United States
Environmental Protection
Agency

Solid Waste and
Emergency Response
(5305)

EPA530-S-94-001
December 1993

EPA

# Report to Congress on Cement Kiln Dust

## Executive Summary

*Printed on Recycled Paper*

# EXECUTIVE SUMMARY

## 1.0 Introduction

### 1.1 Background

In October 1980, the Resource Conservation and Recovery Act (RCRA) was amended by adding §3001(b)(3)(A)(i-iii) (the Bevill Amendment) to exclude, among other things, cement kiln dust (CKD) from regulation as a hazardous waste under RCRA Subtitle C, pending completion of a study and a Report to Congress required by §8002(o), and a subsequent regulatory determination of whether Subtitle C regulation is warranted. In November 1980, the Environmental Protection Agency (EPA) subsequently modified its hazardous waste regulations in RCRA §3001(b)(3)(c), to reflect the provisions of the Bevill Amendment (40 CFR 261.4(b)(8)). Since that time, cement kiln dust has remained exempt from Subtitle C of RCRA, meaning that this material has never been subject to the hazardous waste regulations under federal law.

Because of other priorities, EPA did not complete the Report to Congress by the statutory deadline of 1983. On March 8, 1989, the Environmental Defense Fund (EDF) filed suit against EPA for missing the statutory deadline, and the American Petroleum Institute and the Edison Electric Institute intervened in the case. On June 19, 1991, EPA entered into a proposed consent decree with EDF. In the proposed Consent Decree, EPA agreed to complete the Report to Congress on Cement Kiln Dust by April 30, 1993. The proposed Consent Decree was later modified and the deadline for completion was extended to December 31, 1993.

In keeping with its court-ordered schedule, and pursuant to the requirements of §3001(b)(3)(iii) and §8002(o) of RCRA, the EPA has prepared this report on CKD. In addition to complying with the Congressional mandate, this report will serve to establish a factual basis for EPA decision-making regarding the appropriate regulatory status, under RCRA, of cement kiln dust. The report addresses the following eight study factors required by §8002(o) of RCRA for CKD:

(1) the source and volumes of such materials generated per year;
(2) present disposal practices;
(3) potential danger, if any, to human health and the environment from the disposal of such materials;
(4) documented cases in which danger to human health or 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 natural resources; and
(8) the current and potential utilization of such materials.

In addition, the report includes a review of applicable state and federal regulations so that regulatory decisions that derive from the report will avoid duplication of existing requirements.

## 1.2 Decision Rationale

To examine in detail the study factors mandated by RCRA §8002(o), EPA developed an approach that combined certain study factors into groups along functional lines. These sets of study factors were then evaluated in a step-wise, logical sequence. This approach, the decision-making rationale, has been used in making regulatory determinations for other Bevill exempt, special wastes[1]. In this process, which is described in detail below, the Agency considered the study factors, first assessing the adequacy of current management practices and whether such management poses human health and environmental problems, then evaluating the need for more stringent regulation, and lastly, assessing the operational and economic consequences that would result by regulating this waste under Subtitle C. Each step has sub-steps addressing related study factors, and an affirmative answer to one step forwards the decision-making to the next step of the analysis.

Several assumptions guided EPA in applying this decision-making process to cement kiln dust. First, the Agency recognizes that explicit decision criteria are necessary to achieve reasonable decisions regarding the need for additional regulatory controls. Second, the study factors most critical to determining the regulatory status of CKD are risks posed and documented damages caused by the waste, and the costs and impacts that would be associated with more stringent regulatory controls. This is because without potential risk and/or documented damages, there is no need for hazardous waste regulation under RCRA Subtitle C (the key issue in question). Alternatively, if there is a significant potential or documented danger, the costs and impacts of regulatory controls must be carefully evaluated to ensure that these options would provide adequate protection of human health and the environment <u>and</u> continued operation of the affected facilities. In employing this second assumption, the Agency believes that it has developed and analyzed regulatory compliance scenarios that are realistic from an operational and engineering standpoint, and that are likely to be adequately protective of human health and the environment.

**Evaluation Criteria**

**Step 1: Does management of CKD pose human health and environmental problems? Might current practices cause problems in the future?**

Critical to the Agency's decision-making process is whether CKD either has caused or could cause human health or environmental damage.

(1) Has CKD, as currently managed, caused documented human health impacts or environmental damage?

(2) Does EPA's analysis indicate that CKD could pose significant risk to human health or the environment at any of the sites that generate it (or in off-site use), under either current management practices or plausible management scenarios?

(3) Does CKD exhibit any of the characteristics of hazardous waste?

