.0
Davies *et al.* (1987)	10.0	1.0
Haan (personal Communication)	10.0	1.0
Madhaven *et al.* (1989)	9.0	0.9
Reeves *et al.* (1982)	8.1 *	0.8
Rabinowitz *et al.* (1985)	8.0	0.8
Bornschein (1986)	6.2	0.6
Shellshear *et al.* (1975)	3.9 *	0.4
Lead industry communities		
Brunekreef *et al.* (1981)	12.6 *	1.3
Landrigan *et al.* (1975)	11.7 *	1.2
Neri *et al.* (1978)	11.2 *	1.1
Yankel *et al.* (1977)	7.3 *	0.7
Roberts *et al.* (1974)	5.3 *	0.5
Galke *et al.* (1975)	4.9 *	0.5
Mining communities		
Gallacher *et al.* (1984)	4.1	0.4
Barltrop *et al.* (1974)	0.6 *	0.1
Review articles		
Brunekreef (1986)	5-10	0.5-1.0
AAP (1987)	5-10[2]	1.0-2.0[b]
Duggan (1980, 1983)	5	0.5
EPA (1986a)	2	0.2

[a] Because a detailed review of the studies contained in this table is beyond the scope of this paper, it should be noted that this table reflects unadjusted values (calculated by Brunekreef (1986) and noted by an "*") and values in other studies calculated by the authors of the study.
[b] Covering the range of 500-1,000 μg g^{-1} only.

communities having a shallower slope (though this is not readily apparent from Table 1). Communities are defined as Pb mining where the principle source of soil Pb contamination is due to mines or tailings piles as opposed to emissions from mobile or point sources (alkyl Pb). It is thought that the difference in the dose-response relationships between urban and mining communities may be due to a difference in bioavailability of Pb. Leaded gasoline, which is the predominate source of Pb in urban communities and industrial point sources emit extremely small particles, whereas mines and tailings piles release relatively large particles, primarily as fugitive dust (EPA, 1986a, at 6-18). The difference in the absorption of Pb, as reflected in the differences in the dose-response relationships between urban Pb and mine Pb studies, may be due to this difference in particle size (Chaney *et al.*, 1989). The smaller particles may be absorbed by inhalation as well as by ingestion, increasing total exposure. This is important, because smaller dust particles are easily transferred to one's hands and tend to remain on the hands longer, thereby increasing the potential for ingestion. Another difference may be due to the metal species (Chaney *et al.*, 1989). Another factor that may contribute to the difference in dose-response slopes, between communities, may be the degree of ground cover in the community, since extensive ground cover limits access to the soil by children. In addition, better parental supervision, less pica behavior, and better nutrition may be found in some communities, as opposed to inner-city urban areas, (simply because one parent is working) may also affect the slopes. Whatever the reason or reasons for the apparent differences between the various communities, it is clear that soil-dust Pb levels as low as 100 μg g^{-1} in urban communities pose a significant risk to urban children and may raise blood Pb levels by 0.5 to 1.0+ μg dL^{-1} for each 100 μg g^{-1} increase in soil-dust Pb concentrations.

Many reviews on the dose-response relationships between blood Pb and soil Pb have been reported in the literature (Brunekreef, 1986; Duggan, 1980, 1983; AAP, 1987 and EPA, 1986a). Brunekreef (1986) evaluated numerous studies using unadjusted data, since most studies "do not permit straightforward calculation of [a dose-response relationship] which are properly adjusted for relevant confounders." He concluded that the dose-response relationship was in "the 5.0-10.0 [μg dL^{-1} per 1,000 μg g^{-1}] range" [0.5-1.0 μg dL^{-1} per 100 μg g^{-1}] for Pb in soil, housedust, streetdust, and playground dust. Duggan (1980, 1983), also after reviewing numerous studies, concluded that the dose- response relationship of blood Pb levels to soil Pb concentrations is 5 μg dL^{-1} per 1000 μg g^{-1} [0.5 μg dL^{-1} per 100 μg g^{-1}]. This is very close to his theoretical calculation of 7 μg dL^{-1} per 1,000 μg g^{-1} [0.7 μg dL^{-1} per 100 μg g^{-1}]. (Duggan, 1980). Brunekreef's (1986) review criticized Duggan's analysis because he relied heavily on studies in which one or more pathways were excluded and because he used adjusted instead of unadjusted values in some studies. A notation by the American Academy of Pediatrics concluded that "each increase of 100 μg g^{-1} in the Pb content of surface soil above a level of 500 μg g^{-1} is associated with a mean increase in children's whole blood Pb levels of 1 to 2 μg dL^{-1}" (AAP, 1987). The AAP statement (adopted from an old EPA document [illegible]

13-4)) reflects a dramatic change in blood Pb (5-10 μg dL^{-1}) over a 500 μg g^{-1} range of soil Pb values, but no explanation was provided as to why the slope started at a soil Pb value of 500 μg g^{-1}. EPA (1986a, at 11-191) concluded that the relationship between soil Pb concentrations and blood Pb levels was about 2 μg dL^{-1} per 1,000 μg g^{-1}. This conclusion was based upon a selection of one study out of a handful, rather than a comprehensive review of the soil Pb literature. Further, the report singled out two studies (Stark *et al.*, 1982 and Angle & McIntire 1982), which EPA felt provided good data for the slope estimates (2.2 μg dL^{-1} and 6.8 μg dL^{-1}), but then selected the lowest one as a "median estimate" without explaining why this selection technique is appropriate (EPA, 1986a, at 11-151). Brunekreef (1986) also criticized EPA's conclusion because they mixed adjusted and unadjusted values, and because the use of an adjusted value in the "Stark" study was inappropriate.

In sum, it is clear that soil-dust plays a major role in the child Pb problem because: 1) *normal* hand-to-mouth activity increases blood Pb levels when playing in soil or dust contaminated with Pb; 2) the residual soil Pb contamination in residential areas still poses a risk to children, even after air Pb deposition is decreased through regulation of Pb, sources; 3) many inner-city areas of major urban centers are heavily contaminated with Pb; 4) blood Pb levels rise by as much as 0.5- 1.0+ μg dL^{-1} per 100 μg g^{-1}; and, 5) an apparent difference in the degree of effect of soil Pb concentrations on blood Pb levels appears to exist between the industrial communities and inner- city urban communities.

Establishing a Soil-Dust Lead Standard

There are several areas that need to be addressed in order to provide a compelling argument for the establishment of a soil- dust Pb standard having the force and effect of law. These areas include 1) a general policy towards Pb prevention indicative of underlying societal values towards children; 2) the burden of scientific proof, particularly that required under law, necessary for promulgating a health standard; 3) the adequacy of traditional methods for determining a safe level of soil Pb exposure; 4) the basic argument for choosing a specific soil Pb concentration as the standard; 5) the scope of the standard; and 6) a review of the "compelling case" in relation to other soil Pb standards and recommendations by governments and Pb researchers.

Preventing Pb exposure

Traditionally, the response of public health professionals has been to identify and treat children with Pb poisoning, rather that preventing their exposure (Lin-Fu, 1978). If, however, we truly value children, public health policy must be oriented towards prevention, rather than after-the-fact treatment and remediation. The rationale for preventive intervention programs aimed at child populations is based upon two interrelated concepts: 1) that the incidence of dysfunction, handicaps and disorders of whatever nature may be prevented or reduced; and, 2) that significantly improved health may be promoted by positive actions

(Andrews, 1985). Preventing exposure to Pb involves discovering an controlling the sources of Pb before Pb gets into children (CDC, 1978). T prevent Pb exposure, public health agencies must implement policies that reduc *environmental* Pb levels to their lowest possible levels (rather than identifyin and treating Pb poisoned children). Most of the Pb in the human environment anthropogenic in origin (Nriagu, 1989). It is, therefore, preventable.

Any Pb that is transferred from subsurface geologic stores to the huma environment now or in the future will remain there for hundreds, if nc thousands of years (RCEP, 1983; Chadzynski, 1986). We know that the Pb in so and dust can be a major factor in children's Pb exposure for a long time. Th reduction in environmental Pb contamination should be regarded as an urgen problem in public health (RCEP, 1983; RSC, 1985, 1986; CDC, 1985; ATSDR 1988a; Day *et al.*, 1979). Indeed, the sheer magnitude of the child Pb problem i matched by few other public health problems. In order to appreciate this, on need only look at the prevalence of exposure in the US and the difficult (historically) in determining a safe level for Pb in blood. It must always be kep in mind that the major tragedy of subclinical Pb poisoning is that the effects o the mind are permanent. While treatment can reduce morbidity and mortality, i cannot replace dead neurons (Piomelli *et al.*, 1984). It is self-evident, then, tha the major effort of public health professionals must be directed toward prevention.

Both the US Centers for Disease control and the U.K. Royal Commission or Environmental Pollution have concluded that "the safety margin between the blood Pb [levels] in the general population and those [blood Pb levels] at which adverse effects have been proven is too small, particularly in view of the grea variation in the response of individuals to Pb" (RCEP, 1983; CDC, 1985) Indeed, a safety margin for Pb may not exist, given the inability to establish a definable threshold for the toxic effects of Pb and the prevalence of exposure to levels within the clearly toxic range. As Needleman (1978) has pointed out; "The worth of the human brain is incalculable. The value we assign to it will be defined by the intensity with which we pursue or avoid the protection of its optimum development. In fact, in a larger perspective, as noted by Patterson (NAS, 1980), everyone is Pb poisoned, when compared to preindustrial human populations.

The key to prevention is to focus on those children who are "at risk." Children are "at risk" when "their immediate worlds - their microsystems [home, daycare, classroom] and mesosystem [the interrelationships among micro-systems] - are impoverished" (Andrews, 1985). Prevention means intervening in these "worlds" because (and without being glib) "early happenings have later effects." These worlds are identified through the use of epidemiology. The epidemiological perspective allows us to address the question "What type of patient has this illness?" which is different than the physicians question of "What kind of illness has this patient?" It is through epidemiology, then, that "at risk" children are identified for preventive efforts, *i.e.* the focus becomes one of treating broad population groups, specific age groups, particular environments

and specific health problems; as opposed to individual patients (Andrews, 1985). If macrosystem risks, such as childhood Pb poisoning, are to be addressed, then the eradication of the sources of risk at the macrosystem level should, indeed, lead to a better world.

The well established tradition of geographic epidemiology and the study of the spatial distribution of disease certainly applies to the child Pb problem. Epidemiology has clearly revealed that there is a strong geographic component to the child Pb problem. Children living in inner-city areas generally live in a more Pb contaminated environment and have higher blood Pb levels than children living in the suburbs, small towns or rural areas. In applying geographic epidemiology data to public policy decisions, it should be remembered, as the Royal Society of Canada so eloquently stated, that "it should be a fundamental principle that no child should suffer a significant penalty in body Pb burden because of where he or she lives" (RSC, 1986). This principle is the logical application (to the child Pb problem) of the concept of a "sustainable society," *i.e.*, that society "must satisfy its needs without diminishing the prospects of future generations" (Brown *et al.*, 1988). As an aside, it is interesting to note, given the effects of Pb on intelligence, learning ability and behavior, AND the spatial distribution of psychosocial problems, that both are greater among urban children than in smaller towns and rural communities (Rutter, 1981).

It is already clear that there has been a progressive evolution of the traditional medical model towards prevention. The efforts to limit pollution levels by law, and the restriction on the use of Pb in gasoline and plumbing are significant population based preventive efforts. However, with regard to housing with leaded paint or to the contamination of inner-city soils and interior dusts, preventive efforts have been little or nonexistent. Part of this lack of attention may be due to an expanded sociological perspective on the interrelationship between Pb exposure and diet, parental supervision and other "socioeconomic factors." Some may argue that the focus should be on addressing the issues of nutrition, health care, daycare, and that Pb exposure is a minor problem. If however, one takes seriously the idea of "an epidemiology of health," the issue cannot become one of isolating factors.

The goal of Pb prevention is not a zero-sum game in which less Pb exposure means reduced health care or nutrition and vice versa. A more suitable approach must build upon traditional epidemiology AND take into account "the complexity, open-endedness, multiple interactions, value choices, social rules and types of personalities," and not discard the basic goal of improving the health of the community as a whole (Brown, 1985). With regard to the establishment of environmental Pb standards, it means to recognize the differences between groups and focus attention on the most susceptible subpopulations, *i.e.* the impoverished inner- city children with inadaquate nutrition and poor parental supervision. If a standard is set to protect them, all of us are protected!

What, specifically, can be done to reduce exposure? First, ongoing sources of Pb in food and drinking water must be controlled. Second, substantial reductions

in the rate of Pb discharge into air must be accomplished (Nriagu, 1980). This may require a rethinking of current waste disposal policy. The US Public Health Service now estimates that Pb emissions from municipal solid waste (MSW) incinerators exceed that from either Pb smelters or from the use of leaded gasoline (ATSDR, 1988b). As part of this, the residual allowable Pb in gasoline should be prohibited.

But the largest source of proximate Pb exposure will not be addressed by these measures. To reduce the child Pb problem nationally will require addressing Pb in soil and dust. ATSDR (1988a) estimates that nearly 12 million children are at risk from this source alone. To prevent the continued contamination of soil and dust, ongoing inputs of Pb into air must be greatly reduced. Between 20-50% of Pb in soil is atmospheric in origin, and 96% of current Pb inputs into air are anthropogenic in origin (Nriagu, 1989).

The CDC (1985) has recommended that "for those areas where concentrations of Pb in soil and dust are high, large-scale excavation of soil or relocations of populations is the ideal means of reducing exposure of children to Pb." Government agencies can help to alleviate the urban soil heavy metal problem primarily by establishing consistent and health-based standards to guide local public health effects to identify and replace contaminated soil.

Finally, in applying the concept of prevention to the child Pb problem, it must be remembered that children receive their daily exposures to Pb from multiple sources. However, today as always, public health protection of toxic substances has been a fragmented proposition. Various government agencies regulate exposures on a media-specific or source-specific basis. In applying the principle of prevention to the standard setting process, all sources of exposure must be considered in establishing a standard from any one source. If we define that total allowable individual exposure as 1 or unity, then it is fundamental to public health prevention that that total exposure from all sources not exceed one as described in the following equation. The logical corollary to this is that the sum of all public health standards also must not exceed unity.

$$\frac{\text{Air Exposure}}{\text{Standard}} + \frac{\text{Water Exposure}}{\text{Standard}} + \frac{\text{Food Exposure}}{\text{Standard}} + \frac{\text{Soil Exposure}}{\text{Standard}} + \frac{\text{Other Exposure}}{\text{Standard}} <= 1$$

This cumulative impact approach has been used by EPA in the air quality standard for Pb and approved by the courts (*Ethyl Corp.* versus *EPA* (1976) 8 ERC, 1785, at 1806). Consideration of multiple source impacts should be used in establishing a standard for Pb in soil-dust as well.

The burden of proof for standard setting

Standard setting is both a legal and scientific process. As such, it raises two central questions: 1) Who has the "burden" of proof?; and, 2) What kind of "proof" is necessary in order to promulgate a standard? The NAS (1975) report *Decision Making for Regulating Chemicals in the Environment* offers guidance as to who has the burden of proof justifying the use of a chemical:

"Once the government has made a reasonable case that the challenged use of an existing chemical creates an excessive hazard to human health or the

environment, the burden of producing evidence should shift to the proponent of use, who must make an appropriate showing that the continued use is desirable" (NAS, 1975).

Clearly, the government has made a "reasonable case" in numerous reports that exposure to Pb in soil and dust poses an "excessive hazard to human health." Given that the government would establish the actual public health standard for Pb in soil and dust, the *burden* should be on the government to prove that a given level is safe. This approach was required to be used by the Consumer Product Safety Commission in establishing a level for Pb in paint (CPSC, 1977). The burden should not be on the public to prove whether a proposed level is unsafe.

How much "proof" is necessary to promulgate a standard for Pb in soil and dust? In a recent editorial, Ashford (1987) argued that while "better science is always to be preferred, ...we cannot wait too long to act, too long to see the patterns of mounting evidence..., too long to see the collective picture... Let us have a government [responsive] to the new realities." Similarly, the National Academy of Sciences concluded:

"Efforts to control exposure should proceed with the full acknowledgement of the necessary imprecision of estimates of the costs, risks, and benefits. Control strategies should be based upon coordinated, integrated measures to reduce exposures from all significant sources. A serious effort should be made to reduce *background* level of exposure of the general population to Pb... There is a clear and pressing need for more comprehensive, flexible, and imaginative assessment of the strategies for prevention of exposure to Pb... Significant adverse effects on health of children will continue to occur if indecision about what to do inhibits actions to limit exposure to Pb" (NAS, 1980).

The law has determined the burden of *proof* to be applied to the science in making a decision about toxic substances. A review of the case law shows that the courts, in determining the legality of public health standards, do not place an unreasonable burden regarding scientific evidence upon agency decision makers. The courts have considered the issue of scientific uncertainty when establishing public health standards. Further, they have specifically addressed the issue of the adequacy of information in regulating toxic agents. The courts recognize that some of the questions involved in setting a health standard are "on the frontiers of scientific knowledge [and that agency decision making must rely] to a great extent on policy judgements and less on pure factual analysis."[1] They know that even "though the actual finger points, it does not conclude [the agency decision makers must] act even in circumstances where existing methodology or research is deficient."[2] They understand that "factual proof about particular health risks may not be substantial in the traditional sense because the medical and scientific communities do not yet completely understand the nature of threatening

[1] *Industrial Union Department, AFL-CIO* versus *Hodgson* ((1974) 1 OSHC 1631, at 1637).

