# Appendix I

# REDUCED RISKS TO CHILDREN'S HEALTH

# APPENDIX I

## REDUCED RISKS TO CHILDREN'S HEALTH

Reductions in risks to children's health comprise an important part of the benefits analysis for the Hazardous Waste Combustion (HWC) MACT standards. The risk analysis specifically targets children in estimating risks from HWC facility emissions. Additionally, recent initiatives of the EPA and other branches of the federal government have emphasized the necessity of addressing the subject of environmental threats to the health of children in conjunction with federal regulatory actions, like the MACT standards.

The purpose of this appendix is to highlight the reduction of risk to children's health associated with the MACT standards and to address the regulatory context of these benefits. This appendix is organized into two sections. First, we present a brief background discussion on federal children's health initiatives and describe how we analyze children health risks for the HWC MACT standards. Second, we discuss the reduced risks to children's health associated with the MACT standards. The key findings from the risk assessment are highlighted below:

- **Cancer Risks.** In general, children do not face significant cancer risks from hazardous waste combustion emissions. Only in the case of children of subsistence farmers and commercial dairy farmers do baseline cancer risks exceed $1x10^{-5}$ for the most highly exposed children. With the exception of children (aged 0-5 years) of subsistence farmers living near cement kilns and LWAKs, all of the highest cancer risks are reduced to below levels of concern ($<1x10^{-5}$) post-MACT under both the BTF-ACI and Recommended MACT options.

- **Non-Cancer Risks**. Much of the non-cancer risk reductions resulting from implementation of the MACT standards most likely will benefit children specifically. The MACT standards will lower exposures to particulate matter (PM), and lead, which are two types of pollutants addressed in the non-cancer risk reductions that primarily affect children.

  -- PM reductions will prevent 268,000 asthma attacks in the general population. If these cases are equally distributed across age groups, over 77,000 asthma attacks affecting children will be avoided each year.

-- Reduced lead exposures for children are expected post-MACT which may prevent cognitive and nervous system developmental abnormalities. In particular, the blood lead levels of two children will be reduced to below levels of concern (<10$\mu$g/dL); also, the MACT standards will reduce overall blood lead levels for children of subsistence farmers living near incinerators from approximately 12$\mu$g/dL in the baseline to about 10.5$\mu$g/dL post-MACT.

## BACKGROUND

### Federal Initiatives on Children's Health

Over the past several years, the topic of environmental threats to the health of children has assumed increasing prominence within the regulatory arena. Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks" (April 21, 1997), directs federal agencies and departments to evaluate the health effects of proposed health-related or risk-related regulation on children.[1] Two separate directives issued by the EPA, "Policy on Evaluating Health Risks to Children" (October 1995) and "National Agenda to Protect Children's Health from Environmental Threats" (October 1996), also require consideration of children's health within risk assessments and other components of regulatory analyses.

The topic of environmental threats to children's health is gaining in regulatory importance as scientists, policy makers, and community members continue to recognize the extent to which children are particularly vulnerable to environmental hazards. A few significant physiological characteristics are largely responsible for children's increased susceptibility to environmental hazards. First, children eat proportionately more food, drink proportionately more fluids, and breathe more air per pound of body weight than do adults. As a result, children potentially experience greater levels of exposure to environmental threats than do adults. Second, because children's bodies are still in the process of development, their immune systems, neurological systems, and other immature organs can be more easily and considerably affected by environmental hazards. The connection between these physical characteristics and children's susceptibility to environmental threats are reflected in the higher baseline risk levels for children living near hazardous waste combustion facilities.

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[1] For economically significant rules (i.e., those expected to have an annual effect on the economy of $100 million or more), Executive Order 13045 also requires an explanation as to why the planned regulation is preferable to other alternatives considered. MACT standards are exempt from this requirement because the rule is an example of technology-based regulation rather than a risk-based one (*EPA's Rule Writer's Guide to Executive Order 13045: Guidance for Considering Risks to Children During the Establishment of Public Health-Related and Risk-Related Standards, Interim Final Guidance,* April 21, 1998).

## Analysis of Reduced Risks to Children's Health

The risk assessment performed for the MACT standards addresses threats to children's health associated with hazardous waste combustion by evaluating reductions in risk for children as well as for adults and the population overall. For all exposed sub-populations, the assessment evaluated risks to four different age groups: 0-5 years, 6-11 years, 12-19 years, and adults over 20 years. Areas for potential reductions in risks and related health effects that were identified by the risk assessment are all targeted as priority issues within EPA's September 1996 report, *Environmental Health Threats to Children*.

Where possible, the MACT risk assessment has provided both population and individual risk results for children. The benefits summary presented below summarizes results from the multi-pathway risk assessment in order to examine potential effects of combined exposures on children. We examine both cancer and non-cancer risks across the age groups of children, focusing on the most susceptible sub-populations. With regard to cancer risks, we examine the combined effects of several carcinogens, one of the goals named within EPA's "National Agenda to Protect Children's Health from Environmental Threats."[2]

## SUMMARY OF REDUCED RISKS TO CHILDREN'S HEALTH

The risk assessment for the MACT standards found the potential for reduced risks to children associated with the following pollutants:[3]

[2] U.S. Environmental Protection Agency, *Environmental Health Threats to Children* (EPA 175-F-96-001), September 1996, pages 2 and 6.