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[1] The Regulatory Determinations for mineral processing special wastes (56 *FR* 27305, June 13, 1991) and four large-volume wastes from the combustion of coal by electric utility power plants (58 *FR* 42466, August 9, 1993).

If the answer to any of these three sub-steps was yes, then EPA would conclude that further evaluation was necessary. If the answer to all of these questions was no, then the Agency would conclude that regulation of CKD under RCRA Subtitle C is unwarranted.

**Step 2: Is more stringent regulation necessary and desirable?**

If CKD has caused or may cause human health or environmental impacts, then EPA would conclude that an examination of alternative regulatory controls was appropriate. Given the context and purpose of the present study, the Agency focused on an evaluation of the likelihood that such impacts might continue or arise in the absence of Subtitle C regulation, by posing the following two questions:

(1) Are current practices adequate to limit contaminant release and associated risk?

(2) Are current federal and state regulatory controls adequate to address the management of CKD?

If current practices and existing regulatory controls are adequate, and if the potential for impacts is low (e.g., facilities in remote locations), then the Agency would tentatively conclude that regulation under Subtitle C is unwarranted. Otherwise, further examination or consideration of regulatory alternatives would be necessary.

**Step 3: What would be the operational and economic consequences of a decision to regulate CKD under Subtitle C?**

If, based on the previous two steps, EPA believed that regulation of CKD under Subtitle C might be appropriate, then the Agency would evaluate the costs and impacts of regulatory alternatives. In the case of CKD, EPA evaluated two regulatory alternatives that are based upon Subtitle C, one alternative that reflects one possible approach that might be taken under RCRA Subtitle D, and other possible approaches (i.e., engineering alternatives) that might be employed by potentially affected cement plant operators. The focus of this inquiry was whether the magnitude and distribution of regulatory compliance costs might jeopardize the continued economic viability of one or more generators if the waste were to be regulated under the Subtitle C regulatory scenario. The key questions in the Agency's decision-making process were as follows:

(1) Are predicted economic impacts associated with the Subtitle C scenario significant for any of the affected facilities?

(2) To what extent could these compliance costs be avoided through the implementation of alternative CKD management practices?

(3) In the event that significant impacts are predicted, might a substantial proportion of domestic capacity or product consumption be affected?

(4) What effects would hazardous waste regulation have upon the viability of beneficial use or recycling of CKD?

In EPA's judgement, absence of significant impacts would suggest that Subtitle C regulation might be appropriate for CKD if findings indicate that it poses significant risk. If even less stringent Subtitle C standards impose widespread and significant impacts on facilities, and/or deter the safe and beneficial use of the dust, EPA may conclude that regulation under some form of Subtitle D program might be more appropriate.

### 1.3 Organization of the Report to Congress

This systematic approach employed in EPA's decision-making process is mirrored in chapters of the Report to Congress. EPA has organized the discussion of the analysis (Volume II - Methods and Findings) into chapters that address each segment of the study. The first chapter introduces the analysis with a brief summary of the purpose and scope of the report, general methods and information sources used, and EPA's decision-making methodology. The second chapter begins the review of the analysis with a brief overview of the industry, including a description of CKD waste, the industry structure and characteristics, the cement manufacturing process, the types of production processes used, and significant process inputs (Study Factor 1). The third chapter of the Report to Congress discusses the generation and chemical and physical characteristics of CKD (Study Factors 1 and 3). The fourth chapter outlines the range of CKD management methods employed at domestic cement plants (Study Factor 2). The fifth chapter identifies and summarizes cases of potential and documented damages to human health and the environment (Study Factor 4). The sixth chapter includes a discussion of EPA's risk assessment in which the Agency examined inherent hazards posed by CKD, evaluated site-specific risk factors, and performed quantitative transport, fate and exposure modeling (Study Factor 3). The seventh chapter summarizes applicable federal and state regulatory controls. The eighth chapter investigates alternative waste management practices and potential utilization of the wastes (Study Factors 5, 6, and 7). The ninth chapter discusses costs and impacts under each of several regulatory and operational scenarios (Study Factor 8). And finally, chapter ten presents EPA's study findings and regulatory options.

## 2.0 Information Sources and Methods

The Agency's approach in preparing the Report to Congress was to combine certain study factors for purposes of analysis, and to evaluate these study factors in a step-wise fashion. In support of this analysis, EPA has developed industry-wide and facility specific data and analytical methods that have allowed the Agency to incorporate the information into the decision rationale in a logical fashion, while accounting for the special nature of the cement kiln industry. This section briefly outlines the data sources, methods and decision rationale that the Agency employed to respond to the study factors.