[2] *The Society of Plastics Industry, Inc.* versus *OSHA* ((1975) 509 F. 2d 1301, at 1308, 2 OSHC 1496, at 1501).

diseases. [To protect people, an agency] must rely upon predictions of possibl future events and extrapolations from limited data."[3] Consequently, an agenc does not have to "base his decision solely upon uncontroverted, proven evidence [but may rely upon] inconclusive evidence."[4] In other words, governmen agencies must make decisions on the basis of the "best available evidence" an the agency must have "some leeway where its findings are on the frontier o scientific knowledge....so long as they are supported by a body of reputable scientific thought, the agency is free to use conservative assumptions in interpreting the data....risking error on the side of overprotection rather than underprotection".[5]

Traditional standard setting approaches

The essential objective of environmental health standards is to reduce risks by minimizing the exposure of the public to hazardous substances. Traditionally, in setting public health standards agencies have relied upon various approaches including: 1) the use of the adverse effect threshold; 2) the threshold level plus a margin of safety; 3) the calculation of an Allowable Daily Intake (ADI); or, 4) the use of a biokinetic model. While we do not reject any of these methods by definition, it is important to recognize the shortcomings of each in establishing a standard for Pb in soil.

Simms (1985) has argued that a standard for Pb in soil can be determined by utilizing a "threshold value" (measured as Pb in blood) "above which action is necessary." He recommended the use of 25 $\mu g\ dL^{-1}$ as a blood Pb level requiring environmental investigation. Since Pb exposure is the result of many factors that combine to determine the level of actual exposure, certain populations or subpopulations may be more intensely exposed, more susceptible due to many factors, or express greater exacerbating behaviors, or just be more variably exposed than anticipated. These uncertainties are generally allowed for in standard setting in order to prevent the incidence of high exposures within subpopulations. Thus, the threshold level of exposure associated with an observed adverse health effect should not serve as the sole determinant of a public health standard. The uncertainties associated with both the range of responses in a population to a given pollutant and the ranges of actual absorbed doses are assessed and must be allowed for in setting a health based standard. Further, with regard to Pb in particular, there may be, in fact, no threshold, *i.e.* no safe level.

A second approach often used by agencies is to develop a standard based upon the threshold response plus a margin of safety. Many regulatory agencies rely on the use of safety factors to take uncertainties (in data extrapolation

[3] *AFL-CIO* versus *Marshall* ((1979) 7 OSHC 1775, at 1782).

[4] *Ethyl Corporation* versus *EPA* ((1976) 8 ERC 1785, at 1812).

[5] *Industrial Union Department, AFL-CIO* versus *American Petroleum Institute* (1980) 448 U.S. 607, 100 S.Ct. 2844, 65 L.Ed.2d 1010).

processes, in susceptibility of individuals to degrees of exposure, due to synergistic and potentiated effects with other pollutants, and in variations in individual circumstances) into account. Both the Clean Air Act (Section 112) and the Clean Water Act (Section 307(a)(4)) explicitly require the use of safety factors when establishing standards. A safety factor of 2 to 5 may be considered as sufficient if the effect, from which individuals or a population are to be protected, is not regarded as very severe; if only a small number of workers are likely to be exposed; or if the toxicological information is derived from human data. On the other hand, a safety factor as large as 1,000 or more may be required if the effect is very serious, if the general population is to be protected, or if the toxicological information is derived from limited experiments on laboratory animals. In some cases, the safety factor may be a value that has been used with success and is, therefore, perpetuated (WHO, 1978).

The courts have examined the issue of "the margin of safety" in various cases before them. For example, in *Lead Industry Associates* versus *EPA* ((1980) 647 F.2d 1130, D.C. Cir.) the appellate court upheld the primary air quality standard for Pb which had incorporated an "adequate margin of safety." However, in doing so the court noted that "margins of safety" have generally been "modest or nonexistent [because] new information [often] reveals adverse health effects at pollution levels once thought to be harmless." The court suggested that the margin of safety requirement could be fulfilled by making conservative decisions at various points in the process, rather than by determining a safe level and adding a percentage to that as "the margin of safety."

With regard to the exposure of young children to Pb in soils, special considerations arise which make it difficult to apply the concept of a safety factor in developing a standard. As noted in the ATSDR (1988a) report, exposures to Pb in the US population are currently much higher than any "margin of safety" would permit. Second, Pb exposure comes from many sources, some of which will be extremely difficult to control in the aftermath of millennia of Pb usage. Third, there is no scientifically demonstrable threshold for most of the serious toxic effects of Pb. Thus, the most appropriate approach is a health based goal designed to prevent any *increments* in Pb exposure of children, and, more broadly, to keep 99.5% of the US population of children under six years of age below 10 $\mu g\ dL^{-1}$; the same percentage advocated in EPA's air Pb standard, only at a safer level (EPA, 1977a).

A third approach is to determine an ADI level, which implies an acceptable level of Pb exposure. King (1971) calculated an acceptable daily intake (ADI) for Pb from all sources in order to keep blood Pb levels below 40 $\mu g\ dL^{-1}$. He concluded that the ADI should not exceed 300 μg Pb day^{-1} for children 1-3 years old. Mahaffey (1977) recalculated King's ADI by adjusting the data to fit children's normative body weight. She concluded that a child from birth to six months should not exceed 100 μg Pb day^{-1} and that a child six months to two years should not exceed 150 μg Pb day^{-1}. Like King, she calculated an ADI necessary to avoid a blood lead level of 40 $\mu g\ dL^{-1}$. It should be noted that both King's and Mahaffey's ADI calculations are higher than the National Academy

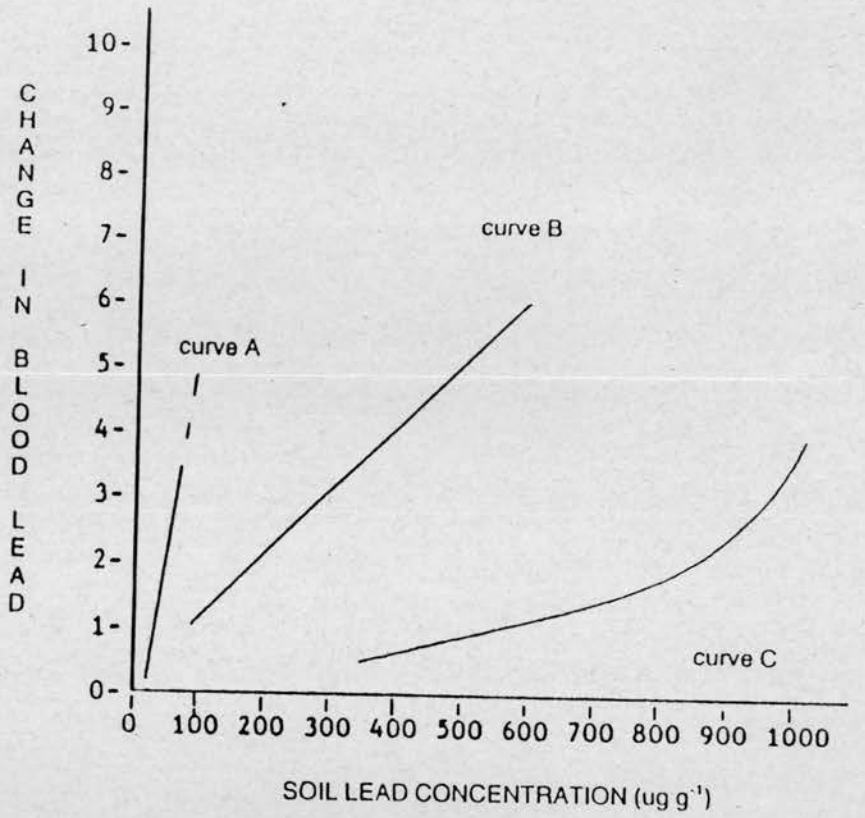


Figure 1 *A comparison of the dose-response curves for Pb in soil utilising clinical (curve A), epidemiological (curve B) or experimental data (curve C).*

of Sciences ADI estimate of that time (50-60 μg Pb day^{-1}) (NAS, 1977, at 310).

Recently, EPA (1986a), ATSDR (1988a) and others have concluded that the blood lead level "of concern" is 10 $\mu g\ dL^{-1}$. If Mahaffey's conclusion is recalculated to keep exposures below 10 $\mu g\ dL^{-1}$ [assuming a linear relationship between Pb intake (μg Pb day^{-1}) and blood Pb ($\mu g\ dL^{-1}$)], then the ADI for a six-month and two-year old child would be 25 μg Pb day^{-1} and 37 μg Pb day^{-1}, respectively. These ADI levels are very similar to those of Marcus (1986), who calculated an ADI of 2.5 $\mu g\ kg^{-1}\ day^{-1}$ or 25 μg Pb day^{-1} for a child weighing 10 kg. 10 kg is the fiftieth percentile for a 12 month old child (Mahaffey 1977). Under Marcus's formula, an ADI for a six month old child (using Mahaffey's normative body weight assumptions) would be 18 μg Pb day^{-1} and an ADI for a two year old child would be 31 μg Pb day^{-1}.

EPA (1986a, at I-49) has calculated an unavoidable baseline exposure for a

two year old child living in a rural area. Total baseline exposure for a rural two year old child is 46.6 μg Pb day^{-1}. Therefore, baseline exposure for a two year old child already exceeds the recalculated Mahaffey ADI estimate by 9 μg Pb day^{-1} and Marcus's ADI by 16 μg Pb day^{-1}. Consequently, in light of the multiple source exposure problem with Pb for children, the calculation of an ADI has little practicle meaning. This exercise merely supports the ideas that 1) the margin of safety in the population is too small; and, 2) no source of exposure should be permitted to increase blood Pb levels.

A fourth method often used in advocating public health standards is the application of a biokinetic model to an available database. There are three different types of information (clinical, experimental, and epidemiological) that could provide a basis for establishing a standard for Pb in soil through the use of a biokinetic model. The clinical data consists of information on the effects of absorption and retention of food Pb and water Pb in humans (reviewed in EPA, 1986a). These data shows that Pb in drinking water under fasting conditions is readily absorbed at low doses varying as a function of the cube root of the water Pb concentration. A dose response curve (curve A of Figure 1) describing this result shows a rapid rise in blood Pb levels at low Pb doses. However, it is not known if Pb in soil behaves the same as Pb in water for purposes of toxicokinetic estimation.

Experimental data on the bioavailability of Pb in soil show a biphasic rate of Pb absorption at low Pb doses which begin to rise dramatically when Pb concentrations in the ingested soil are high (Chaney *et al.*, 1989). A dose response curve reflecting this concept (curve C of Figure 1) shows little change in blood Pb concentrations at low Pb doses. The problem with directly applying these studies to a biokinetic model is that humans, particularly during pregnancy and during the developmental years, are likely to have different absorption characteristics for Pb because of age-dependent mineral metabolism. Pb is more metabolically active in young children and the blood-tissue barriers are weaker, particularly in the brain. Since the absorption of Pb is regulated by factors that modulate calcium absorption, it is not clear that young humans behave the same way as adult animals do.

There are epidemiological data on the effects of exposure to Pb in soils and dusts in young children (reviewed earlier). This data demonstrates a linear relationship between soil Pb concentrations and blood Pb levels at low Pb exposures and a declining non-linear relationship at higher soil Pb concentrations (curve B of Figure 1).

The traditional procedure for selecting a standard for Pb in soil would be to apply the clinical and epidemiological information to a biokinetic model. This method has been used to set standards for Pb in air and drinking water by the EPA. However, there are four major problems with applying this method to the development of a standard for Pb in soil. First, there is no direct clinical information (direct human experiments of young children ingesting Pb at different Pb and soil doses) about Pb in soil which can be plugged into a biokinetic model, which means (taking a prudent approach) that we would have

to assume that Pb in soil behaves the same way as Pb in drinking water under fasting conditions. Second, much of the epidemiological data has been collected on children encompassing an age group (ages 6 months to 6 years) as opposed to specific ages. This critical age group contains an order of magnitude difference in body weight (from 2 to 20 kg). Hence, the presently available epidemiological data does not fit any known model. Third, unlike the situation for air and water exposures, where little variation can be assumed to exist in the amount of air breathed or the amount of fluids consumed among individuals in the population of concern, the intake of soils and dusts by children probably varies by an order of magnitude or more. This intake, while age-dependent, cannot be readily estimated (as will be seen later), since the data are often collected from groups of children encompassing the whole age group. Further, the ingestion of soil-dust is a continuum ranging from almost no exposure in some small group such as hospitalized children to "normal" hand-to-mouth activity, to those children having pica for dirt. As a result, traditional biokinetic models are inadequate for establishing a standard for Pb in soil. As discussed below, none of the soil standards proposed by others is based upon biokinetic models. All of these proposed soil Pb standards utilize an average slope calculated from epidemiological studies on the relationship between soil Pb concentrations and blood Pb levels.

In sum, none of the four traditional methods for establishing public health standards seem to be applicable to the establishment of a standard for Pb in soil.

Utilizing a health based approach for Pb in soil

While there are always possibilities for selection criteria to determine public health standards (Morgan and Simms, 1988), the principal criteria should be that no source should increase blood Pb levels. There are three basic factors affecting the establishment of the numerical value for a soil-dust Pb standard: 1) the nature and magnitude of the contribution of Pb in soil-dust to the overall child Pb problem; 2) the consequences of long-term Pb exposure; and, 3) the necessity of special protection for those children who have habitual pica for soil. Any of these factors alone are sufficient for establishing a standard for Pb in soil-dust. Together, they provide a comprehensive basis for the immediate establishment of such a standard.

Population safety and current exposures: There seems to be a basic consensus within the scientific community that there is no margin of safety for Pb in the population as a whole (NAS, 1980; RCEP, 1983; CDC, 1985 and ATSDR, 1988a). The average Pb exposure in the US continues to be greater than acceptable. Given this, it is important to focus on the most important sources contributing to the problem, *i.e.* those sources that allow blood Pb levels to respond quickly as a result of enforcement actions (Simms, 1986). The number of children estimated to be exposed to the primary contributors to Pb in dust and soil is estimated to be between 5.9 to 11.7 million (ATSDR, 1988a). Consequently, the contribution of Pb in soil-dust to the child Pb problem is great and remediation of Pb contaminated soil can have a significant effect on

The amount of Pb in the human body in modern, industrialized countries is very high on either a historical scale or in comparison to modern, remote populations. This is due to centuries of Pb use which resulted in widespread contamination of all environmental media hundreds of times above levels found in prehistoric times (*i.e.* more than 20,000 years ago). Both environmental and body Pb levels are substantially higher than under the conditions in which people evolved. Air Pb levels are at or below 0.001 $\mu g\ m^3$ in remote areas of the world, in sharp contrast to ambient concentrations of 0.2 to 0.5 $\mu g\ m^3$ often found in inner-city communities (EPA, 1986a). Water Pb concentrations rarely exceed 0.002 $\mu g\ L^{-1}$ in surface or groundwater sources, but due to the use of Pb in plumbing, drinking water Pb levels in some US cities often exceed the current EPA drinking water Pb standard of 50 $\mu g\ L^{-1}$ (Settle and Patterson, 1980). Lead in soil due to crustal weathering is often below 20 $\mu g\ g^{-1}$, but routinely exceeds 1,000 $\mu g\ g^{-1}$ in urban areas and 10,000 $\mu g\ g^{-1}$ in areas impacted by industrial sources (ATSDR, 1988a). The average bone-Pb levels in the US population are 500-1,000 times greater than our ancient ancestors (Pirkle *et al.*, 1985). Finally, blood Pb values in young children in inner- city areas [23.1 $\mu g\ dL^{-1}$ for blacks and 17.4 $\mu g\ dL^{-1}$ for whites (NCHS, 1984)] are substantially greater than modern remote populations, where mean blood Pb levels are usually less than 5 $\mu g\ dL^{-1}$ (in one population less than 1 $\mu g\ dL^{-1}$) (Hecker *et al.*, 1974; Piommelli *et al.*, 1980; Poole *et al.*, 1980; Elwood *et al.*, 1985; Grobler *et al.*, 1985; Wantanabe *et al.*, 1985 and Skerfving *et al.*, 1986).

Chronic health effects: The sequelae of chronic exposure to environmental Pb requires careful evaluation. In addition to its neurotoxic properties, Pb is a factor in hypertensive heart disease, a reproductive toxin, and is likely to be a human carcinogen. It is not yet possible to establish a threshold level for these types of effects. Consequently, in order to minimize the potential risk posed by these effects, blood Pb levels should be kept low. To the extent that soil Pb exposure contributes to blood Pb, childhood soil Pb exposures should be kept low in order to minimize long term risks due to total Pb exposure. Hence, a standard for Pb in soil-dust should not permit an increase in blood Pb levels as a result of exposure to soil-dust.

The most recent review of the toxic effects of Pb was conducted by the Environmental Protection Agency. EPA (1986a, at A48) concluded that "the evidence.... supports the conclusion that fetal exposure to Pb at relatively low and prevalent concentrations can have undesirable effects on infant mental development, length of gestation, and possibly other aspects of fetal development... At present... perinatal blood Pb levels at least as low as 10-15 $\mu g\ dL^{-1}$ clearly warrant concern for deleterious effects on postnatal as well as prenatal development." Since the fetus becomes a "sink" for the mother's Pb burden, including Pb mobilized from bone (Silbergeld *et al.*, 1988), it is essential that her Pb burden be made as low as possible. This requires that the mother's environmental exposure be as low as possible from birth onward in order to minimize the transmission of Pb to the developing fetus during pregnancy.

Following IARC, EPA has recently classified Pb as a Group B2 carcinogen

(probable human carcinogen) (IARC, 1980, 1987; EPA, 1989b). In animals, Pb compounds predictably produce tumors; in humans, the available epidemiological data are sparse and often confounded by co-exposures to other carcinogenic metals. Little information is available on mechanisms of Pb carcinogenicity, although there are studies showing chromosomal abnormalities following Pb exposure in humans and animals (EPA, 1989b). Thus, at this time it may not be possible to quantify the risk of Pb exposure as a cause of cancer in humans. Nevertheless, the qualitative hazard identification supports concern for chronic, low-level exposures.

