F. Potential Risks to Human Health and the Environment

Based on an extensive data base compiled from industry sources, Agency field visits, RCRA section 3007 information requests, information submitted in comments, literature reviews, and other public sources, the Agency conducted a series of risk screening and site-specific risk modeling studies to evaluate potential risks from on-site management and off-site uses of CKD. Methodologies and results of these studies were documented in Chapter 6 of the RTC and its related technical background document and in two subsequent EPA technical background documents titled Human Health and Environmental Risk Assessment in Support of the Regulatory Determination on Cement Kiln Dust (August 31, 1994) and Supplemental Errata Document for the Technical Background Document for the Notice of Data Availability on Cement Kiln Dust (September 30, 1994). Principal findings from these studies include the following:

- Among a sample of 83 plants for which EPA had sufficient data to conduct a site-specific risk screening evaluation for metals in CKD, the Agency predicted only low or negligible risk potential from on-site management of CKD via conventional direct pathways of constituent transport and exposure (drinking water, incidental direct ingestion, chemical inhalation) via ground water contamination, surface water runoff to streams or lakes, or windblown dust. However, there are three principal and important qualifications to these direct pathway findings:
- As noted above, EPA has found empirical evidence of ground water contamination near the management unit at each cement manufacturing facility where ground water quality data exist; these sites are located in both areas of karst and non-karst terrain.
- According to U.S. Geological Survey maps and other sources, about half of all cement plant sites are underlain by limestone formations in areas of karst landscape. These limestone formations may have fissures caused by rock dissolution along joints or bedding planes with hydraulic characteristics that allow leachate to directly enter ground water aquifers without substantial dilution or attenuation. Available ground water pathway modeling techniques are not applicable under these conditions. This does not necessarily mean that ground water contamination will occur at these cement plants (although that would be consistent with some of the damage cases); however, it should be regarded as a significant qualification to the general findings of low or negligible risk from the ground water pathway risk modeling results.
- In its follow-up work leading to the NODA, EPA did find evidence of possible risk to human health due to the fine particulate nature of inhaled dust. Although the Agency's direct inhalation exposure modeling studies described in the RTC did not indicate significant risk from inhaled chemical constituents in CKD, subsequent screening-level modeling on a small number of plants did indicate that windblown dust from uncontrolled CKD waste management units could exceed EPA's health-based fine particulate (10 micron or less) National Ambient Air Quality Standard (NAAQS) at plant boundaries, and potentially at nearby residences. Results from a more recent extension of this work to a larger sample of 52 cement plants suggest that 28 of the plants could exceed NAAQS standards at plant boundaries, if the plants do not have effective dust control mechanisms.[7] Although quantitative risks presently can not be estimated, these initial modeling results relating to fine particulates suggest cause for concern and argue for further attention to this source of fugitive dust.
- The Agency also modeled health risks via indirect food-chain pathways (i.e., risks from ingestion of crop or livestock products or fish containing CKD-derived chemical contaminants). These contaminants reach the food chain as part of storm water run-off and/or wind erosion from uncontrolled CKD storage or disposal areas to nearby water bodies and farm fields. The Agency's indirect pathway methodology is relatively new, complex, and still under refinement and peer review. Therefore, the reported results must be regarded as preliminary and subject to substantial uncertainties. However, the methodology represents the best available approach for evaluating these potential risk pathways of interest.

EPA's indirect food chain risk modeling estimated that potential individual cancer risks in the 1×10^{-5} (1 in 100,000) to 1×10^{-3} (1 in 1,000) range to highly exposed subsistence farmers and subsistence fishers from CKD metals (principally arsenic) could occur at about 12 percent of the 83 cement plants studied. Similar risk levels due to dioxins are also possible at some additional sites, although the Agency's data base on dioxin concentrations in CKD was not extensive enough to conduct a similar large sample study. In addition, about 18 percent of the plants (mostly the same plants with the higher estimates for cancer risks) were estimated to have potential non-cancer hazard ratios greater than 0.1 for highly exposed potential farmer/fisher individuals. That is, they would contribute enough of a toxic metal such as cadmium, chromium, or thallium through a possible food source (fish, vegetable, or beef and milk source) to equal one-tenth of a subsistence individual's allowable health-based-standard intake from all sources. In a few instances, a toxic metal food chain exposure was estimated to exceed a non-cancer health based standard by more than a factor of 100. Preliminary analysis presented in the September 1994 technical background document also suggested possibilities for elevation of blood lead levels in children living near uncontrolled CKD piles, due to food chain exposures.

These indirect pathway risk estimates are based on current standard Agency methods to account for toxic metals and dioxins to be bio-concentrated in plant and animal components of foods for human consumption. The Agency did not have direct data on local food consumption patterns for backyard gardeners, subsistence farmers, or recreational or subsistence fishermen in areas of potential exposure. In this instance, standard Agency assumptions (as documented in the RTC and background document) regarding consumption rates of home-grown beef, dairy products, vegetables and family-caught fish were used to estimate exposures to these potentially affected consumers.

The particular sites selected for indirect pathway analysis from among the 83 plants in EPA's study were carefully screened with respect to the potential for CKD releases from currently active piles and exposures via land, air, and surface water pathways. Proximity to nearby streams or lakes (for possible risk via fish ingestion) and distance to actual farm fields and rural dwellings likely to have gardens (for potential exposures from home grown vegetables and/or beef and milk) were determined from a variety of sources, including company-provided maps, U.S. Geological Survey maps, and aerial photographs.

[7] Documentation and detailed results of five case study facilities are documented in the technical background document for the NODA on human health and environmental risk assessment (see 59 FR 47133). The documentation and detailed results of the more recent work are presented in the Technical Background Document on Potential Risks from Cement Kiln Dust in support of the Cement Kiln Dust Regulatory Determination, January, 1995. This document is located in the RCRA docket No. F–95–RCKD–FFFFF.