### 2.1 Data Collection Activities

In compiling information to address the eight study factors, EPA conducted a number of research and data collection activities. Since the focus of most of these efforts was site-specific, EPA has been able to compile reasonably detailed industry-wide information, which the Agency used extensively to prepare this report. The major information gathering initiatives were as follows:

- Portland Cement Association (PCA) 1991 Main Questionnaire Survey of Cement Kiln Facilities;

- EPA site visits to cement manufacturing facilities to familiarize EPA staff with the cement manufacturing process and CKD management techniques;
- 1992 and 1993 EPA site visits to cement manufacturing facilities to collect samples of cement kiln dust;
- State agency files (reviewed as part of the effort to identify proven cases of danger to human health or the environment, referred to as "damage cases");
- RCRA §3007 Waste and Site Characteristics Data Requests;

## 2.2 Methods

This section summarizes EPA's approach for addressing each of the study factors.

**Waste Characterization, Generation, and Current Management Practices**

**1991 Survey of Cement Kiln Facilities**

To characterize the generation and management of cement kiln dust, EPA had to identify the facilities that generate the wastes, the production processes used and the products produced, the quantity and characteristics of the waste generated and the practices that are employed to manage CKD. The Agency contacted industry representatives to determine if such information was available. PCA responded by developing a questionnaire for its members, that garnered information regarding CKD. The results of the PCA survey were made available to the public. EPA used this information to support its analysis. Specifically, the questionnaire addressed CKD waste characteristics, generation, and current management at clinker producing facilities (CKD Generation and Characteristics, Chapter 3; and Current Management Practices for CKD, Chapter 4); as well as on the operational characteristics of the industry (Cement Industry Overview, Chapter 2).

One hundred and fifteen cement plants were identified through industry and U.S. Bureau of Mines Sources that were believed to generate CKD. The survey was prepared and distributed to the facilities in December 1991, by the Portland Cement Association. Approximately 80 percent of the facilities surveyed responded to the questionnaire, which addressed waste management and tracked CKD from point of generation through its ultimate disposal (through on-site recycling, on-site disposal or off-site beneficial use). Responses to the questionnaire were provided to EPA, and entered into a computerized data base, which EPA has used in this analysis.

Information submitted by industry in response to the survey was supplemented and critically evaluated against data obtained from published sources, information collected during the damage case development process, and EPA observations made during waste sampling and other visits.

**RCRA Section 3007 Data Requests**

In order to allow affected facilities to have meaningful input into the Agency's evaluation of physical and chemical characteristics of CKD (Chapters 3 and 4), EPA issued a formal written request, under authority of RCRA §3007, to 115 cement plant operators seeking any currently

available information on the characteristics of the dust that they generate. The Agency specifically sought information on the presence and concentrations of organic and other constituents in CKD, patterns of off-site use in productive applications, and site-specific environmental characteristics of those plants for which PCA surveys had not been received. To make compliance as easy as possible, the request did not specify a data format or the quantity of data required. The Agency has reviewed all of these data submittals and has collected and utilized the data that are relevant to the analyses presented in the study.

**EPA Site Visits and Cement Kiln Dust Sampling and Analysis**

The primary objective of EPA's site visits and sampling effort was to bolster the Agency's data base on CKD characteristics and other plant specific information e.g., production rates, kiln operating information, etc. (Chapters 2, 3, and 4). (Additionally, the results of the sampling effort supported the Agency's review of potential and documented damage cases.) The site visits served to enhance the Agency's general understanding of the processes whereby CKD is generated, and of the techniques by which it is and could be managed (Chapters 3, 4, and 8).

Since EPA's Office of Solid Waste (OSW) had not previously studied cement kiln dust, during the summer of 1991, EPA staff visited two cement facilities to gain a general understanding of CKD waste management practices. In the early part of 1992, EPA conducted a CKD and cement clinker sampling and analysis program (referred to as Phase I in the Report). The Agency's field sampling teams visited 15 cement facilities, recorded observations of operational practices, took photographs of waste management activities, and collected samples of CKD and clinker. EPA generally took CKD samples on both an "as generated" basis (directly from the kiln at the time of the site visit) and on an "as managed" basis (CKD from 1- to 6-month old disposal piles).