Another much better documented chronic effect of Pb exposure is an increased risk of hypertensive heart disease. Several early epidemiological studies have found close associations between Pb exposure and increased cardiovascular disease mortality (Hunt *et al.*, 1971; Challop, 1971; Crawford *et al.*, 1973; Voors and Johnson, 1973 and Sauer, 1974). Newer studies have found an increased risk of hypertension at low levels (Moreau *et al.*, 1982; Batuman *et al.*, 1983; Kromhout *et al.*, 1984; Pocock *et al.*, 1984; Harlan *et al.*, 1985 and Pirkle *et al.*, 1985). Pirkle *et al.* (1985) found no threshold for Pb's effect on hypertension across a range of blood Pb levels from 7 to 34 $\mu g\ dL^{-1}$. EPA (1985) found that the dose-response relationship characterized by the Pirkle study as indicative of large initial increments in blood pressure, followed by a leveling off of blood pressure increments at higher blood Pb levels.

Pica behavior: It has been argued by some that exposure to Pb and other contaminants in dusts and soils is a problem of limited significance, confined only to those children with abnormal ingestive behaviors characterized as pica or geophagy (Paustenbach *et al.*, 1986). With respect to Pb, some have argued that pica behavior is directed only towards Pb paint. Both of these assertions are inaccurate.

The pica problem affects a large portion of the population ages six months to five years. Several studies have estimated the extent of pica behavior. Barltrop (1966) reported that 75% of children 1-3 years mouthed small objects and that 35% ingested them, whereas by age 5 only 33% mouthed objects and 6% had pica. The NHANES II survey show that the pica problem affected 8.1% of the under-six population (7.5% of whites, 11.4% of blacks) in children 6 months to 5 years (NCHS, 1984).

The pica literature indicates that chips of Pb paint is neither the sole non-food item that children eat, nor the sole culprit responsible for elevated blood Pb levels. Shellshear *et al.* (1975) examined pica behavior for Pb in paint and soil-dust and found that 7.1% exhibited pica behavior; 75% had pica for soil alone. He concluded that children exposed to more than 100 $\mu g\ g^{-1}$ of Pb in soil and who have pica for soil are at considerable risk from Pb poisoning. Cohen *et al.* (1973) found that children were five times more likely to eat dirt than paint. EPA concluded, based upon published and unpublished CDC data, that "about 40 to 50% of confirmed cases of elevated [blood Pb] levels, a possible source of [Pb paint] hazard could not be located" (EPA, 1986a, at 11-160).

Fundamentally, it is inaccurate to classify children

Table 2 *Soil ingestion estimates.*

CDC[a]		Lagoy[b]	
Age (years)	Amount (g day^{-1})	Age (years)	Amount (g day^{-1})
0.75-1.5	1	0-1	0.25
1.5-3.5	10	1-6	0.50
3.5-5.0	1	6-11	0.25
>5.0	0.1	>11	0.10

[a] Kimbrough *et al.* (1984)
[b] Lagoy (1987)

respect to soil ingestion behavior) into one group with pathological rates of ingestion and another with no ingestion. Ingestion of soils and dusts actually reflects a behavioral continuum in young children. Indeed, young children who "mouth" more than others have 2-3 times higher blood Pb levels, *i.e.* the greater the mouthing behavior the higher the blood Pb levels (Rabinowitz and Bellinger, 1988). Mouthing of non-food items is normal for infants and young children. The extent of abnormal ingestion behaviors (and the amounts of non- food substances ingested under such conditions) are not known with certainty. Attempts to answer this question by utilizing soil tracer methodologies have resulted in an order of magnitude difference in soil ingestion amounts. Numerous factors affect the determination of actual ingestion amounts including: 1) seasonal influences; 2) social and cultural influences; 3) degree of exposed versus covered soils; and, 4) possible nutritional covariates for the population measured (Calabrese *et al.*, 1989; Johnson and Tenuta, 1979). Nevertheless, the studies noted above indicate that the pica for soil problem is great and that a significant portion of the population ages six months to six years may exhibit pica for soil; possibly 5-10%.

How much soil do pica children ingest? Soil tracer methodologies have produced results ranging from 0.05 to 10.0 g day^{-1} (Binder *et al.*, 1986; Clausing *et al.*, 1987; Calabrese *et al.*, 1989). CDC, in a "conservative" attempt to calculate exposure to dioxin in residential soils, examined the question of the rate of soil ingestion and found it to be related to characteristic activity patterns which were in turn were closely dependant upon age (see Table 2). CDC concluded that very young children could ingest as much as 10 grams of soil-dust per day.

The issue of soil-dust ingestion has received considerable debate, particularly by industry groups who are concerned about the financial costs of cleaning up contaminated soil (Paustenbach *et al.*, 1986). However, part of the problem has been the unwillingness of some to distinguish between "normal" mouthing behavior and pica for dirt behavior. Lagoy (1987) reviewed the literature from

this perspective and concluded that the maximum soil ingestion rates f mouthing behavior:

"are unlikely to underestimate exposure within a range from 100 to 500 r [0.1 to 0.5 g day^{-1} (see Table 2). He also concluded that] it is prudent to use t higher of these two numbers (0.5 g day^{-1}) as the soil ingestion rate for t maximally exposed child between 1 and 4 years. A value of 5,000 mg day^{-1} [5 day^{-1}] is considered a reasonable estimate of a maximum single-day exposu for a child with habitual pica."

This value (5 g day^{-1}) is based upon studies of children with habitual pi (Schaum, 1984). It should be noted that in the most recent soil tracer study, o child was reported to ingest over 5 g day^{-1} of soil (Calabrese *et al.*, 1989). In th particular study, this is significant since the 1 to 4 year old children we selected from daycare centers and non-randomly selected, highly committe volunteer families. A value of 5 g day^{-1} for habitual pica is used by EPA (198 in its risk assessment criteria for MSW incinerators.

The literature shows that 1) children who have pica for soil-dust have highe blood Pb levels than children who do not have habitual pica; 2) children wit habitual pica ingest 10-50 times the soil that non-pica children ingest; and, 3) substantial portion of young children have pica and the incidence of pica for so may be greater than the incidence of pica for paint. A child who has pica for so at an ingestion rate of 5 g day^{-1} with a soil Pb concentration of 100 μg g^{-1} coul ingest 500 μg Pb day^{-1}. This amount is many times greater than any acceptabl ADI for Pb.

Even assuming a non-linear rate of bioavailability as a function of increasin dose [*e.g.* a 10 fold increase in dose resulting in only a doubling of blood Pb] the pica child remains an important problem. In the real world, sandy soils coul substantially reduce the rate of resorbtion of Pb by the soil after it leaves the gu allowing for increased absorption by the child. Further, differences in Ca intak and absorption capacity also affect the bioavailability of Pb. Hence, pic children are at greatest risk even if that risk is non-linear. It is important to kee in mind that pica behavior represents the extreme on a scale of ingestive mouthing behaviors that are found in most infants and young children. Thus basing a standard upon measured pica ingestion rates provides a conservative upper bound estimate of exposure, with benefits that are not just limited to a subpopulation of abnormal children.

The scope of the standard

How broad should a soil Pb standard be? A review of the literature indicates at least ten different factors that can affect the applicability or scope of a soil Pb standard: 1) the type of land use; 2) exposed versus bare soils; 3) whether children are present or have access; 4) exterior of houses painted with Pb; 5) whether a soil survey is required; 6) distinguishing between sample types; 7) the percentile rank of violation based on a survey; 8) cost of abatement; 9) a soil replacement "standard;" and 10) type of soil.

1) Should a soil Pb standard apply to every possible site on the planet [or within the rule making authority's jurisdiction] or should it be limited in

general it is recognized that not all geographic areas and land uses pose the same risk to children. Many agencies have established different soil Pb standards for differing land uses. Since the focus of the discussion in this paper has been the effect of ingesting Pb in soil-dust in young children, it seems reasonable to limit the scope of the standard to residential areas and other areas where children have ready access to commercial and industrial sites.

2) Should any soil with Pb concentrations above the standard be in violation or should the standard be limited to bare soils? It is clear that if there is a barrier between the children and the Pb, it is unlikely that children will routinely obtain access to the Pb. Hence, this would seem to limit the scope of the standard to bare soils. On the other hand, it is well known that many neighborhoods that are now considered "run-down" were at one time considered affluent. Neighborhoods in US cities undergo major transitions in use and residence patterns over time. Consequently, soils presently covered could become bare in the future. Hence, it may be wise to require all soils to be covered by the standard unless some enforced policy exists to require adequate ground cover into perpetuity.

3) Should the standard be limited to only those houses where children live or should it include the entire neighborhood? Children often visit other houses to play with other children, to go to the baby-sitter, to visit relatives or just to wander around. It does not seem reasonable to limit the standard to only the property where the child resides.

4) Should a legally enforceable standard apply to areas where the housing is contaminated with exterior lead-based paint? On the surface, one could conclude that the weathering of exterior painted surfaces would result in higher foundation soil Pb levels and a higher incidence of blood Pb levels. Mielke *et al.* (1989) found that the mere presence of older Pb painted houses does not guarantee high exterior soil Pb concentrations. In a comparison between Rochester, Minnesota, where 74.2% of the housing was built before 1950, the median soil Pb concentrations of foundation samples were less than 50 $\mu g\ g^{-1}$; whereas in inner-city South Minneapolis, with only 58.8% of the housing built before 1950, the median soil Pb concentrations of foundation samples exceeded 600 $\mu g\ g^{-1}$. Similarly, for blood Pb levels, none of the Rochester children had blood Pb levels greater than 10 $\mu g\ dL^{-1}$; compared to 46.7% of inner-city South Minneapolis children. Similar results were reported by Angle *et al.* (1975), who found that blood Pb values were lower in areas of dilapidated housing (where foundation soil Pb values ought to be high if exterior leaded paint made a large contribution to exterior soil Pb levels) than in other areas where housing was not considered dilapidated. Consequently, the mere presence of exterior Pb paint should not be a barrier to the implementation of a soil Pb standard in residential areas.

5) A related question is whether any single sample found to be in excess of a proposed standard would automatically require cleanup of the site? In studies on the spatial variation of soil Pb, it was found that soil Pb surveys could only be reliably reproduced in larger geographic contexts than a residential home site

paint chips in relatively clean areas, soil standards must factor this variable into account. One way to avoid this problem is to apply the standard to a geographic area instead of a single home site. Such an area might be as small as a square block. Then, all residences within that area would be subject to the standard.

6) Another factor is whether any distinction should be made by sample type, if a soil survey is required for implementation of the standard. Mielke (1989) clearly shows that there is a fundamental difference in the soil Pb concentration in the same area between foundation, mid-yard and street-side samples. By distinguishing between sample types in the standard, one could avoid abating portions of residential soils already below the soil Pb standard.

7) If a soil Pb survey is required for implementation of the standard, what statistical value must the survey show before enforcement takes place? As already noted, the purpose of the survey is to avoid abating areas where the standard was violated due to an isolated paint chip. After all, children are not divining rods who seek out either the maximum or minimum soil- lead area to play in. One solution is to require 8-12 samples per sample type in each area and require abatement when 25% or more of the samples exceed the standard. This should eliminate isolated and erroneous values.

8) What role should "cost" play in the implementation of a soil Pb standard? The issue of "cost" is not a relevant factor in making these decisions. In Lead Industry Associates v. EPA ((1980) 647 F.2d 1130, D.C. Cir.) the appellate court upheld the primary air quality standard for Pb even though EPA had given no consideration to cost. Why should it be any different for Pb in soil? To consider cost is to change the purpose of the soil-dust Pb standard from the protection of public health to the protection of the pocketbook. Alternatively, if a standard is established to deal only with those areas that could be cleaned up with available monies, it could require that the entire administrative process be repeated each time new monies becomes available for remediation.

9) Often abatement means "the large-scale replacement and removal of contaminated soil" (CDC 1985). If so, then replacement soil will be needed. This requires that there be two soil Pb standards, one for initiating abatement and one for the replacement soil. Since natural background levels of Pb in soil vary from place to place, it seems reasonable to set a replacement standard at natural background on a site specific basis; *i.e.* as low as practicle below 100 $\mu g\ g^{-1}$.

10) In some areas the predominate soils will be almost all sand. Because Pb on sandy soil is more bioavailable that Pb in other soils, the Ontario Ministry of the Environment (OME) has recommended that allowable Pb concentrations for sandy soils be reduced from the "normal," *i.e.* non-sandy soil, standard (RSC, 1986, at 270, OME 1986). Specifically, the OME requires that, whenever residential soils are greater than 70% sand or less than 17% organic matter, the allowable soil Pb concentration be reduced 25% (OME, 1986). Serious consideration should be given to including a clause in a standard which reduces the allowable amount of Pb in soil if that soil is predominately sand or low in

Table 3 *Soil-lead standards for various land uses (μg g^{-1}).*

Location	Agriculture	Industry	Sewage sludge	Residential
UN FAO (1)	100	-	-	-
US (2,3,4)	<400	500[a]	-	500[a]
Minnesota (4,5)	-	600	-	500[b]
OME, Canada (2,6)	-	750[c]	60	375[c]
	-	1,000[d]	-	500[d]
EEC (7,8)	-	300	100	
	-	-	50[e]	-
Netherlands (9)	-	-	-	50[f]
	-	-	-	150[g]
	-	-	-	600[h]
West Germany (8)	-	-	100	-
England (8,10)	-	-	450	500[i]
London (11)	-	-	-	500[j]

[a] 600 μg g^{-1} repealed changed to leachate standard, interim 500 μg g^{-1} guideline.
[g] proposed emergency rule, interim 1,000 μg g^{-1} standard.
[c] sandy soil.
[d] non-sandy soil.
[e] proposed standard.
[f] reference value.
[g] further investigation.
[h] clean up value
[i] redevelopment of industrial lands.
[j] dust standard.

Sources: (1) FAO (1977); (2) Rinne *et al.* (1986); (3) OSWER (1989); (4) personal communication; (5) Minnesota hazardous waste regulations; (6) OME (1986); (7) EEC (1975); (8) Davies and Wixson (1986); (9) Assink and Vanderbrink (1986); (10) DOE (1987); and, (11) Wilson (1983).

Soil Pb standards and recommendations

The most often cited soil Pb concentration as a level "of concern" is the 500-1,000 μg g^{-1} figure quoted in the CDC (1985) statement *Preventing Lead Poisoning in Young Children:* "In general, lead in soil and dust appears to be responsible for blood lead levels in children increasing above background levels when the concentration in soil or dust exceeds 500-1,000 μg g^{-1}." The purpose of this CDC

Table 4 *Soil Pb standard recommendations.*

Author(s)	Standard	Comment
Shellshear *et al.* (1975)	<100	Needed to protect pica children.
Mielke *et al.* (1989)	<150	Necessary to prevent Pb toxicity (10 μg dL^{-1}).
Chaney *et al.* (1986, 1989)	<150	Necessary to protect pica children.
Duggan and Williams (1977)	300	Keep ADI <50 μg Pb day^{-1} (Streetdust standard).
Bourcier *et al.* (1985)	300	Needed to keep blood Pb below 25 μg dL^{-1}.
Simms and Becket (1987)	500	Calculated to keep blood Pb below 25 μg dL^{-1}.
Madhaven *et al.* (1989)	600	Would permit an increase in blood lead of 5 μg dL^{-1} above existing levels.
	250	Necessary to protect children where there is no grass cover.
Steenhout (1987)	900	Based upon an ADI of 200 μg Pb day^{-1}.
Laxen *et al.* (1987)	1000	Allows dust to contribute 2.5-3.0 μg dL^{-1} (housedus

poisoning at a lower blood Pb level, and update our recommendations or lead-based paint abatement." The committee, which wrote the 1985 CDC "statement" was not formed to establish a soil Pb standard. The same is true o all the other reports which have cited the 500-1,000 μg g^{-1} figure (Chadzynski 1986; AAP, 1987; ATSDR, 1988a; OSWER, 1989).

How did the CDC arrive at the 500-1,000 μg g^{-1} as a level "of concern" and where did it originate? The first mention of this figure was in an EPA (1977b) report *Air Quality Criteria for Lead*, which concluded that "The consensus appears to be that observable increases in blood Pb levels occur at soil or dust Pb exposures of 500-1000 μg g^{-1}." This 12 year old report based its conclusions on two studies: Fairy and Gray (1970) [500 μg g^{-1} cutoff point in chi-square contingency analysis (75% of samples were less than 500 μg g^{-1})], and Galke *et al.* (1975) [compared two groups divided upon median soil Pb value of 585 μg g^{-1}]. While there is nothing intrinsically wrong with either study, the conclusions of the 1977 EPA report do not reflect the numerous studies conducted since that report was issued. More recent studies point to lower soil Pb concentrations associated with significant changes in blood Pb levels. Therefore, the 500-1,000 μg g^{-1} figure reached by EPA in 1977, adopted by reference by the CDC, and cited extensively by others should be interpreted in the context of its time and not be looked upon as the

Table 5 *Normalizing soil Pb standard recommendations.*

Author(s)	Recommended standard	Normalised standard
Shellshear *et al.* (1975)	<100	<100
Mielke *et al.* (1989)	<150	<150
Chaney *et al.* (1986, 1989)	<150	<150
Duggan and Williams (1977)	300	150
Bourcier *et al.* (1985)	300	120
Simms and Becket (1987)	500	200
Madhaven *et al.* (1989)	600	120
	250	50
Steenhout (1987)	900	112
Laxen *et al.* (1987)	1,000	333

or issued guidelines for Pb in soil. These standards are summarized in Table 3. Unfortunately, few governments publish their rationale for promulgating a standard or issuing a guideline in the open scientific literature. Hence, it is difficult to evaluate these standards, *i.e.* to differentiate between the role of science and the influence of politics. It can be noted, however, that many of these standards are below 500 $\mu g\ g^{-1}$.

Several Pb researchers have calculated an "acceptable" level of Pb in soil or dust. Table 4 summarizes the "recommended" soil or dust Pb level and the principle argument used to justify the recommendation. As may be seen, there is an order of magnitude difference in the recommendations offered in the literature. These standards reflect four basic arguments used to advocate a specific Pb limitation. Shellshear *et al.* (1975) and Chaney *et al.* (1986, 1989) argue that a soil Pb standard needs to be below 100 $\mu g\ g^{-1}$ or 150 $\mu g\ g^{-1}$ to protect pica children. Bourcier *et al.* (1985) and Simms and Becket (1987) argue that a standard of 300 and 500 $\mu g\ g^{-1}$, respectively, are needed to keep blood Pb levels below 25 $\mu g\ dL^{-1}$. Mielke *et al.* (1989) argues that the standard needs to be less than 150 $\mu g\ g^{-1}$ to keep blood Pb levels below 10 $\mu g\ dL^{-1}$. Laxen *et al.* (1987) and Madhaven *et al.* (1989) both argued for a standard, which would allow blood Pb levels to increase by 3-5 $\mu g\ dL^{-1}$ as a consequence of their recommendations, over and above existing blood Pb levels. In addition, Madhaven notes that children exposed to Pb at 250 $\mu g\ g^{-1}$ in bare soils could increase blood Pb levels by 2 $\mu g\ dL^{-1}$. Duggan and Williams (1977) and Steenhout (1987) recommend blood Pb levels of 300 and 900 $\mu g\ g^{-1}$, respectively, based on an ADI of 50 and 200 μg Pb day^{-1}, respectively.

In this paper, it has been argued that 1) no one should have a blood Pb level greater than 10 $\mu g\ dL^{-1}$; 2) that pica children should be protected; 3) that soil and dust Pb exposure should not be allowed to increase blood Pb levels; and, 4) (indirectly) that the allowable daily intake of Pb (ADI) should not exceed 25 μg Pb day^{-1}. Table 5 utilizes these criteria to "normalize" the recommendations (based upon an assumed linear relationship) summarized above. It should be noted that these "normalized" values reflect an assumption that all the allowable Pb came from soil-dust. A further downward adjustment should be made to allow for other Pb sources contributing to total body Pb burden. In addition, the "Laxen" value was not adjusted for age (he examined 10-12 year old children, instead of the high risk 2-4 year old children). As may be seen, by utilizing these criteria, all but one of these normalized recommendations are 200 $\mu g\ g^{-1}$ or less. Hence, it may be argued that the literature, as a whole, supports a low soil Pb standard of 100 $\mu g\ g^{-1}$ or so.

Conclusions and Recommendations

In summary, the following conclusions are germane to the establishment of a soil Pb standard:

1) Lead has no biologic value, the only safe level is 0 $\mu g\ dL^{-1}$ (AAP, 1987);
2) The adverse effect level of concern for reductions in IQ, growth and stature, hearing loss, *etc.* and below which one should keep the population at-risk is at least as low as 10 $\mu g\ dL^{-1}$;
3) Based upon national data [NHANES II] 88% of children under six have blood Pb levels greater than 10 $\mu g\ dL^{-1}$ and are at risk (NCHS, 1984);
4) A principle pathway of Pb to blood is soil; it is the major uncontrolled Pb source; and, nearly 12 million children are exposed to high concentrations of Pb in soil;
5) Relatively low soil Pb levels (from 100-600 $\mu g\ g^{-1}$) increase blood Pb levels dramatically (about 1 $\mu g\ dL^{-1}$ per 100 $\mu g\ g^{-1}$);
6) Lead in soil and dust account for the major difference in blood Pb levels between urban and rural populations;
7) Expert committees and Pb researchers have been steadily reducing their soil Pb standards and recommendations and are now recommending soil Pb standards 100 $\mu g\ g^{-1}$ or so.

In approaching the issue of establishing a soil Pb, one must keep in mind a number of ancillary points:

1) Lead in soil is not going to go away by itself.
2) No one is advocating that soil be the exclusive pathway to be addressed. However, without addressing Pb in soil, the population as a whole, cannot be adequately protected.
3) Strategies to reduce childhood Pb exposure must be expanded beyond simply reacting to cases of Pb poisoning. While there has been a lessening of disease severity, the continued prevalence of blood Pb levels greater than 10 $\mu g\ dL^{-1}$ indicates that childhood Pb poisoning still exists as an environmental and social problem.
4) Perfect information is never going to exist on this subject, nor is it required in order to establish a soil Pb standard. Therefore, efforts to control exposure should proceed with the full acknowledgement of th

of estimates of the costs, risks and benefits.

We propose that a soil-dust Pb standard be established at a level of 100 μg g^{-1}. This figure was chosen because:

1) There is no margin of safety for Pb in the population, as a whole, which requires that every Pb source be controlled;
2) Lead in soil-dust increases blood Pb levels rapidly at low soil Pb concentrations;
3) Lead may contribute to chronic disease conditions (including cancer and heart disease) for which there is no known safe level, and childhood Pb exposure could contribute to chronic disease years later;
4) Lead is a reproductive toxin;
5) No known safe blood Pb level exists; and,
6) Children who have habitual pica for Pb in soil can ingest a substantial amount of Pb when soil Pb concentrations exceed those associated with natural background.

In proposing this soil-dust Pb standard, we are also proposing that the standard:

1) Be limited to residential areas;
2) Be a bare soil standard, if and only if, the community can guarantee adequate ground cover, essentially forever;
3) Be based upon a soil Pb survey in a geographic area large enough so that the survey can be reproduced with some degree of reliability;
4) Be applicable to property based upon sample type (foundation [one meter away], streetside [one meter away], and midyard [distance between previous two sample types]);
5) Be enforceable whenever 25% or more of the samples in an area exceed the standard by sample type;
6) Include a soil replacement standard to be promulgated at the same time; and,
7) Take into account the type of soil, *i.e.*, the standard should be lower for sandy soils or soils having a low content of organic matter.

We also recommend that the following factors NOT be included in a soil-dust Pb standard: 1) whether children live there or not; 2) whether the structure is painted or not; and, 3) cost.

What role should education play in a soil standard? Education is often used in lieu of remediation; an approach that requires people to modify their behavior, as well as, their children's behavior. Whenever, such programs have been evaluated, a lack of success has been demonstrated where education has been the *exclusive* approach (Baker, 1981). On the other hand, it has been the consistent experience of public health agencies that passive measures, which require no change in behavior on the part of the recipient, are successful (Haddon, 1980). Hence, it is necessary to promulgate a soil Pb standard (along with a government funded abatement program) to act as an enforceable measure of cleanup; as opposed to guidelines and other techniques, which place the burden almost exclusively on the parents. In short, education is a component of, not a substitute for, the standard setting or enforcement process.

The Royal Society of Canada concluded that "it should be a fundamental

principle that no child should suffer a significant penalty in body Pb burde because of where he or she lives" (RSC, 1986). Presently, such penalties do exis because government has responded to the problem of human exposure to toxi substances on an environmental media by environmental media basis. We have *Clean Air Act* and a *Clean Water Act etc.*, but no *Clean Soil Act*. Consequently Pb is regulated in air and water, but not soil, except, of course under Superfund if it leaches into the ground at an industrial site. On the federal level, the Toxi Substances Control Act (TSCA) was enacted to engage in some "foresight" i order to prevent exposure to chemical substances that pose "an unreasonable risk of injury." TSCA is a law designed, ostensibly, to fill in the gaps in the othe laws. Unfortunately, TSCA, as constituted, is not designed to address a situatio like Pb in urban soils. As a result, children in urban communities, as well as, Pb industry communities are trapped in "islands of risk." Doesn't the governmen owe some form of protection to those who are so trapped? Government decision makers have concluded that the continued exposure of children to Pb in soil is undesirable. Therefore, swift action on the issue of Pb in soil is necessary to protect children. If this means we need a *Clean Soil Act* to protect the health and welfare of people, then its time we got on the stick and did it!

Acknowledgements

Special thanks to Howard Mielke of Xavier University of Louisiana and Rufus Chaney of the Agricultural Research Service, USDA for their cogent advice, and to Robert F. Nelson of the Minnesota Environmental Control Citizens Association (MECCA) and Ruth Lunde for their support.

References

AAP (Committee on Environmental Hazards and Committee on Accident and Poison Prevention of the American Academy of Pediatrics). 1987. Statement on childhood lead poisoning. *Pediatrics*, 79, 457-465.

Andrews, H.F. 1985. The ecology of risk and the geography of intervention: from research to practice for the health and well- being of urban children. *Annals Assoc. Am. Geographers*, 75(3), 370-382.

Angle, C.R., McIntire, M.S. and Colucci, A.V. 1974. Lead in air, dustfall, soil, housedust, milk, and water: correlation of blood lead in urban and suburban school children. *Trace Substan. Environ. Health*, 8, 23-29.

Angle, C.R., McIntire, M.S. and Stelmak, K.L. 1975. High urban lead and decreased red cell survival. *Conf. Heavy Metals Environ.*, 9, 87-104.

Angle, C.R. and McIntire M.S. 1979. Environmental lead and children: the Omaha study. *J. Toxicol. Environ. Health*, 5, 855- 870.

Angle, C.R. and McIntire M.S. 1982. Children, the barometer of environmental lead. *Adv. Pediatr.*, 29, 3-30.

Angle, C.R., Marcus, A., Cheng, I. and McIntire, M.S. 1984. Omaha childhood blood lead and environmental lead: a linear total exposure model. *Environ. Res.*, 35, 160-170.

Annest, J.L. 1983. Trends in the blood lead levels of the US population: the Second National Health and Nutrition Examination Survey (NHANES II) 1976-1980. In: Rutter, M. and Jones, R.R. (eds.), *Lead Versus Health: Sources and Effects of Low Level Lead Exposure*, pp.33-58. John Wiley, New York.

Ashford, N.A. 1987. New scientific evidence and public health perspectives. *New Eng. J. Med.*, 316(7), 107-108.

Assink, J.W. and Vandenbrink, W.J. (eds.) 1986. *Contaminated Soils*. Mashiws Nijhoff Publishers.

ATSDR (Agency for Toxic Substances and Disease Registry). 1988a. *The Nature and Extent of Lead Poisoning in Children in the United States: A Report to Congress*. US Public Health Service, Atlanta.

ATSDR (Agency for Toxic Substances and Disease Registry). 1988b. *Toxicological Profile Report for Lead*. US Public Health Service, Atlanta.

Baker, S. 1981. Childhood injuries: the community approach to prevention. *J. Pub. Health Pol.*, (Sept), 235-246.

Barltrop, D. 1966. The prevalence of pica. *Am. J. Dis. Child.*, 112, 116-123.

Barltrop, D., Strehlow, C.D., Thorton, I. and Webb, J.S. 1974. Significance of high soil lead concentrations for childhood lead burdens. *Environ. Health Perspect.*, 7, 75-82.

Batuman, V., Landy, E., Maesaka, J.K. and Weeden, R.P. 1983. Contribution of lead to hypertension with renal impairment. *N. Eng. J. Med.*, 309, 17-21.

Bellinger, D.C., Needleman, H.L., Leviton, A., Waternaux, C., Rabinowitz, M.B. and Nichols, M.L. 1984. Early sensory motor development and prenatal exposure to lead. *Neurobehav. Toxicol. Teratol.*, 6, 387-402.

Bellinger, D.C., Leviton, A., Waternaux, C., Needleman, H.L. and Rabinowitz, M. 1985. A longitudinal study of the developmental toxicity of low-level lead exposure in the prenatal and early postnatal periods. *Conf. Heavy Metals Environ.*, 1, 32-34.

Bellinger, D.C., Leviton, A., Needleman, H.L., Waternaux, C. and Rabinowitz, M. 1986. Low-level lead exposure and infant development in the first year. *Neurobehav. Toxicol. Teratol.*, 8, 151-161.

Bellinger, D.C., Leviton, A., Waternaux, C., Needleman, H.L. and Rabinowitz, M. 1987a. Longitudinal analyses of prenatal and postnatal lead exposure and early cognitive development. *N. Eng. J. Med.*, 316 1037-1043.

Bellinger, D.C., Sloman, J., Leviton, A., Waternaux, C., Needleman, H.L. and Rabinowitz, M. 1987b. Low level lead exposure and Child development: assessment at age 5 of a cohort followed from birth. *Conf. Heavy Metals Environ.*, 1, 49-53.

Benignus, V.A., Otto, D.A., Muller, K.E. and Seiple, K.J. 1981. Effects of age and body lead burden on CNS function in young children: II. EEG Spectra. *Electroencephalogr. Clin. Neurophysiol.*, 52, 240-248.

Binder, S., Sokal, D. and Maughan, D. 1986. Estimating the amount of soil ingested by young children through tracer elements. *Arch. Environ. Health*, 41, 341-345.

Bornschein, R. 1986. Lead in soil in relation to blood lead levels in children. *Trace Substan. Environ. Health*, 20, 322-332.

Bourcier, D.R., Matthews, D.R., Ellis, B.H. and Galke, W.A. 1985. Multimedia aspects of lead exposure and toxicity. *Trace Substan. Environ. Health*, 19, 160-172.

Brown, L.R., Chandler, W.U., Durning, A., Flavin, C., Heise, L., Jacobson, J., Postel, S., Shea, C.P., Starke, L. and Wolf, E.C. 1988. *State of the World 1988*. Worldwatch Institute, New York.

health programs. *Health Policy*, 4, 331-340.

Brunekreef, B., Veenstra, S.J., Biersteker, K. and Boleij, J.S.M. 1981. The Arnhem lead study: I: Lead uptake by 1 to 3-year-old children living in the vicinity of a secondary lead smelter in Arnhem, The Netherlands. *Environ. Res.*, 25, 415-448.

Brunekreef, B., Noy, D., Biersteker, K. and Boleij, J. 1983. Blood lead levels of Dutch children and their relationship to lead in the environment. *J. Air Poll. Cont. Assoc.*, 33, 872-876.

Brunekreef, B. 1986. *Exposure of Children to Lead*. University of London, Monitoring Assessment Research Center, London, UK.

Calabrese, E.J., Barnes, R., Stanek III, E. J., Pastides, H., Gilbert, C.E., Veneman, P., Wang, X., Lasztity, A. and Kostecki, P.T. 1989. How much soil do young children ingest: an epidemiological study (unpublished).

CDC (Center for Disease Control). 1978. *Preventing Lead Poisoning in Young Children*. US Public Health Service, Atlanta, Georgia.

CDC (Centers for Disease Control). 1985. *Preventing Lead Poisoning in Young Children*. Public Health Service, Atlanta, Georgia.

Chadzynski, L. 1986. *Manual for the Identification and Abatement of Environmental Lead Hazards*. HHS, Washington, DC.

Challop, R. 1971. Role for cadmium in lead poisoning. *N. Eng. J. Med.*, 285, 970-971.

Chaney, R.L. and Mielke, H.W. 1986. Standards for soil lead limitations in the United States. *Trace Substan. Environ. Health*, 20, 357-377.

Chaney, R.L., Mielke, H.W. and Sterret, S.B. 1989. Speciation, mobility and bioavailability of soil lead. *Environ. Geochem. Health* 9 [Supp]: 105-129.

Charney, E. Sayre, J. and Coulter, M. 1980. Increased lead absorption in inner city children: where does the lead come from? *Pediatrics*, 65, 226-231.

Clausing, P., Brunekreef, B. and van Wijnen, J.H. 1987. A method for estimating soil ingestion in children. *Int. Arch. Occ. Environ. Med.*, 59, 73.

CLF. Szabo, N. and Pollach, S. 1987. *A Silent and Costly Epidemic: The Medical and Educational Costs of Childhood Lead Poisoning in Massachusetts*. Conservation Law Foundation of New England, Boston.

Cohen, C.J., Bowers, G.N., and Lepow, M.L. 1973. Epidemiology of lead poisoning: a comparison between urban and rural children. *JAMA*, 226, 1430-1433.

CPSC (Consumer Product Safety Commission). 1977. Determination of safe level of lead in paint. *Federal Register*, 42(32), 9404-9406.

Crawford, M. *et al.* 1973. Lead in bones and drinking water in towns with hard and soft water. *Brit. Med. J.*, 2, 21-23.

Davies, B.E., and Wixson, B.G. 1986. Lead in soil - how clean is clean? *Trace Substan. Environ. Health*, 20, 233-241.

Davies, D.J.A., Thorton, I., Walls, J.M., Culbard, E.B., Harvey, P.G., Delves, H.T., Sherlock, J.C., Smart, G.A., Thomas, J.F.A. and Quinn, M.J. 1987. Relationship between blood lead and lead the UK. *Conf. Heavy Metals Environ.*, 2, 203-205.

Davis, J.M. and Svendsgaard, D.J. 1987. Lead and child development. *Nature*, 329, 297-300.

Day, J.P., Fergusson, J.E. and Chee, T.M. 1979. Solubility and potential toxicity of lead in urban street dust. *Bull. Environ. Contam. Toxicol.*, 23, 497-502.

Dickinson, N.M., Lepp, N.W. and Surtan, G.T.K. 1987. Lead and potential health risks in Kenya. *Environ. Geochem. Health*, 9(2), 37-42.