In May 1993, EPA conducted a second more focused CKD sampling and analysis program (referred to as Phase II in the Report), to clarify certain analytical issues raised by the results of the Phase I and analysis effort. Specifically, the Agency visited and took CKD (and in some cases clinker) samples from six cement plants, one of which had been visited in Phase I (for purposes of verification of Phase I sampling results), and performed various chemical analyses. The CKD samples were analyzed for the following classes of analytes: volatile and semi-volatile organics, pesticides, PCBs, dioxins, furans, metals, radionuclides and general chemistry. One important distinction between the two sampling and analysis programs is that the analytical methods employed for measuring dioxin and dibenzofuran concentrations in Phase II analysis were more sensitive than those used in Phase I[2]. The knowledge and insights gained during these 21 site and sampling visits have enabled the Agency to understand and evaluate current waste management practices and the chemical characterization of CKD.

**Potential Danger to Human Health and the Environment**

EPA is required by §8002(o)(3) to assess the potential danger to human health and the environment associated with CKD management. To evaluate potential risks to human health and the environment from the management of CKD, EPA employed a three-step analysis of potential

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[2] The data developed in the Agency's two-phase CKD sampling program may be found in summarized form in the supporting docket for this report (Docket No. F-93-RCKA-FFFFF), while a description of EPA's waste sampling study is presented in a Technical Background Document, which may also be found in the docket.

risks from on-site management practices (Chapter 6). This allowed EPA to narrow the scope of the analysis to those CKD waste streams, facility settings, and pathways that pose the greatest potential risk. First, the Agency conducted a preliminary risk screening, to determine the extent to which the dust contains toxic or radioactive constituents that could pose risks to human health or the environment. To identify the "constituents of potential concern", EPA compared concentrations of chemicals measured in CKD to "risk screening criteria". These criteria were developed using accepted Agency toxicity values and conservative chemical release, transport, and exposure factors. Other chemical and physical properties that may tend to mitigate or qualify risks associated with particular CKD constituents were also evaluated.

The next step was to conduct a more realistic case study evaluation of the likely degree of risk at a series of 15 representative cement plants. This study focused on the specific waste constituents, net generation rates, current CKD management practices, environmental settings, and surrounding residential and other land use patterns at each of the 15 plants, as developed from the PCA survey and EPA site visit and mapping data. Potential relative risks from possible releases of CKD constituents (via ground water, windblown dust, and surface stormwater run-off) were thus evaluated semi-quantitatively on a site-specific basis at each facility for each feasible pathway of concern. All 15 facilities were then ranked into relative potential risk categories (negligible, low, medium, and high) for each pathway.

The two highest ranked cement plants and three plants representing more central tendency risks for each risk pathway from step two were then selected for a detailed quantitative evaluation in the third step of the on-site management risk assessment. For the quantitative assessment of these situations, the Agency used a multi-media risk model ("MMSOILS") to estimate risks to human health and the environment. The study focused not only on the direct constituent transport pathways (ground water, surface water, air), but also on indirect food chain pathways, including local farming and fish products that could biologically concentrate toxic constituents and that might be locally consumed in larger or smaller quantities by various population groups.

In addition to on-site management scenarios, the Agency evaluated the risks associated with the beneficial use of CKD at off-site locations separate from cement plants. Six case studies were developed from data on the nature, extent, and location of off-site CKD uses, including uses in general construction, highway and parking lots, waste stabilization, and as a substitute for lime and fertilizer in agriculture. The Agency then collected additional data on risk factors associated with each of these case studies, evaluated potential release and exposure pathways, and developed hypothetical (but plausible) scenarios representing both central tendency and high-end potential risk conditions that could exist when CKD is used off site. The human health and environmental risks associated with these off-site use scenarios were both qualitatively evaluated and selectively modeled.

The Agency used these steps to evaluate the range of conditions and risks that exist across the industry, while also identifying and focusing on those CKD constituents, waste streams, management practices, facility settings, and pathways that pose the greatest potential risk.

**Documented and Potential Damages to Human Health and the Environment**

§8002(o)(4) of RCRA requires that EPA's study of cement kiln dust waste examine "documented cases in which danger to human health of the environment has been proved." This section describes the approach the Agency has employed to address this requirement. First, the

Agency defined damage to human health to include both acute and chronic effects (e.g., directly observed health effects such as elevated blood lead levels, or loss of life) associated with management of cement kiln dust waste. Second, danger to the environment was defined to include: (1) impairment of natural resources (e.g., contamination of any drinking water reasonably expected to be used, impairment of air quality); (2) ecological effects resulting in degradation of the structure or function of natural ecosystems and habitats; and (3) effects on wildlife resulting in impairment to terrestrial fauna or aquatic biota (e.g., reduction in species diversity or density, impairment or reproduction).