Int. J. Biosoc. Res., 8, 151-168.
Dietrich, K.N., Krafft, K.M., Shukla, R., Bornschein, R.L. and Succop, P.A. 1987. The neurobehavioral effects of early lead exposure. In: Schroeder, A. (ed.), *Toxic Substances and Mental Retardation: Neurobehavioral Toxicology and Teratology*, pp.71-98. AAMD Monographs, Washington, DC.
Dietrich, K.N., Krafft, K.M., Bier, M., Berger, O., Succop, P.A. and Bornschein, R.L. 1989. Neurobehavioral effects of fetal lead exposure: the first year of life. In: Smith, M.A., Grant, L.D. and Sors, A.I. (eds.), *Lead Exposure and Child Development: An International Assessment*, pp.320-331. MTP Press, Lancaster, UK.
DOE. 1987. ICRCL. *Guidance on the Assessment and Redevelopment of Contaminated Land*. UK Department of the Environment.
Duggan, M.J. and Williams, S. 1977. Lead-in-dust in city streets. *Sci. Total Environ.*, 7, 91-97.
Duggan, M. 1980. Lead in urban street dust: an assessment. *Water, Air, Soil Poll.*, 14, 309-321.
Duggan, M.J. 1983. Contribution of lead in dust to children's blood lead. *Environ. Health Perspect.*, 50, 371-381.
Duggan, M. 1984. Temporal and spatial variations of lead in air and in surface dust - implications for monitoring. *Sci. Total Environ.*, 33, 37-48.
EEC Official Gazette, 7 July 1975. In: Dalpra', L., Tibiletti, M.G., Nocera, G., Gilulotto, P., Auriti, L., Camelli, V. and Simoni, G. 1983. SCE analysis in children exposed to lead emission from a smelting plant. *Mutation Res.*, 120, 249-256, at 251.
Elias, R. and Croxdale, J. 1980. Investigation of the deposition of lead-bearing aerosols on the surfaces of vegetation. *Sci. Total Environ.*, 14, 265-278.
Elwood, P.C., Blaney, R., Robb, R.C., Essex-Cater, A.J., Davies, B.E. and Toothill, C. 1985. Lead levels on traffic-less islands. *J. Epidemiol. Comm. Health*, 39 256-258.
EPA (Environmental Protection Agency). 1977a. Lead: proposed national ambient air quality standard. *Federal Register*, 42(240) 63076-63094, at 63079.
EPA. 1977b. *Health Effects Research Lab, Air Quality Criteria for Lead*, pp.12-31. EPA, Research Triangle Park, NC.
EPA. 1985. *Office of Policy Analysis, Costs and Benefits of Reducing Lead in Gasoline*. EPA, Washington, DC.
EPA. 1986a. *Environmental Criteria and Assessment Office, Air Quality Criteria for Lead*. EPA, Research Triangle Park, NC.
EPA. 1986b. *Office of Policy Planning and Evaluation, Reducing Lead in Drinking Water: A Benefit Analysis*. EPA, Washington, DC.
EPA. 1987. Cheverly, D. *Municipal Waste Combustion Study: Assessment of Health Risks Associated with Municipal Waste Combustion Emissions*. Radian Corp, Research Triangle Park.
EPA. Office of Health and Environmental Assessment. 1989a. Supplement to the 1986 EPA Air Quality Criteria for Lead - Volume 1 Addendum (Pages A1-A67. Draft. EPA, Washington, DC.
EPA. Office of Health and Environmental Assessment. 1989b. Evaluation of the Potential Carcinogenicity of Lead and Lead Compounds: In Support of Reportable Quantity Adjustments Pursuant to CERCLA Section 102, Draft. EPA, Washington, DC.
Ernhart, C.B., Wolf, A.W., Kennard, M.J., Filipovich, H.F., Sokol, R.J. and Erhard, P. 1985. Intrauterine lead exposure and the status of the neonate. *Conf. Heavy Metals*

Environ., 1, 35-37.
Ernhart, C.B., Wolf, A.W., Kennard, M.J., Erhard, P., Filipovich, H.F. and Sokol, R.J. 1986. Intrauterine exposure to low levels of lead: the status of the neonate. *Arch. Environ. Health*, 41, 287-291.
Ernhart, C.B., Morrow-Tlucak, M. and Wolf, A.W. 1988. Low level lead exposure and intelligence in the preschool years. *Sci. Total Environ.*, 71, 453-459.
Fairey, F.S. and Gray, J.W. III. 1970. Soil lead and pediatric lead poisoning in Charleston, SC. *S. Carolina Med. Assoc. J.*, 66, 79-82.
FAO. 1977. United Nations Food and Agriculture Organization, Consultation on the Establishment of the European Research Network on Trace Elements.
Fergusson, J.E. and Ryan, D.E. 1984. The elemental composition of street dust From large and small urban areas related to city type, source and particle size. *Sci. Total Environ.*, 34, 101-116.
Fergusson, J.E. and Schroeder, R.J. 1985. Lead in housedust of Christchurch, New Zealand: sampling, levels and sources. *Sci. Total Environ.*, 46, 61-72.
Fergusson, J.E., Forbes, E.A., Schroeder, R.J. and Ryan, D.E. 1986. Lead: petrol lead in the environment and its contribution to human blood lead levels. *Sci. Total Environ.*, 50, 1-54.
Flaak, R. 1986. CASAC Closure Letter for Lead Criteria Document and Recommendation Letter for Lead Staff Paper, August 20 (unpublished).
Gallacher, J.E.J., Elwood, P.C., Phillips, K.M., Davies, B.E. and Jones, D.T. 1984. relation between pica and blood lead in areas of differing lead exposure. *Arch. Dis. Child.*, 59, 40-44.
Galke, W.A., Hammer, D.I., Keil, J.E. and Lawrence, S.W. 1975. Environmental determinants of lead burdens in children. *Conf. Heavy Metals Environ.*, 9, 53-74.
Grobler, S.R., Rossouvv, R.J. and Maresky, L.S. 1985. Blood lead levels in a remote, unpolluted rural area in South Africa. *S. African Med. J.*, 68, 323-324.
Haddon, W. 1980. Advances in epidemiology of injuries as a basis for public policy. *Pub. Health Reports*, 95 411-421.
Hamilton, R.S., Revitt, D.M. and Warren, R.S. 1984. Levels and physio-chemical associations of Cd, Cu, Pb, and Zn in roadside sediments. *Sci. Total Environ.*, 33, 59-74.
Harlan, W.R., Landis, J.R., Schmouder, R.L., Goldstein, N.G. and Harlan, L.C. 1985. Blood lead and blood pressure: relationship in the adolescent and adult US population. *JAMA*, 253, 530-534.
Hasselblad, V. and Nelson, W. 1975. Additional analysis of the Seven City lead study. In: Griffin, T. and Knelson, J.H. (eds.), *Lead*, pp.147-151. Academic Press, New York.
Hecker, L.H., Allen, H.E., Dinman, B.D. and Neel, J.V. 1974. Heavy metal levels in acculturated and unacculturated populations. *Arch. Environ. Health*, 29, 181-185.
Hunt, W.F. Jr., Pinkerton, C., McNulty, O. and Creason, J. 1971. A study of trace element pollution of air in 77 midwestern cities. *Trace Substan. Environ. Health*, 5, 56-68.
IARC (International Agency for Research on Cancer). 1980. *Lead and Lead Compounds*. Monographs on the Carcinogenic Risk of Chemicals to Humans: Volume 23. IARC, Lyon, France.
IARC (International Agency for Research on Cancer). 1987. Monographs on the Evaluation of Carcinogenic Risks to Humans: Overall Evaluations of Carcinogenicity: An Updating of IARC Monographs 1 to 42. IARC, Lyon, France

Johnson, D.E., Tillery, J.B. and Prevost, R.J. 1975. Levels of platinum, palladium, and lead in populations of Southern California. *Environ. Health Perspect.*, 12 27-33.
Johnson, N.E. and Tenuta, K. 1979. Diets and lead blood levels of children who practice pica. *Environ. Res.*, 18, 369-376.
Kimbrough, R.D., Falk, H. and Stehr, P. 1984. Health implications of 2,3,7,8-tetrachloro-dibenzo-dioxin (TCDD) contamination of residential soil. *J. Toxicol. Environ. Health*, 14, 47-93.
King, B. 1971. Maximum daily intake of lead without excessive body lead-burden in children. *Am. J. Dis. Child.*, 122, 337-340.
Kromhout, D. and Couland, C.L. 1984. Trace metals and CHD risk indicators in 152 elderly men (the Zutphen study). *Eur. Heart J. Abstr.*, (Suppl.1), 101
Lagoy, P. 1987. Estimated soil ingestion rates for use in risk assessment. *Risk Analysis*, 7, 355-359.
Landrigan, P.J., Gehlback, S.H., Rosenblum, B.F., Shoults, J.M., Candelaria, R.M., Barthel, W.F., Liddle, J.A., Smrek, A.L., Staehling, N.W. and Sanders, J.F. 1975. Epidemic lead absorption near an ore smelter. *New Eng. J. Med.*, 292, 123-129.
Lau, W. and Wong, H. 1982. An ecological survey of lead contents in roadside dusts ans soils in Hong Kong. *Environ. Res.*, 28, 39- 54.
Laxen, D.P.H., Raab, G.M. and Fulton, M. 1987. Children's blood lead and exposure to lead in household dust and water - a basis for an environmental standard for lead in dust. *Sci. Total Environ.*, 66, 235-244.
Lin-Fu, J. 1978. *Preventing Lead Poisoning in Children*. Public Health Service, Rockville, MD.
Linton, R.W., Natusch, D.F.S., Solomon, R.L. and Evans, C.A. Jr. 1980. Physiochemical characterization of lead in urban dusts: a microanalytical approach to lead tracing. *Environ. Sci. Tech.*, 14, 154-164.
Madhaven, S., Rosenman, K. and Shehata, T. 1989. Lead in soil: recommended maximum permissible levels. *Environ. Res.*, 49, 136- 142.
Mahaffey, K. 1977. Relation between quantities of lead ingested and health effects of lead in humans. *Pediatrics*, 59, 448-456.
Marcus, W. 1986. Lead health effects in drinking water. *Toxicol. Ind. Health*, 2, 363-407.
Mielke, H.W. 1989. *Patterns of Life: Biogeography of a Changing World*. Unwin and Hyman, London.
Mielke, H.W., Adams, J.L., Reagan, P.L. and Mielke, P.W. 1989. Soil-dust lead and childhood lead exposure as a function of city size and community traffic flow: the case for lead abatement in Minnesota. *Environ. Geochem. Health* (in press).
Mielke, H.W., Anderson, J.C., Berry, K.J., Mielke, P.W., Chaney, R.L. and Leech, M. 1983. Lead concentrations in inner-city soils as a factor in the child lead problem. *AJPH*, 73, 1366-1369.
Mielke, H.W., Blake, B., Burroughs, S. and Hassinger, N. 1984. Urban lead levels in Minneapolis: the case of the Hmong children. *Environ. Res.*, 34, 64-76.
Mielke, H.W., Burroughs, S., Wade, R., Yarrow, T. and Mielke, P.W. 1985. Urban lead in Minnesota: soil transect results of four cities. *J. Minn. Acad. Sci.*, 50, 19-24.
Moreau, T., Orssaud, G., Juguet, B. and Busquet, G. 1982. Blood lead levels and arterial pressure: initial results of a cross sectional study of 431 male subjects (Letter), *Rev. Epidemol. Sante Publique.*, 30, 395-397.
Morgan, H. and Simms, D.L. 1988. Setting trigger concentrations for contaminated land. In: Wolf, K., Van den Brink, W.J. and Colon, F.J. (eds.), *Contaminated Soil*, Vol.1, pp.327-337. Kluwer Academic Publishers, Dordrect, Holland.

NAS. 1975. *Committee on Principles of Decision Making for Regulating Chemicals in the Environment, Decision Making for Regulating Chemicals in the Environment*. National Academy of Sciences, Washington, DC.
NAS. 1977. *Safe Drinking Water Committee, Drinking Water and Health*, Vol.1. National Academy of Sciences, Washington, DC.
NAS. 1980. *Committee on Lead in the Human Environment, Lead in the Human Environment*. National Academy of Sciences, Washington, DC.
NCHS. 1984. Blood lead levels for persons ages 6 months - 74 years: United States, 1976-1980. *Vital and Health Statistics*, 11, 233.
Needleman, H. 1978. Exposure to lead: sources and effects. In: *CDC* 1978).
Needleman, H.L. 1988. Why should we worry about lead poisoning? *Current Pediatrics*, March, 34-56.
Needleman, H.L., Gunnoe, C., Leviton, A., Reed, R., Peresie, H., Maher, C. and Barrett, P. 1979. Deficits in psychological and classroom performance of children with elevated dentine lead levels. *New Eng. J. Med.*, 300, 689-695.
Neri, L.C., Johanson, H.L., Schmitt, N., Pagen, R.T. and Hewitt, D. 1978. Blood lead levels in children in two British Columbia communities. *Trace Substan. Environ. Health*, 12, 403-410.
Nriagu, J.O. 1978. Lead in soils, sediments and major rock types. In: Nriagu, J.O. (ed.), *The Biogeochemistry of Lead in the Environment*, Part 1A, pp.15-72. Elsevier, New York.
Nriagu, J. 1980. Lead in the atmosphere and its effect on lead in humans. In: Singhal, R.L. and Thomas, J.A. (eds.), *Lead Toxicity*, pp.483-505. Urban and Schwarzenberg, Baltimore.
Nriagu, J. 1989. A global assessment of natural sources of atmospheric trace metals. *Nature*, 338, 47-49.
Okubo, T., Tsuchiya, K., Nagasaki, M., Nakajima, T., Kamijyo, H. and Mizoguchi, I. 1978. A further study of the biological effects of lead on urban and suburban Tokyo school children. *Int. Arch. Occ. Environ. Health*, 41, 17-23.
OME. 1986. Rinne, R.J., *Phytotoxicology Section Recommended Soil Clean-up Criteria for Decommissioning of Industrial Lands - Background and Rationales for Development*. Ontario Ministry of the Environment.
OSWER. 1989. Langest, H.L. and Diamond, B., *Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites*. EPA OSWER Directive No. 9355.4-02, (9/1/89).
Otto, D.A., Benignus, V.A., Muller, K.E. and Barton, C.N. 1981. Effects of age and body lead burden on CNS function in young children: I: slow cortical potentials, *Electroencephalogr. Clin. Neurophysiol.*, 52, 229-239.
Otto, D.A., Benignus, V.A., Muller, K.E., Barton, C.N., Seiple, K., Prah, J. and Schroeder, S. 1982. Effects of low to moderate lead exposure on slow cortical potentials in young children: two year follow-up study. *Neurobehav. Toxicol. Teratol.*, 4, 733-737.
Otto, D.A., Robinson, G., Baumann, S., Schroeder, S., Mushak, P., Kleinbaum, D. and Boone, L. 1985. Five-year follow-up study of children with low to moderate lead absorption: electrophysiological evaluation. *Environ. Res.*, 38. 168-186.
Paustenbach, D.J., Shu, H.P. and Murray, F.J. 1986. A critical examination of assumptions used in risk assessments of dioxin contaminated soil. *Regulat. Toxicol. Pharmocol.*, 6 284-307.

Piomelli, S., Corash, L., Corash, M.B., Seaman, C., Mushak, P., Glover, B. and Padgett, R. 1980. Blood lead concentrations in a remote Himalayan population. *Science*, 210, 1135-1136.

Piomelli, S., Rosen, J.F., Chisholm, J.J. Jr. *et al.*, 1984. Management of childhood lead poisoning. *J. Pediatr.*, 105, 523- 532.

Pirkle, J.L., Schwartz, J., Landis, J.R. and Harlan, W.R. 1985. The relationship between blood lead levels and blood pressure and its cardiovascular risk implications. *Am. J. Epidemiol.*, 121 246- 258.

Pocock, S.J., Shaper, A.G., Ashby, D., Delves, T. and Whitehead, T.P. 1984. Blood lead concentration, blood pressure, and renal function. *Brit. Med. J.*, 289 872-874.

Poole, C. and Smythe, L. 1980. Blood lead levels in Papua, New Guinea children living in a remote area. *Sci. Total Environ.*, 15, 17-24.

Provenzano, G. 1980. The social costs of excessive lead exposure during childhood. In: Needleman, H. (ed.), *Low Level Lead Exposure: The Clinical Implications of Current Research*, pp.299- 315. Raven Press, New York.

Rabinowitz, M.B. and Bellinger, D.C. 1988. Soil lead - blood lead relationships among Boston children. *Bull. Environ. Contam. Toxicol.*, 41, 791-797.

Rabinowitz, M., Leviton, A., Needleman, H.L., Bellinger, D. and Waternaux, C. 1985. Environmental correlates of infant blood lead levels in Boston. *Environ. Res.*, 38, 96-107.

RCEP. 1983. *Royal Commission on Environmental Pollution, Lead in the Environment*, 9th Report. HMSO, London.

Reagan, P.L and Mielke, H.W. 1989. *The Social Costs of Childhood Lead Exposure*. Lead Coalition, St. Paul.

Reeves, R., Kjellstrom, T., Dallow, M. and Mullins, P. 1982. Analysis of lead in blood, paint, soil, and housedust for the assessment of human lead exposure in Auckland. *New Zealand J. Sci.*, 25, 221-227.

Richardson, R.M., Jeffery, D.W. and Kevany, J. 1982. Lead in Petrol (Letter). *Brit. Med. J.*, 284, 1705-1706.

Rinne, R.J., Linzon, S.N. and Stokes, P.M. 1986. Clean-up of lead contaminated sites - the Ontario experience. *Trace Substan. Environ. Health*, 20, 308-321.

Roberts, T.M., Gizyn, W. and Hutchinson, T.C. 1974. Lead contamination of air, soil, vegetation, and people in the vicinity of secondary lead smelters. *Trace Substan. Environ. Health*, 8, 155-166.

Roels, H.A., Buchet, J.P., Lauwerys, R.R., Bruaux, P., Claeys- Thoreau, F., Lafontaine, A. and Verduyn, G. 1980. Exposure to lead by the oral and the pulmonary routes of children living in the vicinity of a primary lead smelter. *Environ. Res.*, 22, 81-94.

RSC. 1985. *The Commission on Lead in the Environment, Lead in Gasoline: A Review of the Canadian Policy Issue*, (interim report), September. Royal Society of Canada, Ottowa, Ontario.

RSC. 1986. *The Commission on Lead in the Environment, Lead in the Canadian Environment: Science and Regulation* (final report), September. Royal Society of Canada, Ottowa, Ontario.

Rutter, M. 1981. The city and the child. *Am. J. Orthopsychiat.*, 51, 610-625.