EPA used the "tests of proof" used in previous Bevill Waste Determinations[3] to evaluate potential damage cases. Damages are found to exist: (1) as part of the findings of a scientific study; (2) through a formal administrative ruling (e.g., conclusions of an enforcement action); and (3) through the ruling of a court or out-of-court settlement.

EPA conducted an exhaustive examination of the extent to which CKD has been implicated in environmental contamination incidents in response to the mandate to describe documented cases in which danger to human health or the environment has been proved (Chapter 5). In undertaking this effort, staff were contacted in all EPA regions and states in which one or more cement kiln facilities is located. Where telephone contacts indicated that relevant damage case information might exist at the regional, state, or local level, the information was obtained through the mail or through visits to state/local officials having regulatory jurisdiction over CKD management.

The Agency's damage case analysis is based primarily on documented evidence, rather than on visits to the sites being evaluated. However, the Phase I waste sampling visits to the 15 facilities also included an effort to collect information on the existence of potential environmental pathways through which CKD and its constituents might migrate and cause adverse impacts. The results of this effort is a compilation of information regarding past and present management practices that have been applied to CKD, and the environmental or human health consequences of these practices[4].

**Existing Federal and State Waste Management Controls**

In response to the suggestion in RCRA §8002(o) that EPA "...review studies and other actions of federal and state agencies", with a view toward avoiding duplication of effort, EPA has also examined other applicable federal and state waste management controls to help characterize current waste management practices (Chapter 7).

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[3] The Regulatory Determinations for mineral processing special wastes (56 *FR* 27305, June 13, 1991) and the four large-volume wastes from the combustion of coal by electric utility power plants (58 *FR* 42466, August 9, 1993).

[4] In addition to the description provided in Chapter 6 of this report, the individual sites that have been evaluated in detail are listed in the supporting Technical Background Document (Docket No. F-93-RCKA-FFFFF) which also provides more extensive discussions and supporting evidence.

**Federal Controls**

EPA's objective in this analysis was to identify and evaluate existing regulatory controls over the management of cement kiln dust that have been promulgated by agencies of the federal government.

In the initial phase of the analysis, EPA examined the relevant statutes and regulations pertaining to air quality, water quality, and solid waste as they might apply to the management of cement kiln dust. In order to develop a baseline of information about current federal and state regulations, EPA conducted an on-line search of the Computer-Aided Environmental Legislative Data Systems (CELDS), a data base containing abstracts of federal and state environmental regulations.

EPA identified and evaluated existing federal regulatory controls on cement kiln dust, focusing on programs and requirements established by EPA. This characterization is necessary for two reasons. First, some states do not have EPA-approved programs for regulating air pollution emissions to the atmosphere or discharging contaminants to surface waters. If a state program is not federally approved, then federal EPA regulations take precedence. Second, the federal government has not delegated authority to some states for implementing some environmental protection statutes and regulations and is thus responsible for their implementation. In those states that do not have federally approved programs, EPA regional staff were contacted for the purpose of conducting a detailed regulatory analysis of the implementation of existing federal statutes and regulations that pertain to the management of CKD.

**Requirements in Selected States**

After reviewing federal regulations, the Agency then performed a more detailed review of state statutes and regulations. Scheduling and resource limitations made it impossible to perform a detailed regulatory analysis on all of the states that contain cement plants. Consequently, EPA limited this review to four of the states with the largest clinker production and finished grinding capacities; together, California, Michigan, Pennsylvania, and Texas represent over 35 percent of 1990 clinker production capacity. EPA assumed that these states would have the most extensive experience in controlling the management of cement kiln dust and would have the greatest interest in regulating CKD.

EPA contacted state and local officials involved with implementing CKD management requirements in order to learn how those statutes and regulations are interpreted in practice, and to obtain facility-specific implementation information. EPA had found that the scope of state programs is not always clear from the state statutory and regulatory language. The information compiled from these contacts was combined with the existing information on statutory and regulatory requirements to produce the final implementation analysis.

**Alternative Management Practices and Potential Utilization**

§8002(o)(5) of RCRA requires that EPA analyze "alternatives to current disposal methods" for cement kiln dust, as well as the current and potential utilization of the wastes addressed by the Report to Congress. In this analysis, the Agency viewed technologies that are available and under development to minimize the quantity of CKD that must be removed from the kiln system, and alternative management practices and potential uses for the net CKD that is generated (Chapter 8).

Information for this analysis was collected by first conducting a comprehensive computer-assisted literature search, then evaluating the information obtained thereby. In some instances, more detailed information was solicited from individual researchers, agencies, and industry representatives. Discussions with plant personnel during facility site-visits also provided insight into alternative management practices. Detailed discussion of alternatives is limited in scope, however, to those for which information is adequate to assess their technical feasibility (i.e., EPA has not included alternatives that are experimental, unproven, or have not seen at least pilot-scale application).

**Cost and Economic Impacts**

§8002(o)(6) of RCRA requires EPA to analyze the costs of alternatives to current disposal methods for cement kiln dust. The focus of this analysis, presented in Chapter 9, is on the operational and financial consequences of adopting these alternative CKD management practices under various regulatory schemes. EPA first assessed the costs of managing CKD with a variety of different land disposal and resource recovery practices. Then the Agency examined the impacts of potential regulatory scenarios, given the costs of the various CKD management alternatives, as they would be experienced by a representative sample of 10 selected cement manufacturing plants.

This analysis draws on the information presented in the Report to Congress on current CKD management practices (Chapter 4) and potential CKD management alternatives (Chapter 8) including the use of emerging technologies for treating CKD to extract alkalis for sale as fertilizer and reclaim the bulk of the material as kiln feed or processed clinker. Specifically, EPA has collected and analyzed detailed site-specific data on cement plant operations and CKD generation and waste management practices. The 1991 PCA Survey served as the primary data source for baseline conditions, supplemented by observations made during the 1992 field sampling visits. Basic design, operation, and cost information on emerging recycling technologies was obtained from both published and primary sources. The Agency then conducted an engineering cost study to apply these technologies to the case study facility conditions. Case study recycling costs were then compared with current practice baseline and alternative Subtitle C land disposal costs to assess compliance options and impacts. EPA based its assumptions regarding the economic conditions facing the cement industry on industry and market data obtained by the PCA, the Bureau of Mines, the International Trade Commission and the Bureau of the Census.

## 3.0 Technical Findings, Decision Rationale and Regulatory Options

§3001(b)(3)(c) of RCRA requires that the Agency, based on the findings of this report and public comment, either determine to promulgate regulations under Subtitle C of RCRA for cement kiln dust waste or determine that such regulations are unwarranted. Accordingly to facilitate comment on this report and subsequent preparation by the Agency of the required "regulatory determination", this section presents a summary of the Agency's analysis and possible options, pending receipt and analysis of public comments, that EPA is evaluating regarding the appropriate regulatory status of cement kiln dust.

### 3.1 Decision Rationale

Based upon the analysis of the eight study factors in RCRA §8002(o), EPA has reached some preliminary findings. Utilizing the three step procedure described in Chapter 1 of Volume II (Section 1.2), EPA has arrived at tentative answers to the questions posed in its decision

rationale, which are described below. The decision rationale contributed to development of the five proposed options for managing CKD waste (listed in Section 10.3.2 of Volume II), although the Agency has not yet made a final decision. EPA is soliciting comment on how the decision rationale can be used in the Agency's decision-making process.

**Step 1: Does management of CKD pose human health and environmental problems? Might current practices cause problems in the future?**

After reviewing evidence of damage to human health and the environment, performing a risk assessment, and reviewing the results of laboratory analyses of waste samples, EPA has concluded that risks associated with CKD management are generally low, however, there is a potential under certain circumstances for CKD to pose a danger to human health and environment, and it may do so in the future.

Data collected from state files and EPA site visits identify common CKD waste management practices, including management in exposed, unlined piles, abandoned quarries, and landfills, that have caused, and may continue to cause, contamination of air and nearby surface water and ground water. Management practices such as disposal in a water-filled quarry and management in piles adjacent to grazing and agricultural fields or surface water bodies also pose a potential danger to human health and the environment. In addition, risk modeling results support the conclusion that CKD can potentially pose risks to human health and the environment under certain hypothetical, yet plausible scenarios.

**Step 2: Is more stringent regulation necessary or desirable?**

EPA has reached no conclusions with respect to the need for more stringent regulation. EPA's preliminary analysis of the effectiveness of state and federal regulations and controls suggests that additional controls should be evaluated; for example, controls for CKD management scenarios which potentially present high risks, if those scenarios exist. While CKD is regulated under state and local laws, the specific requirements for CKD vary from state to state. In many instances, minimal controls are applied to these wastes. Also, recycling technologies could be used as a means to improve waste management practices.

**Step 3: What would be the operational and economic consequences of a decision to regulate CKD under Subtitle C?**

Operational costs of CKD regulation are largely dependent on the management alternative selected. If CKD is managed as a hazardous waste under RCRA Subtitle C, facilities that manage their CKD through on-site land disposal are estimated to incur significant compliance costs. However, the financial burden of compliance, even for waste dust generated in kilns that burn RCRA hazardous waste, may be reduced or potentially turned into net income, if facilities are able to adopt pollution prevention technologies which recycle CKD.