Sauer, H. 1974. Relationship between trace element content of the drinking water and chronic diseases: observed effects of trace elements in drinking water on human health. In: *NAS 1979. Panel on the Geochemistry of Water in Relation to Cardiovascular Disease, Geochemistry of Water in Relation to Cardiovascular Disease*. National Academy of Sciences, Washington, DC.

Sayre, J.W. 1981. Dust lead contribution to lead in children. In: Lyman, D.R., Piantanida, L.G. and Cole, J.F. (eds.), *Environmental Lead*, pp.23-40. Academic Press, New York.

Sayre, J.W., Charney, E., Vostal, J. and Pless, I.B. 1974. House and hand dust as a potential source of childhood lead exposure. *AJDC*, 127, 167-170.

Schaum, J. 1984. *Risk Analysis of TCDD Contaminated Soil*. Environmental Protection Agency, Washington, DC.

Schwartz, J., Angle, C. and Pitcher, H. 1986. The relationship between childhood blood lead and stature. *Pediatrics*, 77, 281- 288.

Schwartz, J. and Otto, D. 1987. Blood lead, hearing thresholds, and neurobehavioral development in children and youths. *Arch. Environ. Health*, 422, 153-160.

Settle, D.M. and Patterson, C.C. 1980. Lead in Albacore: guide to lead pollution in Americans. *Science*, 207, 1167-1176.

SHAG (Science Health Advisory Group). 1984. *Lead Poisoning: Strategies for Prevention*. Department of Health and Mental Hygiene, Baltimore: Maryland.

Shellshear, I.D., Jordon, L.D., Hogan, D.J. and Shannon, F.T. 1975. Environmental lead exposure in Christchurch children: soil lead as a potential hazard. *New Zealand Med. J.*, 81, 382-386.

Silbergeld, E. 1983. Experimental studies of lead neurotoxicity: implications for mechanisms, dose-response and reversibility. In: Rutter, M. and Jones, R. (eds.), *Lead Versus Health*, pp.191-216. John Wiley, New York.

Silbergeld, E., Swartz, J. and Mahaffey, K. 1988. Lead and osteoporosis: mobilization of bone lead in post-menopausal women. *Environ. Res.*, 47, 79-94.

Simms, D.L. 1985. Towards a scientific basis for regulating lead contamination. *Conf. Heavy Metals Environ.*, 1, 16-27.

Simms, D.L. 1986. Towards a scientific basis for regulating lead contamination. *Sci. Tot. Environ.*, 58, 209-224.

Simms, D.L. and Beckett, M.J. 1987. Contaminated land: setting trigger concentrations. *Sci. Tot. Environ.*, 65, 121-134.

Skerfving, S., Schultz, A. and Ranstam, J. 1986. Decreasing lead exposure in Swedish children, 1978-1984. *Sci. Total Environ.*, 58, 225-229.

Stark, A.D., Quak, R.F., Meigs, J.W. and De Louise, E.R. 1982. The relationship of environmental lead to blood lead levels in children. *Environ. Res.*, 27, 372-383.

Steenhout, A. 1987. How clean is clean?: An ecotoxicological method for getting guidelines (air, dust, deposition, water....) for lead, keeping tooth and blood lead in the normal range. *Conf. Heavy Metals Environ.*, 2, 283-285.

Sturges, W.T. and Harrison, R.M. 1985. An assessment of the contribution from paint flakes to the lead content of some street and household dusts. *Sci. Total Environ.*, 44, 225-234.

Thorton, I., Culbard, E., Moorcroft, S., Watt, J., Wheatley, M. and Thompson, M. 1985. Metals in urban dusts and soils. *Environ. Toxicol. Letters*, 6, 137-144.

Tsuchiya, K., Okubo, T., Nagasaki, M., Nakajima, T., Kamijo, H. and Mizoguchi, I. 1977. Biologic effects of lead on school children of urban and suburban Tokyo. *Int. Arch. Occ. Environ. Health*, 38, 247-257.

Vimpani, G. 1985. The Port Pirie cohort study: blood lead concentration and childhood development assessment. In: Goldwater, L.J., Wysocki, L.M. and Volpe, R.A. (eds.), *Lead Environmental Health - The Current Issues*, pp.139-146. Duke University, Durham.

Voors, A.W. and Johnson, W.D. 1973. Arterial lead and cardiac death: a hypothesis.

Environ. Health Perspec., Exp. Issue No.4, p.97.

Vostal, J.J., Taves, E., Sayre, J.W. and Charney, E. 1974. Lead analysis of house dust: a method for the detection of another source of lead exposure in inner city children. *Environ. Health Perspec.*, 7, 91-97.

Warren, H.V., Delavault, R.E., Fletcher, K. and Wilks, E. 1971. *Trace Substan. Environ. Health*, 4, 94-103.

Watanabe, T., Fujita, H., Koizumi, A., Chiba, K., Miyasaka, M. and Ikeda, M. 1985. Baseline level of blood lead concentrations among Japanese farmers. *Arch. Environ. Health*, 40, 170-176.

Wheeler, G. and Rolfe, G. 1979. The relationship between daily traffic volume and the distribution of lead in roadside soil and vegetation. *Environ. Poll.*, 18, 265-274.

WHO. 1978. Report of a WHO Scientific Group, Environmental Health Criteria 6: *Principles and Methods for Evaluating the Toxicity of Chemicals, Part I.* WHO, Geneva.

Wilson, D. 1983. *Lead Scandal*, p.61. Hienemann Books, London.

Winneke, G., Beginn, U., Ewert, T., Havestadt, C., Kraemer, U., Krause, C., Thron, H.L. and Wagner, H.M. 1985a. Comparing the effects of perinatal and later childhood lead exposure on nueropsychological outcome. *Environ. Res.*, 38, 155-167.

Winneke, G., Brockhaus, A., Collet, W., Kramer, U., Krause, C., Thron, H.L. and Wagner, H.M. 1985b. Predictive value of different markers of lead-exposure for neuropsychological performance. *Conf. Heavy Metals Environ.*, 1, 44-47.

Winneke, G., Collet, W., Kramer, U., Brockhaus, A., Ewert, T. and Krause, C. 1989. Follow-up studies in lead exposed children. In: Smith, M.A., Grant, L.D. and Sors, A.I. (eds.), *Lead Exposure and Child Development: An International Assessment*, pp.260-270. MTP Press, Lancaster, UK.

Wolf, A.W., Ernhart, C.B. and White, C.S. 1985. Intrauterine lead exposure and early development. *Conf. Heavy Metals Environ.*, 2, 154-155.

Yankel, A.J., Lindern, I.H. and Walter, S.D. 1977. The Silver Valley lead study: the relationship between childhood blood lead levels and environmental exposure. *J. Air Poll. Cont. Assoc.*, 27, 763-767.

APPENDIX F

PHOSPHORIC ACID PRODUCTION WASTES

Introduction

EPA's Report to Congress studied two wastes from the production of phosphoric acid: phosphogypsum and process wastewater. Despite the clear and present danger posed by the disposal of these wastes, EPA tentatively concluded hazardous waste regulation of either waste is unwarranted. The sole basis for EPA's position is the alleged cost differential of Subtitle C and D regulation. However, as demonstrated below, the cost differential between Subtitle C and D regulation is not substantial, therefore a nonhazardous waste determination cannot be sustained on that basis. Moreover, even if a substantial cost differential exists, the risks to human health and the environment posed by the phosphoric acid production wastes are so severe that the expenditures of additional funds to properly control these wastes are amply justified.

Documented Risks and Damages

According to EPA, there are 21 facilities currently generating and managing the two phosphoric acid wastes. Incredibly, only one of the 21 facilities has either not contaminated the environment already or, according to EPA, does not present a substantial threat to human health and the environment.

Groundwater at all 11 facilities in Central Florida is already contaminated beyond the facility property boundary in excess of

drinking water standards.[1] At a minimum of three sites, the contamination extends to lower aquifers currently used as sources of drinking water.[2] In one instance, the areal extent of contamination is almost 28 acres in the upper aquifer and at least six acres in the lower aquifer.[3] In another instance, groundwater contamination adversely impacted 12 drinking water wells, resulting in their replacement with public water supplies.[4]

Incredibly, 10 of the 11 facilities are within 1,000 meters of a public water supply. Two of them have also contaminated saltwater marshes and surface waters, and EPA believes "similar releases" can occur at eight of the remaining nine facilities.

Groundwater contamination is also documented at four of the ten facilities not located in Central Florida. Contamination has extended into the potentially usable intermediate aquifer at a

---

[1] At one site reported by EPA, contamination has exceeded drinking water standards for chromium, radium 226, radium 228, gross alpha, chloride, iron, manganese, pH, total dissolved solids, fluoride, and sulfate. See Damage Case Investigation Technical Background Document, Report on Gardinier Facility, East Tampa, Florida.

[2] At the October 17, 1990 public hearing, representatives of the Florida Phosphate Council attempted to minimize the importance of the existing groundwater contamination in Central Florida, alleging the contamination had not yet migrated into lower aquifers used for drinking water at the "bulk" of the facilities. While this assertion is unsupported by the data in the Report, even if true, the assertion is irrelevant if it cannot be conclusively demonstrated that such migration will not take place in the future.

[3] Id., Report on CPI Facility, Plant City, Florida.

[4] The wells were contaminated with arsenic, lead, sodium, gross alpha, radium 226, radium 228, iron, pH, sulfate, and total dissolved solids. Id., Report on Seminole Facility, Bartow, Florida.

North Carolina facility.[5] Two of three Louisiana facilities have contaminated groundwater, as has one of two Idaho facilities.[6] Therefore, 15 of the 21 facilities have already contaminated groundwater.

According to EPA, groundwater contamination is also likely at three additional facilities, including the third Louisiana facility and a North Florida facility where residences are located 180 meters downgradient of either site.[7]

At two of the three facilities without documented groundwater contamination or a high potential for such contamination, EPA believes there is a high or moderate potential for surface water contamination. These plants are located in Idaho and Texas.

---

[5] This aquifer is located between 35-100 feet below the ground surface. Since the unlined ponds at this site are located below the seasonal high water table, the contaminants in the ponds are hydraulically connected to the groundwater at the site. Id., Report on Texasgulf Facility, Aurora, North Carolina.

[6] Groundwater contamination at the Idaho facility was first detected only two years after the facility began operating. Both spills and impoundment releases have contributed to the groundwater contamination over time. Monitoring of the spill releases indicates contaminants can quickly infiltrate the local groundwater system. See Damage Case Investigation Technical Background Document, Report on Nu-West Facility, Caribou, Idaho.

[7] In fact, according to the Louisiana Department of Environmental Quality, the groundwater at all three Louisiana sites exhibits elevated sulfate levels, therefore groundwater contamination has already occurred at the third Louisiana facility. Indeed, all three facilities have performed groundwater quality investigations in response to the detected contamination. In addition, the groundwater at a fourth Louisiana facility EPA judged to be "on standby" in 1988 exhibits elevated levels of sulfate, and radium 226 concentrations over 12 times greater than federal drinking water standards were detected in June 1989. See Memorandum from Joey Hebert to Louis Johnson, Administrator, LADEQ Groundwater Protection Division, October 8, 1990.

Furthermore, the cancer risk posed by the inhalation of radon from the phosphogypsum stacks is greater than 1 X 10^{-5} at 17 of 21 facilities. When summed with the cancer risks posed by the inhalation of radionuclides in particle emissions, and arsenic and chromium blown from the stacks, the total cancer risk approaches 1 X 10^{-4}. A cancer risk of this magnitude would typically trigger the initiation of a corrective measures study and then corrective action under the rules recently proposed by the Agency for hazardous waste facilities. See 55 Fed. Reg. 30816, 30826 (July 27, 1990). The Texas plant mentioned above is one of four plants posing the greatest risk of cancer through the inhalation route.

Finally, 18 of 21 plants are located near "sensitive environments", including eight plants in 100 year floodplains, three plants in wetlands and 13 others within one mile of a wetland, one plant in a fault zone, and two in karst terrain. Accordingly, these facilities are in locations where substantial releases can occur suddenly, migrate in an unattenuated or undiluted fashion, and/or adversely impact important wildlife habitat and natural ecosystems.

In summary, environmental contamination has already occurred at the overwhelming majority of phosphoric acid production facilities. For most of the remaining facilities, it is simply a matter of time, and the locations of these facilities will often exacerbate either the magnitude or the adverse consequences of the present or potential contamination. Furthermore, the inhalation cancer risks posed by these plants is a matter of grave and

immediate concern.

Toxicity of the Wastes

The dramatic record of environmental degradation associated with the two phosphoric acid production wastes is no surprise, considering the physical and chemical properties of the wastes and the way they are managed. Virtually all of the groundwater contamination incidents described above were caused by the migration of contaminants from unlined units. Even EPA concluded "current practices are inadequate to protect human health and the environment from the potential danger posed by these wastes."[8]

This acknowledged lack of proper controls is particularly disturbing since the physical and chemical properties of the wastes meet the statutory definition of hazardous waste, are very similar to wastes current regulated as hazardous, and but for the statutory exemption, would be regulated as hazardous in many instances. Accordingly, it seems clear that left to their own devices, the regulated community and state agencies are unable or unwilling to manage these wastes in a manner commensurate with their risk throughout the United States.

In the absence of the statutory exemption, the process wastewater would be regulated as hazardous due to its acidity and heavy metal constituents. In 42 of 68 samples taken, the pH was less than 2.0, and would be considered a hazardous waste under 40

---

[8] Report To Congress at 12-31.

CFR 261.22.[9] At two of the facilities, the pH was less than 1.0. EPA considers a pH less than 1.0 to be a "high hazard" waste, and if the pH was less than 1.0 industrywide, process wastewater would not even be eligible for the Bevill exemption from hazardous waste regulation.[10]

At four of seven facilities sampled, and in at least two thirds of the samples taken at these facilities, the process wastewater contained heavy metals in concentrations sufficient to exhibit the hazardous waste toxicity characteristic. The heavy metals of concern are cadmium (exceeded characteristic levels in 19 samples), chromium (exceeded characteristic levels in three samples), and selenium (exceeded characteristic levels in one sample).[11] Significantly, while the selenium exceedence may appear trivial since it only occurred once, at least one of the documented groundwater contamination incidents concerns the

---

[9] The corrosivity characteristic based upon a lower pH limit of 2.0 was promulgated by EPA because wastes exhibiting low pH can cause harm to human tissue, promote the migration of contaminants from other wastes, react dangerously with other wastes, and harm aquatic life. See 45 Fed. Reg. 33109 (May 19, 1980).

[10] A pH of 1.0 represents a one order of magnitude increase in acidity since the pH scale is logarithmic. As noted previously, wastes exhibiting a pH less than 1.0 are clearly high hazard wastes. See 54 Fed. Reg. 36600 (September 1, 1989).

[11] The characteristic levels were established by EPA at 100 times drinking water standards because "anything which fails the EP at this factor has the potential to present a substantial hazard regardless of the attenuation mechanisms at play....EPA is quite convinced that any waste which fails the EP at the 100-times standard presents the potential for substantial hazard if improperly managed no matter what leaching medium it is actually exposed to." 45 Fed. Reg. 33111-2 (May 19, 1980).

presence of selenium in excess of drinking water standards.[12]

In addition to the three heavy metals, other contaminants are present in the wastewater at substantial concentrations that present a significant threat to human health and the environment. For example, phosphorous and phosphate are present in the wastewater at concentrations posing a substantial risk to surface water in all the samples taken. Maximum concentrations of these contaminants exceed 1000 times water quality screening levels. In total, process wastewater contains 30 constituents at concentrations that potentially pose substantial risks to human health and the environment (See Exhibit 12-5 from the Report to Congress reproduced below).

In the case of phosphogypsum, four constituents in the solids and 17 constituents in the leachate from the solids pose a substantial potential risk to human health and the environment. Chromium was detected in the leachate at concentrations exceeding characteristic levels at one of eleven facilities sampled. Arsenic, lead, cadmium, fluoride, zinc, antimony, copper, and thallium were also present in the leachate in concentrations that could cause adverse human health effects. The concentration of arsenic could pose a cancer risk of less than 1×10^{-5} through long-term drinking exposures.

It should be noted that insofar as the phosphogypsum is comanaged with process wastewater, these leach test results vastly understate the mobility of the constituents in their actual

---

[12] Report to Congress at 12-20.

Exhibit 12-5
Potential Constituents of Concern in Phosphoric Acid Process Wastewater (Total)[a]

Potential Constituents of Concern	No. of Times Constituent Detected/No. of Analyses for Constituent	Screening Criteria[b]	No. of Analyses Exceeding Criteria/ No. of Analyses for Constituent	No. of Facilities Exceeding Criteria/ No. of Facilities Analyzed for Constituent
Arsenic	77 / 78	Human Health*	76 / 78	15 / 15
		Resource Damage	37 / 78	8 / 15
		Aquatic Ecological	21 / 78	5 / 15
Phosphorus	31 / 31	Aquatic Ecological	31 / 31	10 / 10
Phosphate	38 / 38	Aquatic Ecological	38 / 38	9 / 9
Cadmium	73 / 77	Human Health	65 / 77	14 / 15
		Resource Damage	69 / 77	14 / 15
		Aquatic Ecological	68 / 77	14 / 15
Chromium	75 / 78	Human Health	26 / 78	8 / 15
		Resource Damage	65 / 78	14 / 15
		Aquatic Ecological	44 / 78	9 / 15
Aluminum	58 / 59	Resource Damage	42 / 59	8 / 10
		Aquatic Ecological	53 / 59	10 / 10
Gross Alpha	46 / 47	Resource Damage	40 / 47	11 / 11
Gross Beta	34 / 47	Resource Damage	30 / 47	9 / 9
Radium-226	86 / 89	Human Health*	26 / 89	9 / 13
		Resource Damage	14 / 89	5 / 13
Phenol	4 / 5	Resource Damage	4 / 5	3 / 3
Iron	54 / 55	Resource Damage	52 / 55	10 / 10
		Aquatic Ecological	33 / 55	6 / 10
Manganese	44 / 44	Resource Damage	41 / 44	10 / 10
Nickel	68 / 72	Resource Damage	14 / 72	8 / 14
		Aquatic Ecological	57 / 72	12 / 14
Lead	64 / 75	Human Health	28 / 75	8 / 15
		Resource Damage	51 / 75	12 / 15
		Aquatic Ecological	22 / 75	7 / 15
Vanadium	38 / 41	Human Health	18 / 41	5 / 10
		Resource Damage	30 / 41	9 / 10
Sulfate	57 / 57	Resource Damage	43 / 57	10 / 11
Copper	69 / 74	Human Health	1 / 74	1 / 14
		Resource Damage	1 / 74	1 / 14
		Aquatic Ecological	37 / 74	7 / 14

(a) Constituents listed in this table are present in at least one sample from at least one facility at a concentration that exceeds a relevant screening criterion. The conservative screening criteria used in this analysis are listed in Exhibit 2-3. Constituents that were not detected in a given sample were assumed not to be present in the sample.