The possible economic outcomes of a decision to regulate CKD under RCRA Subtitle C cover a broad spectrum. An economic analysis of innovative pollution prevention technologies (including alkali leaching, flue gas desulfurization, and fluid bed dust recovery), suggests that the potentially high compliance costs of CKD land disposal may drive the industry toward more recycling of their CKD. However, at this early stage of their development, it is uncertain that these recycling technologies can be widely adopted by the industry. Moreover, even if CKD is recycled, some facilities may incur substantial disposal costs.

### 3.2 Regulatory Options

Based on the findings, and an initial evaluation of regulatory options, the Agency has not decided whether to retain or remove the CKD exemption. The Agency considered a number of options which represent a wide range of scenarios that would subject CKD to different management requirements and enforcement oversight. From these, the Agency has chosen to highlight five, including three in which CKD would be managed under Subtitle C, with the intent to focus public comment from environmental groups, industry, and other interested parties regarding the most appropriate approach to manage CKD.

EPA notes that regulations for the management of CKD waste under Subtitle C may not be warranted or appropriate if other Agency-administered programs are better suited to address the concerns identified in this Report. Whether or not the Agency lifts the exemption, dust suppression and stormwater management at facilities that burn hazardous waste, as well as on-site CKD management practices at all other facilities would be subject to current and potential future regulation under the federal Clean Air and Clean Water Acts, and where such provisions exist, all applicable state laws and regulations. Damages at existing CKD disposal sites also could be addressed by RCRA §7003 and CERCLA §104 and §106, if the site posed an imminent and substantial danger to human health and the environment.

**Option 1: Retain the CKD Exemption.**

Since CKD exhibits low inherent toxicity and poses minimal risk when evaluating the various exposure pathways using average or best case conditions, it may be appropriate to retain the exemption for cement kiln dust waste, that is, maintain the status quo. Under this option, CKD management would continue to be regulated by the states, if at all.

**Option 2: Retain the CKD Exemption, but enter into discussions with the industry, in which they voluntarily implement dust recycling technologies, reduce waste, and monitor and control certain off-site uses.**

Since certain management scenarios may present risks when assuming plausible worst case conditions and pollution prevention alternatives may be promising in certain instances, the Agency could enter into discussions with the cement manufacturing industry to urge it to implement selected waste minimization/pollution prevention technologies, or implement more environmentally protective management practices, including controlling certain off-site uses.

The Agency, under this option, could also develop guidance for states regarding site management, off-site uses, and pollution prevention and waste minimization technologies. This guidance would assist states in reducing the potential risks posed by mismanagement of CKD and recommend implementation of technologies that would promote recycling of CKD.

Under this option, CKD management would not be controlled by the provisions of RCRA Subtitle C. However, since the exemption for CKD remains in place, CKD generated in kilns that burn hazardous waste would still be subject to the two-part test for residuals under 40 CFR 266.112. If CKD does not pass the two-part test, it would be treated to standards for land disposal (40 CFR 268.43) and disposed in a Subtitle C facility. Damages at existing CKD disposal sites would still be addressed by RCRA §7003 and CERCLA §104 and §106, if the site posed an imminent and substantial danger to human health and the environment.

**Option 3: Remove the CKD Exemption but delay implementation for some period of time (e.g., two years), that would allow industry time to employ pollution prevention options.**

By delaying lifting the exemption for some period of time (e.g., two years after the Regulatory Determination), industry would be provided an opportunity to implement pollution prevention alternatives and thus, manage the hazardous waste management costs they would incur. During this interim period between submittal of the Report to Congress and the effective date of the Final Rule, the CKD exemption would still be in effect. The Agency believes that many of the affected facilities would utilize the time to adopt pollution prevention technologies which would reduce, if not eliminate, the amount of hazardous CKD they generate or stop burning hazardous waste.

Under this option, on-site CKD management practices at those facilities with dust that exhibited any of the RCRA hazardous waste characteristics, or CKD derived from the burning of listed hazardous wastes (see 40 CFR 261.3(c)(2)(i)) would be affected by the provisions of RCRA Subtitle C. CKD disposal piles which are inactive on or before the effective date of the Final Rule would be unaffected by the provisions of Subtitle C, unless subsequently managed.

Those facilities that do not burn hazardous waste would not generally be affected by removing the exemption unless they generated characteristic RCRA hazardous waste. The Agency expects the number of non-hazardous waste burning facilities affected by this option would be small, since CKD rarely exhibits a characteristic of hazardous waste. These facilities would have an incentive to control their cement manufacturing process to avoid generating characteristic CKD.