(b) Human health screening criteria are based on cancer risk or noncancer health effects. "Human health" screening criteria noted with an "*" are based on 1×10^{-5} lifetime cancer risk; others are based on noncancer effects.

Exhibit 12-5 (cont'd)
Potential Constituents of Concern in Phosphoric Acid Process Wastewater (Total)[a]

Potential Constituents of Concern	No. of Times Constituent Detected/No. of Analyses for Constituent	Screening Criteria[b]	No. of Analyses Exceeding Criteria/ No. of Analyses for Constituent	No. of Facilities Exceeding Criteria/ No. of Facilities Analyzed for Constituent
Boron	2 / 2	Resource Damage	1 / 2	1 / 1
Molybdenum	34 / 39	Resource Damage	27 / 39	10 / 10
Antimony	27 / 70	Human Health	10 / 70	6 / 14
Thallium	18 / 56	Human Health	18 / 56	5 / 13
Cobalt	35 / 41	Resource Damage	7 / 41	3 / 10
Silver	43 / 73	Aquatic Ecological	12 / 73	5 / 14
Mercury	45 / 74	Aquatic Ecological	6 / 74	4 / 14
Fluoride	53 / 53	Human Health Resource Damage	3 / 53 1 / 53	1 / 12 1 / 12
Zinc	77 / 77	Aquatic Ecological	9 / 77	3 / 14
Chloride	26 / 26	Resource Damage	2 / 26	1 / 6
Beryllium	66 / 71	Resource Damage	2 / 71	1 / 14
Selenium	56 / 73	Human Health Resource Damage Aquatic Ecological	1 / 73 2 / 73 2 / 73	1 / 14 1 / 14 1 / 14
pH	68 / 68	Resource Damage	59 / 68	13 / 14

(a) Constituents listed in this table are present in at least one sample from at least one facility at a concentration that exceeds a relevant screening criterion. The conservative screening criteria used in this analysis are listed in Exhibit 2-3. Constituents that were not detected in a given sample were assumed not to be present in the sample.

(b) Human health screening criteria are based on cancer risk or noncancer health effects. "Human health" screening criteria noted with an "*" are based on $1x10^{-5}$ lifetime cancer risk; others are based on noncancer effects.

Release, Transport, and Exposure Potential

This analysis evaluates the baseline hazards of phosphogypsum and phosphoric acid plant process wastewater as it was generated and managed at the 21 phosphoric acid facilities in 1988. It does not assess the hazards of off-site use or disposal of these wastes or the risks associated with variations in waste management practices or potentially exposed populations in the future because of a lack of data on off-site and projected future conditions.

EPA has identified a variety of documented cases of dangers posed by the release of constituents from these wastes to the environment, and EPA's Office of Air and Radiation (OAR) has studied air pathway risks (from radionuclides) posed by these wastes. Consequently, the Agency has used information on documented and potential damages from these other analyses to support its evaluation of the release, transport, and exposure potential of the current management of these wastes.

codisposal environment. EPA's data was obtained utilizing the EP leaching procedure, which employs acetic acid of pH approximately 5.0 as the leaching medium. However, as discussed above, process wastewater typically exhibits a pH at least three orders of magnitude lower, and is therefore a much more aggressive leaching medium than acetic acid. Accordingly, the EP leach test will underestimate the leaching potential of phosphogypsum as it is actually managed, thus the true number of constituents posing a potential hazard and the magnitude of the potential hazard is much larger than the EPA data indicates. The Agency's failure to sample phosphogypsum using a more aggressive leaching medium, or to acknowledge the obvious inadequacy of its reliance on the EP leach test in this instance, is an important defect in the Report to Congress.

Radiation exposure from phosphogypsum is also a matter of substantial concern. Gross alpha and beta radiation levels from phosphogypsum exceed typical levels in soils by 10-100 times. Radium concentrations exceed human health screening criteria in 26 of 29 samples, even based upon an unprotective 1×10^{-5} lifetime cancer risk.

In summary, the constituents present in both phosphogypsum and process wastewater pose substantial threats to human health and the environment when improperly managed or released into the environment. As demonstrated by the documented damage cases and the prevalent waste management practices in the industry, these wastes are not properly managed, therefore the threats are real,

immediate, and ongoing.

Cost Impact Assessment

Notwithstanding the documented and potential risks posed by phosphogypsum and process wastewater to human health and the environment, the Agency has not proposed Subtitle C regulation for these wastes solely due the alleged economic impact that would result from regulating the wastes as hazardous. However, a close examination of the economic data upon which EPA relies reveals the cost differential between a Subtitle C and D program for these wastes is minimal. Therefore, since the framework for a Subtitle C program is in place and would become effective much more rapidly than a corresponding Subtitle D program, resulting in greater environmental benefits within a shorter time frame, the Agency's proposed Subtitle D approach for the wastes is irrational and unjustified.

To determine the economic impact of Subtitle C regulation for phosphogypsum and process wastewater, the Agency first must determine the wastes and the facilities that would be subject to Subtitle C regulation if the Bevill exemption was lifted. In the case of process wastewater, the Agency assumed all wastewater at every facility would be regulated as hazardous, even though its sampling data at least some of the process wastewaters did not exhibit one or more hazardous waste characteristics. The Agency based this assumption upon a determination that all process wastewater is comingled and comanaged at every facility, and is not

capable of being segregated, an assumption the Agency admits is not valid.[13]

Significantly, even assuming the assumption is valid, the annual cost of compliance differential between Subtitle C and Subtitle D regulation is less than two million dollars at all 21 facilities combined. This two million dollars translates into an additional 0.9% above the $213,000,000 EPA estimates will be required to comply with a Subtitle D regulatory program. The reason for this slight cost differential is because the Subtitle C and D controls that would be imposed are "nearly identical", and the only savings that would result from a Subtitle D program are "permitting and associated costs".[14] Since a permitting program under Subtitle D has not been established and will not be for several years, even these minuscule estimated cost savings are purely hypothetical.

In the case of phosphogypsum, the Agency assumed the waste at 11 of 21 facilities would be regulated as hazardous. The Agency arrived at this assumption by adding the one facility where phosphogypsum exhibited a hazardous waste characteristic through sampling and all 10 facilities which were not sampled. Since the phosphogypsum at only one of the 11 facilities that were sampled exhibited a hazardous waste characteristic, the Agency's assumption that all unsampled phosphogypsum would also exhibit a hazardous waste characteristic is clearly invalid and results in vastly

---

[13] Id. at 12-48.

[14] Id. at 12-50, 12-52.

overstated compliance costs.

Utilizing the invalid assumption, EPA estimates Subtitle C compliance costs at all 11 facilities would be $216,738,000 annually, while Subtitle D annual compliance costs would equal $166,188,000. Significantly, the analogous costs for the only facility where the phosphogypsum has been determined to exhibit a hazardous waste characteristic is $1,276,000 under a Subtitle C program, and $483,000 under a Subtitle D program. The Agency acknowledges this facility would suffer no economic impact if phosphogypsum were regulated as a hazardous waste.[15] Therefore, the vast dollar differentials between a Subtitle C and D program are solely due to EPA's invalid assumption regarding the remaining 10 facilities.[16]

Furthermore, the alleged cost savings between the Subtitle C and D programs are due to a second assumption that under a Subtitle D regulatory program, capping of the phosphogypsum stacks would not be required and the stack slopes can remain as they currently are. Given the cancer risks posed through the inhalation route described above, and the documented stack failures or near failures resulting in significant environmental releases, this assumption is also

---

[15] Id. at 12-54.

[16] Interestingly, in developing Subtitle C compliance cost estimates for ferrous wastes, EPA assumed facilities with unsampled wastes would not be subject to Subtitle C regulation "because the wastes did not exhibit a hazardous waste characteristic at the majority of facilities sampled and there were only a small number of exceedences." Id. at 8-51. These factors are even more dramatic in the case of phosphogypsum.

completely unjustified.[17]

Finally, the Agency compounded the effect of its assumptions by considering the cost impacts of regulating phosphogypsum and process wastewater together rather than individually. EPA purports to justify the aggregation by claiming phosphogypsum and process wastewater are "typically" comanaged, but there is no evidence presented as to how often this is the case or whether segregation techniques can be employed. Indeed, the Agency acknowledges only a portion of the process wastewater flow is typically comanaged with phosphogypsum, and further segregation may be possible.[18]

In summary, the Agency employed a range of assumptions that vastly overstated the cost of Subtitle regulation of these wastes. In fact, the cost of Subtitle C and D controls are relatively similar, and significant compliance costs will be imposed upon the regulated community under either scenario because of the grossly inadequate waste management practices utilized by the industry to date.[19]

---

[17] For a description of damages associated with stack failures, see pages 12-27 through 12-31 of the Report.

[18] Id. at 14, 12-60.

[19] At the October 17, 1990 public hearing, representatives of the regulated community argued EPA had understated the costs associated with hazardous waste regulation of phosphoric acid production wastes. In particular, they asserted the costs of Subtitle C corrective action were not considered and would dwarf the costs identified by EPA, thereby further demonstrating Subtitle D regulation is preferable for the wastes. This argument lacks merit. It incorrectly assumes similar corrective action costs would not be imposed under a Subtitle D program, an assumption that cannot be made at the present time. Either Congress or EPA may impose facilitywide corrective action at Subtitle D facilities by incorporating inactive units at active sites into the mining waste

Conclusion

Phosphogypsum and process wastewater are inadequately managed, and pose as great a risk to human health and the environment as many wastes currently regulated as hazardous. The cost differential between a Subtitle C and D regulatory program is insignificant, and even if it were substantial, the documented damage cases and the intrinsic hazards posed by these wastes demonstrate the need for stringent control of these wastes as soon as possible. Only a Subtitle C regulatory program can provide those controls in a short and certain time frame, since the administrative and legislative structure for the program is in place and state programs are currently operating within it. The Subtitle D approach would require vast legislative and regulatory changes at both the federal and state level to implement and enforce, resulting in uncertainty and further unnecessary delay.

---

regulatory program. In addition, since EPA recently proposed a site specific risk-based corrective action program under Subtitle C, corrective action requirements under the Subtitle C and D programs may be quite similar in scope and effect.

The regulated community further alleged at the hearing that Subtitle C regulation would threaten the viability of the industry. However, ongoing improvements in facility design and management at several facilities, including Texasgulf in North Carolina and one or more in Florida, indicate substantial cost expenditures may be incurred by this industry and still remain profitable. Indeed, without Subtitle C regulation, the expenditures will not be made uniformly, potentially resulting in both resistance to upgrading and economic impacts caused by widespread variations in the timing and level of improvements that may be required of one or more facilities sometime in the future.

Appendix G
Titanium Tetrachloride Wastes

Chloride process waste solids from titanium tetrachloride production are one of four special wastes that EPA considers may merit regulation under Subtitle C of RCRA. Based on the information presented in the Report to Congress, it is clear that this special waste poses a potentially significant threat to human health and the environment. In addition, the Report does not go far enough to identify the extent of the hazard that this waste may create now or in the future. Accordingly, the waste should be regulated as hazardous.

Of sixteen samples of chloride process waste solids analyzed, almost one-fourth failed the EP toxicity test for either chromium or lead. All four facilities with chloride process waste solids that potentially exhibit the toxicity characteristic have a high potential to contaminate ground water resources.[1] In addition, ten of twelve samples exceeded EPA's screening criteria for radium. In some cases, levels of arsenic in the solid waste and in leachate derived from it also exceeded EPA screening criteria. A variety of different feedstocks may be used in manufacturing titanium tetrachloride,[2] leading presumably to the generation of solid waste of a rather variable character. Clearly, more

---

[1] Report to Congress at 13-25.

[2] Id. at 13-3.

than sixteen samples must be analyzed before the maximum levels of toxic constituents in the waste can be conclusively determined.

For example, arsenic from chloride process waste solids is recognized in the Report as posing a potential cancer threat via air, accidental ingestion, and ground water. However, the magnitude of the threat may be substantially understated in the Report. The Report notes that "arsenic concentrations in the solids . . . vary over five orders of magnitude."[3] The upper bound for arsenic levels cannot possibly have been determined: only eight samples of solid waste -- not even one from each facility -- were analyzed for arsenic, and the arsenic levels in the samples that were analyzed were far too variable.

Threats to fragile ecosystems from contaminated waters and airborne particulates are also possible. Fully seven of the nine facilities are located within one mile of sensitive environments, with six located in the immediate vicinity of wetlands.[4] In this regard, both the sensitivity of aquatic life to heavy metals poisoning and the tendency of certain metals to accumulate in fish tissues are cause for concern. However, the possible threat of chloride process waste solids to these natural environments and to the "recreational" food chain is virtually ignored in the Report.

---

[3] Id. at 13-5.

[4] Id. at 13-10,11,12.

EPA further understates the risks posed by chloride process waste solids by limiting its assessment of risks to current facilities, current waste management practices, current population patterns, and current water uses. Although it is doubtless a useful exercise to examine existing risks from the nine operating titanium tetrachloride facilities, the assessment cannot end there.

For example, the threat to ground water quality and to drinking water from exempted waste at the Kerr-McGee facility in Hamilton, Mississippi, is deemed to be high in the report. However, it is stated that the risk may perhaps be reduced by the discharge of ground water to McKinley Creek, which runs in between the waste impoundments and the nearest drinking well, which is only 700 m distant.[5] The present lack of a drinking water well closer to the facility does not reduce the "potential" hazard of the waste, particularly since EPA does not demonstrate why it would be unreasonable for a drinking water well to be placed even closer to the facility in the future.

Indeed, EPA's own model predicts a lifetime cancer risk from arsenic of 3×10^{-4} for the ground water 60 m from the impoundment, at the property line.[6] By ignoring or minimizing the importance of this risk, the Agency in effect condones the contamination of ground water that may be caused

---

[5] Id. at 13-9.

[6] Id. at 13-17.

by this facility. The adequacy of waste management practices should not depend on solely on where current water wells happen to be located.

Three of the titanium facilities have waste impoundments located in 100-year floodplains. However, the occurrence of a large flood that could liberate the waste is termed "unlikely" in the Report.[7] Yet, if there is only a one in 100 chance of flooding at each of three facilities for a given year, then there is a better than 50% chance that one of the facilities will experience flooding within the next twenty-five years.

The focus on current facilities and practices, which runs throughout the entire Report to Congress, is particularly unfortunate in the case of chloride process waste solids. Production of titanium dioxide, the main end product derived from titanium tetrachloride, has increased by over 50% since 1982 and has set record levels each year since then.[8] Production of titanium metal (sponge) also set a record in 1989. Titanium dioxide producers have been operating at almost full capacity, and a number of them, including Du Pont, Kemira, Kerr-McGee, Kronos, and SCM are planning significant expansions in capacity over the next

---

[7] Id. at 13-16.

[8] Minerals Yearbook 1985 (Washington, DC: U.S. Government Printing Office, 1987), p. 975. L. E. Lynd, E&MJ, March 1990, p. 41.

few years.[9] Sponge producers including Oremet, Timet, and RMI, are also expanding their operations. Demands for titanium dioxide and titanium sponge are expected to grow at annual rates of 3% and 5% respectively over the next several years.[10]

Thus the environmental danger resulting from the continued exemption of chloride process solids will only increase in the future. Our efforts to guard against this growing danger must not depend upon the serendipitous presence of creeks or the absence of water wells from polluted regions, or upon the regular occurrence of moderate rainfall. In view of the hazardous nature of this waste and of the identical costs estimated for Subtitle C and Subtitle D regulatory programs, we see every reason to remove this material from the scope of the Bevill exclusion and to regulate it as a hazardous waste.[11]

---

[9] L. E. Lynd, E&MJ, March 1990, p. 43.

[10] Id.

[11] The nine titanium tetrachloride production facilities generate an average of 46,000 MT/yr of chloride process waste solids. This amount barely qualifies for the Bevill exemption as a "high volume" waste and is clearly amenable to Subtitle C regulation. See 54 Fed. Reg. 36613 (September 1, 1989).

Appendix H

ZINC WASTES

As EPA acknowledges, both the processed slag and the ferrosilicon wastes (zinc slag wastes) from the one pyrometallurgical primary zinc production facility that generates Bevill wastes (ZCA in Monaca, PA) have relatively high intrinsic hazards. "Based on EP leach test results, 25 out of 36 samples of processed slag and 1 out of 1 sample of ferrosilicon from the Monaca facility contain lead concentrations in excess of the EP toxicity regulatory levels" (p. 14-26). Additionally, because the total annual generation of these two wastes is equivalent to the 45,000 metric ton "high-volume" threshold defined in the September 1, 1989 final rule on the Mining Waste Exclusion, there is no justification for excluding these wastes from RCRA Subtitle C standards while wastes of similar hazards (according to EP leach test results) and volumes are not excluded from hazardous waste management requirements.