**Option 4: Remove the CKD Exemption, and rely on existing hazardous waste rules to control cement kiln dust.**

This option is similar to Option 3, except the exemption would be removed in accordance with RCRA §3010(b). (Under Subtitle C of RCRA, wastes brought under regulatory control have up to six months from the Regulatory Determination before they become subject to hazardous waste control.) Thus, CKD that is hazardous waste-derived or exhibits a RCRA hazardous characteristic would be made subject to the provisions of RCRA Subtitle C. Otherwise, this option is the same as Option 3.

**Option 5: Promulgate Regulatory Standards for the Management of CKD Waste.**

As described above, the likely regulatory result under Options 3 and 4 would be to make CKD generated by a kiln that burns listed hazardous wastes itself a hazardous waste under the derived-from rule (40 CFR 261.3(c)(2)(i)). The indirect foodchain risks potentially identified in this Report, however, are not associated only with CKD generated by hazardous waste burning kilns. As a result, EPA is also considering regulatory mechanisms that would specifically address these risks, including promulgating regulatory standards under Subtitle C for the management of CKD waste that would provide adequate protection against these risks.

RCRA §3001(b)(3)(C) provides that EPA shall within six months of the RTC "determine to promulgate regulations under this subchapter...or determine that such regulations are unwarranted." The statute does not describe the type of regulation that EPA should consider promulgating (if any), other than that such regulation be under Subtitle C of RCRA. EPA could

promulgate minimally burdensome management standards for cement kiln dust that would adequately control the indirect foodchain risks, such as: (1) requiring that dust piles be kept covered to control fugitive emissions and institute surface water run-off and erosion controls; (2) maintaining ground-water protection, perhaps by requiring that CKD piles be maintained on a non-earthen base or by requiring a liner; and (3) establishing risk-based concentration thresholds for all constituents of concern (including 2,3,7,8-TCDD, arsenic, cadmium, and lead) for CKD used as a direct soil amendment. Additional or alternative standards may be appropriate, and EPA welcomes comments and suggestions on this aspect of its options.

Of the five options being considered by the Agency, Options 3, 4 and 5 would provide more control through implementation of the provisions of Subtitle C. The principal difference between Options 3 and 4 is the timing of the implementation of the regulatory controls. Option 3 provides industry additional time to implement waste minimization/pollution prevention options and more protective CKD management standards. Option 4 would bring CKD under Subtitle C regulatory control more quickly. Removing the exemption also would impose regulatory equity between CKD generated from kilns that burn RCRA hazardous waste and residues from other incinerators that burn RCRA hazardous waste that do not have such an exemption. Option 5 would provide management standards to control all CKD, and would be targeted to specifically address only those risks of potential concern.

The Agency did not evaluate the risk from the land application of agricultural lime, so it cannot determine whether there is an increase in incremental risk when CKD is substituted. In any event, CKD-sewage sludge derived fertilizers and soil amendments are considered safe for such uses as fertilizer and pose minimal risk because these final products are required to be tested to assure they comply with all provisions of 40 CFR 503, which are fully protective of human health and the environment. It should be noted that if the exemption is removed, fertilizer that is derived from CKD generated from a kiln that burns listed hazardous waste is itself a hazardous waste under the derived-from rule (40 CFR 261.3(c)(2)(i)); the extent of regulation, however, is limited (see 40 CFR 266.20(b)).

In addition, it should also be noted that under current rules, if CKD is recycled, the resulting clinker is not automatically subject to the provisions of Subtitle C. By removing the exemption, however, clinker may be affected by the derived-from rule (40 CFR 261.3(c)(2)(i)) if the kiln burns listed hazardous waste, thereby becoming a hazardous waste. The Agency has not yet fully analyzed available data on trace constituents in clinker. Based on our understanding of current data, however, the Agency does not believe that clinker produced from kilns that burn listed hazardous waste generally poses a hazard to human health and the environment.

## 4.0 Next Steps

This report will be subject to a 45 day comment period and a public hearing in Washington, D.C., so that the Agency can receive public comment. After an evaluation of public comments on this Report to Congress, the Agency will, in accordance with RCRA §3001(b)(3)(C), reach a final Regulatory Determination on the management status of CKD within six months of submission of this Report. The Regulatory Determination requires the Agency only to determine to promulgate regulations under Subtitle C, or determine that Subtitle C is unwarranted. Thus, if RCRA §3004(x) or Option 5 is chosen, EPA would have time beyond six months to promulgate a Final Rule.