Potential Risks

Despite the intrinsic hazards of processed slag and ferrosilicon wastes, EPA did not conclude that RCRA Subtitle C regulation of these wastes is warranted, based on the Agency's predictive modeling results that show: 1. metals leached from zinc slag wastes will not reach the useable aquifer within 200 years, and 2. the Ohio River will assimilate the "chronic loading of contaminants that is expected on a routine basis" (p. 14-26). The process used to arrive at conclusion one is problematic, as

discussed below, and conclusion two is unacceptable because it rejects, on its face, protection of human health and the environment.

To arrive at its conclusion of overall low risk, EPA relies on its MMSOILS modeling prediction for the time it would take contaminants released from the ZCA facility to reach groundwater. EPA utilized in its modeling exercise, however, an inaccurate figure for the depth to groundwater, which the Agency admits is probably greater than the depth to the shallowest groundwater at the site. Specifically, EPA uses as an input to the MMSOILS model groundwater from the relatively deep (approximately 24 meters) aquifer underlying the ZCA site.[1] EPA acknowledges, however, that it "has no data on the presence of shallower ground water at this site, but considering the close proximity of the facility to the Ohio River, shallow ground water probably does exist" (p. 14-10). Therefore, EPA arbitrarily ignores the likely existence of shallow groundwater in its modeling efforts. In order to protect human health and the environment, shallow groundwater at this site must be protected from contamination, and its distance below the units should have been utilized in the predictive model, following a definitive hydrogeologic investigation.

---

1. EPA does not even know for a fact if the drinking water well serving the Beaver County Home and Hospital, located around 120 meters from the facility, withdraws water solely from the deep aquifer.

By incorporating the distance to the shallower groundwater into the MMSOILS model, the result inevitably would be a significantly earlier prediction of groundwater contamination by heavy metals than the 340 to 10,000 years predicted by the model. Such a prediction surely would require EPA to conclude that these wastes do not pose an "overall low risk," given the wastes' relatively high intrinsic hazards. Additionally, since EPA's modeling results show that groundwater will eventually be contaminated with heavy metals and RCRA requires EPA to protect our nation's groundwater resources for future uses, RCRA Subtitle C management standards for these zinc slag wastes are clearly warranted.

Indeed, based on the site-specific characteristics of the facility, reliance on the model is misguided. The fact is that each of the ZCA site-specific design and location characteristics is likely to promote, rather than prevent, environmental contamination: high precipitation and groundwater recharge rates, permeable soils, absence of liners and leachate collection systems, a distance to surface water of only 60 meters, relatively steep slopes, no stormwater run-off controls, and location in a 100-year floodplain. These characteristics clearly enhance the likelihood of serious environmental damages at the Monaca site. The lack of apparent damage at the site does not necessarily indicate that this type of degradation is not occurring, but may instead reflect the inadequacy of the facility's groundwater monitoring system, particularly as it

pertains to the Monaca site's relatively large non-hazardous waste management units.

The four[2] damage cases described in the Report to Congress and its technical background document provide much stronger evidence of the contamination potential of zinc slag wastes than the apparent lack of damage at the Monaca site. These damage cases include one Superfund site (Palmerton Zinc in Palmerton, PA) with extensive environmental contamination caused by zinc slag; one facility where laboratory tests linked the leachability of its slag with heavy metals in the Rio Grande that could only be controlled following pond lining and stormwater controls (ASARCO in El Paso, TX); and one facility discharging acutely toxic concentrations of heavy metals to surface waters (ASARCO in Columbus, OH).

Slag Utilization

As discussed above in the body of these comments, EPA cannot adequately assess the risks of non-regulation under RCRA Subtitle C without sufficient knowledge of off-site waste management techniques. In the case of zinc slag wastes, this lack of knowledge concerning the risks of waste utilization techniques could result in, EPA admits, an "underestimate [of] the risks associated with these wastes at other locations" (p. 14-26). Nevertheless, even though "EPA is concerned that some types of

---

2. Only two are mentioned in Section 14.3.3, "Findings Concerning the Hazards of Zinc Slag and Ferrosilicon" (p. 14-17).

slag and ferrosilicon utilization may not be protective of human health and the environment" (Ibid; see also the discussion in Appendix E on the benefits of decreased utilization of materials that can disperse lead into the environment), EPA still recommends in the Report to Congress that these wastes continue to be managed outside the hazardous waste system. Such a conclusion conflicts with the overall intent of RCRA and, unfortunately, can result in significant non-point pollution through utilization of the processed slag as road rock (p. 14-19), for example. Given EPA's insufficient information about the hazards of zinc slag waste utilization, EPA either should have collected more information before reaching its conclusion of "overall low risk," or should have upgraded the overall risk, particularly since the Agency suspects it underestimated the risks associated with waste utilization.

Cost Impact Assessment

EPA admits that the economic impacts on the Monaca facility of increased waste management requirements would be only "marginally significant at worst" (p. 14-25). The Report to Congress describes at least two options that will allow the Monaca facility to continue operations should EPA decide to regulate zinc slag wastes as hazardous wastes under RCRA Subtitle C. First, ZCA can "adopt the practices of other smelter operations and shift to secondary processing" (Ibid.), which would enhance its pollution prevention efforts, as discussed below. Second, EPA states that ZCA "might be able to raise

prices sufficiently to offset some or all of its compliance costs, at least in the short term" (Ibid.), given the currently tight worldwide supply of zinc. These alternatives allow the ZCA facility to remain economically viable, while simultaneously increasing the facility's protection of the environment through regulation of its zinc slag wastes under RCRA Subtitle C.

Pollution Prevention Opportunities

Continued use of the Monaca facility as a primary zinc production facility appears to pose a disincentive to overall pollution prevention efforts for this industrial sector. Though the Report to Congress does not explicitly say so, it can be inferred from the Report that the three other active primary zinc producers, who all use electrolytic production techniques, produce less waste because they do not generate any Bevill wastes (p. 14-1). Thus, by not regulating the Monaca zinc slag wastes under RCRA Subtitle C, the facility is, in effect, being rewarded for its higher waste generation rate.

Though the Report to Congress states that "there is little potential for further reducing the amounts of waste slag being generated by increased recycling efforts...[since] the facility adjusts the amount of zinc slag being returned to the process to extract the maximum amount of zinc from the inputs" (p. 14-18), the Agency should explore whether the toxicity (not volume) of the waste slag could be reduced through increased recycling. That is, if greater recycling occurred at the Monaca facility, perhaps through increased crushing of the slag which would

produce increased zinc fines, more zinc could be incorporated into product and less into waste slag, thereby increasing the facility's pollution prevention efforts. Of course, if increased recycling occurs, the amount of Bevill waste requiring disposal would fall below the "high-volume" threshold, further arguing for RCRA Subtitle C management standards for zinc slag wastes.

Another way to increase the amount of pollution prevention at ZCA also exists. As the Report to Congress notes, the Monaca facility could be converted to a secondary processor, which would presumably reduce its zinc slag waste generation rate (p. 14-25).

Conclusion

The high intrinsic hazard and low volume of processed slag and ferrosilicon wastes, in combination with the serious environmental contamination problems at numerous other primary zinc pyrometallurgical zinc processing sites, argues for regulation of the zinc slag wastes at the Monaca facility under RCRA Subtitle C. The site-specific design and location characteristics clearly will not prevent releases to ground and surface waters, and the lack of current apparent damages is in no way sufficient to guarantee the protectiveness of this facility in the future. Moreover, non-regulation under RCRA Subtitle C has the potential to increase overall risks through the currently unknown hazards of slag utilization. Finally, under a RCRA Subtitle C regulatory scenario, alternative operations at the ZCA facility can allow the facility to remain profitable and increase its contribution to pollution prevention.

CERTIFICATE OF RESOLUTION ADOPTING RULES

I, Charles W. Williams, do hereby certify that I am the Commissioner of the Minnesota Pollution Control Agency, an agency duly authorized under the laws of the State of Minnesota, and that the following is a true, complete, and correct copy of a resolution adopted at a meeting of the Minnesota Pollution Control Agency duly and properly called and held on the twenty-first day of May, 1991, that a quorum was present at said meeting, that a majority of those present voted for the resolution and that said resolution will be set forth in the minutes of said meeting and has not been rescinded or modified:

> BE IT RESOLVED, that the Minnesota Pollution Control Agency hereby approves and adopts the attached rule amendments governing the management, storage, treatment, and disposal of hazardous waste, Minn. Rules pts. 7045.0020, 7045.0102, 7045.0120, 7045.0135, 7045.0139, 7045.0141, and 7045.0265, pursuant to the authority vested in the Minnesota Pollution Control Agency by Minn. Stat. § 116.12, subd. 1 (1990).
>
> BE IT FURTHER RESOLVED, that prior to publishing the rules as adopted in the State Register, the Commissioner is authorized to make any form changes to the rules that the Revisor of Statutes requires the Minnesota Pollution Control Agency to make in order to obtain the Revisor's Certification as required by Minn. Stat. § 14.07, subd. 2 (1990).
>
> BE IT FURTHER RESOLVED, that the Minnesota Pollution Control Agency adopts the Findings of Fact, Conclusions, and Order Adopting Rule Amendments and that the Commissioner is hereby authorized to sign the above-mentioned document on behalf of the Minnesota Pollution Control Agency and to perform the necessary acts to provide that the rule amendments shall have the force and effect of law.

IN WITNESS WHEREOF, I have hereunto subscribed my name this 22nd day of May, 1991.

CHARLES W. WILLIAMS
Commissioner

STATE OF MINNESOTA
POLLUTION CONTROL AGENCY

In the Matter of Proposed Amendments Governing Mining Wastes, the Lists of of Hazardous Wastes, Shipments of Hazardous Waste Out-of-State, and Mixtures of Hazardous and Nonhazardous Wastes, Minn. Rules Pts. 7045.0020, 7045.0102, 7045.0120, 7045.0135, 7045.0139, 7045.0141, and 7045.0265

FINDINGS OF FACT, CONCLUSIONS, AND ORDER ADOPTING RULES

The above-entitled matter came on for decision before the Minnesota Pollution Control Agency (MPCA) on the day of May 21, 1991. After affording all interested persons the opportunity to present written and oral data, statements, and arguments to the MPCA, in accordance with statutory requirements regarding the adoption of noncontroversial rules, after considering the Statement of Need and Reasonableness, after considering all of the evidence adduced upon the records, files, and proceedings herein, the MPCA, being fully advised in the premises, hereby adopts the following Findings of Fact, Conclusions, and Order:

FINDINGS OF FACT

1. Notice of the MPCA's intent to adopt the above-entitled rule amendments without a public hearing was published in the State Register on March 18, 1991 (15 SR 2087-2092), and was sent by mail to all persons on the list maintained by the MPCA pursuant to Minn. Stat. §§ 14.14, subd. 1a. and 14.22 (1990) on March 14, 1991.

2. The Statement of Need and Reasonableness was prepared prior to mailing and publication of the notice and was made available to the public.

3. All persons were given the opportunity to submit comments on the rule amendments for 30 days after notice of proposed rulemaking. The 30-day comment period, as set out in the notice, expired on April 17, 1991.

4. No requests for public hearing were received during the comment period.

5. No requests for notice of submission of the adopted rule amendments to the Attorney General were received by the MPCA.

6. During the comment period the MPCA received two written comment letters. The MPCA received letters from the United States Environmental Protection Agency (EPA), Region V Office and the Environmental Defense Fund. As a result of the comments from EPA, the MPCA finds that two modifications to the proposed rule amendments are justified by the record in this proceeding, as follows:

a. The proposed rule amendments to Minn. Rules pt. 7045.0120, item I define the term "beneficiation". The MPCA is correcting a spelling error made in this subpart by changing the word "calcinizing" to "calcining" as shown below. This modification does not constitute a substantial change.

Minn. Rules pt. 7045.0120, item I is modified to read:

7045.0120 EXEMPT WASTES.

I. waste from the extraction, beneficiation, and processing of ores and minerals, including coal, and including phosphate rock and overburden from the mining of uranium ore. For purposes of this item, beneficiation of ores and minerals is restricted to the following activities: crushing; grinding; washing; dissolution; crystalization; filtration; sorting; sizing; drying; sintering; pelletizing; briquetting; ~~calcinizing~~ calcining to remove water or carbon dioxide; roasting, autoclaving, or chlorination in preparation for leaching (except where the roasting, autoclaving, or chlorination/leaching sequence produces a final or intermediate product that does not undergo further beneficiation or processing); gravity concentration; magnetic separation; electrostatic separation; flotation; ion exchange; solvent extraction; electrowinning; precipitation; amalgamation; and heap, dump, vat, tank, and in situ leaching. For the purposes of this item, waste from the processing of ores and minerals includes only the following wastes:

b. The proposed rule amendments to Minn. Rules pt. 7045.0135, subp. 2, item S add a waste stream to the lists of hazardous wastes. The MPCA is correcting a spelling error made in this item by changing the word "dessicant" to "desiccant" as shown below. This modification does not constitute a substantial change.

Minn. Rules pt. 7045.0135, subp. 2, item S is modified to read:

7045.0135 LISTS OF HAZARDOUS WASTES.

Subp. 2. Hazardous wastes from nonspecific sources. Hazardous wastes from nonspecific sources are listed with the generic hazardous waste number and hazard code in items A to V.

S. F025, condensed light ends, spent filters and filter aids, and spent ~~dessicant~~ desiccant wastes from the production of certain chlorinated aliphatic hydrocarbons, by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to and including five, with varying amounts and positions of chlorine substitution: (T);

7. In addition to the modifications made in Finding No. 6 above, the MPCA is initiating another modification. The proposed rule amendments to Minn. Rules pt. 7045.0265, subp. 4, item B outline the manifesting requirements for out-of-state shipments of hazardous waste. The MPCA is modifying this item by adding the words "United States Environmental Protection Agency" before the words "authorized state" in order to clarify by whom the state is authorized. This modification does not constitute a substantial change.

7045.0265 USE OF MANIFEST.

Subp. 4. Out-of-state shipments. When a hazardous waste is to be delivered to a hazardous waste facility located outside the state of Minnesota, the generator must insure that:

B. for shipments of hazardous waste to a designated facility in ~~an~~ United States Environmental Protection Agency authorized state which has not yet obtained authorization to regulate that particular waste as hazardous, the designated facility agrees to sign the manifest and return the manifest to the generator, and that any out-of-state transporter signs and forwards the manifest to the designated facility.

8. The MPCA adopts the Statement of Need and Reasonableness, in its entirety, as the factual basis for the proposed rules. The MPCA hereby incorporates the Statement of Need and Reasonableness into these findings, except as modified in Finding Nos. 6 and 7 above.

9. The above-captioned rule amendments, together with the modifications made by the MPCA in Finding Nos. 6 and 7 above to respond to comments received during the comment period and initiated by the MPCA to clarify the amendments as proposed, are needed and reasonable.

CONCLUSIONS

1. The MPCA duly acquired and has jurisdiction over this proceeding.

2. The MPCA published and served due, timely, and adequate notice of the intent to adopt the rule amendments without a public hearing.

3. All relevant legal and procedural requirements of statute and rule have been complied with.

4. The modifications to the proposed rule amendments are supported by the record and do not result in a substantial change in the proposed rule amendments.

ORDER

NOW, THEREFORE, IT IS ORDERED, that the attached amendments to Minn. Rules pts. 7045.0020, 7045.0102, 7045.0120, 7045.0135, 7045.0139, 7045.0141, and 7045.0265 governing the management of hazardous waste, are adopted pursuant to the authority vested in the MPCA by Minn. Stat. § 116.07, subd. 4 (1990).

Dated: 5/22/91

Patricia A. Bloomgren

Charles W. Williams
Commissioner

STATE OF MINNESOTA
POLLUTION CONTROL AGENCY

In the Matter of the Proposed Rule Amendments Governing Mining Wastes, the Lists of Hazardous Wastes, Shipments of Hazardous Wastes Out-of-state, and Mixtures of Hazardous and Nonhazardous Wastes, Minn. Rules Pts. 7045.0020, 7045.0102, 7045.0120, 7045.0135, 7045.0139, 7045.0141, and 7045.0265

AFFIDAVIT OF RECEIVING NO REQUESTS FOR NOTICE OF SUBMISSION OF RULES ADOPTED WITHOUT PUBLIC HEARING TO THE ATTORNEY GENERAL

STATE OF MINNESOTA)
) ss.
COUNTY OF RAMSEY)

Glenn Skuta, being duly sworn says:

1. That he is the person named in the Notice of Intent to Adopt Rules Without a Public Hearing (15 SR 2087-2092, March 18, 1991) as the person to receive requests for notification of submission of rule adopted without a public hearing to the Attorney General concerning the above-entitled matter.

2. That there were no requests received by the the Minnesota Pollution Control Agency for notification of submission of rule adopted without a public hearing to the Attorney General concerning the above-entitled matter.

Glenn Skuta

Subscribed and sworn to before me this 5th day of June, 1991.

Marilyn J. Wegwart
Notary Public

MARILYN J. WEGWART
NOTARY PUBLIC - MINNESOTA
RAMSEY COUNTY
My commission expires 4-19-96

STATE OF MINNESOTA
POLLUTION CONTROL AGENCY

In the Matter of the Proposed Rule Amendments Governing Mining Wastes, the Lists of Hazardous Wastes, Shipments of Hazardous Wastes Out-of-State, and Mixtures of Hazardous and Nonhazardous Wastes, Minn. Rules Pts. 7045.0020, 7045.0102, 7045.0120, 7045.0135, 7045.0139, 7045.0141, and 7045.0265

DECLARATION OF COUNSEL

I, Alan R. Mitchell, Special Assistant Attorney General, do hereby declare that I have examined the above-captioned rules and the supporting rulemaking record, and that, based on my examination, the Administrative Procedure Act and Minnesota Rules ch. 2010 have been followed.

Alan R. Mitchell

Special Assistant
Attorney General

June 10, 1991