[3] Risk data are from: Research Triangle Institute, *EPA Technical Support Document: Risk Assessment Support to the Development of Technical Standards for the Emissions from Combustion Units Burning Hazardous Wastes, Human Health and Ecological Risk Results: Baseline and MACT,* Prepared for U.S. EPA, Office of Solid Waste, September 1998.

**Particulate Matter (PM) Exposure** -- resulting in the potential for asthma that commonly affects children. The risk assessment found that approximately 268,000 asthma attacks would be avoided across the entire population per year following the implementation of the MACT standards.[4] While these risk results are for the entire population (i.e., both children and adults) and are not broken down into separate estimates for different age groups, if we assume these cases are equally distributed across age groups, over 77,000 asthma attacks affecting children will be avoided each year.[5] True PM health benefits, however, are likely to be even higher that these estimates suggest because the vulnerability of children to PM exposure may make them primary recipients for these benefits.[6]

**Mercury Exposure** -- through contaminated fish intake, results in potential for developmental abnormalities in the offspring of affected sub-populations.[7] The risk assessment concluded that in the baseline and under all MACT standards, mercury levels are below levels of concern. Consequently, EPA does not estimate that any recreational anglers to be at risk for having offspring with developmental abnormalities (i.e., will be exposed to mercury above levels of concern, (HQ>1)). Adult subsistence fishermen living near incinerators face the highest hazard quotients for mercury in the baseline; with the MACT standards, the hazard quotient for subsistence fishermen changes from 0.40 in the baseline to 0.20 under the Recommended MACT. Because the hazard quotients are below levels of concern in the baseline, developmental abnormalities for this sensitive sub-population are not expected to be reduced as a result of the MACT Standards.

**Lead Poisoning** -- from exposure to lead in HWC facility emissions, causes potential for abnormalities in cognitive and nervous system development. The blood lead levels of approximately two children, ages 0-5, will be reduced to below levels of concern in a given year because of the MACT standards.[8] In addition, the MACT standards will reduce cumulative, or overall, blood lead levels from approximately 12 $\mu$g/dL to 10.5$\mu$g/dL for children of subsistence farmers with the highest exposure levels (at the 99th percentile). Children of subsistence fishermen, commercial beef

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[4] Results reflect a total modeled population of 72,270,100 (all age groups -- adults as well as children).

[5] Children are defined as ages 0-19. We assume children represent 28.8 percent of the general population (U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States 1997*, Table No. 14, "Resident Population, by Age and Sex: 1980 to 1996," page 15.)

[6] U.S. EPA, *Environmental Health Threats to Children* (EPA 175-F-96-001), September 1996, page 4.

[7] *Ibid*.

[8] Levels of concern for lead exposure are defined as blood lead levels above 10$\mu$g/dL.

farmers, and commercial dairy farmers who face the greatest levels of cumulative lead exposure (at the 99th percentile) will also experience some reductions in overall exposure as a result of the MACT standards; blood lead levels for these groups of children are reduced by as much as 0.05$\mu$g/dL post-MACT (see Exhibit I-1).

**Cancer Risks** -- associated with direct and indirect exposure of levels of concern to dioxin and other pollutants for certain sub-populations. With the exception of two sensitive children sub-populations, baseline individual cancer risks are below levels of concern (i.e., $<1x10^{-5}$).

- Children of subsistence farmers (aged 0-5), who face the greatest individual risk in the baseline, experience no cancer risk reductions under the MACT Floor. Under the Recommended and BTF-ACI MACT Standard, the portion of this sensitive sub-population living near incinerators experiences risk reductions to below levels of concern (for those living near commercial incinerators, risks are reduced from as much as $6x10^{-5}$ in the baseline to below $8x10^{-6}$). For the portion of this sensitive sub-population living near cement kilns and LWAKs, cancer risks are not reduced to levels below concern under any MACT option. As previously stated, under the Floor, cancer risks do not change at all. Under the Recommended and BTF-ACI MACT options for this sensitive children group living near kilns, individual risks are only reduced slightly, from $1x10^{-5}$ to $3x10^{-5}$ in the baseline to $1x10^{-5}$ to $2x10^{-5}$.

- The most highly exposed children (aged 0-5 years) of commercial dairy farmers residing near LWAKs and commercial incinerators also experience cancer risks above $1x10^{-5}$ in the baseline. These risks are not reduced to levels below concern under the MACT Floor. Under the Recommended and BTF-ACI MACT, however, all of these risks decrease to levels below concern.

**Exhibit I-1**

**BLOOD LEAD LEVELS IN CHILDREN: BASELINE AND POST-MACT**

| Child (age 0-5) of: | Combustion Sector | Blood Lead Levels (99th percentile) | | | | Change in Cumulative Exposure Level (ug/dL) |
|---|---|---|---|---|---|---|
| | | Baseline | | Recommended MACT | | |
| | | Total (ug/dL) | Incremental (ug/dL) | Total (ug/dL) | Incremental (ug/dL) | |
| Resident | CK | 10.89 | 0.18 | 10.52 | <0.01 | 0.37 |
| | LWAK | 10.96 | <0.01 | 10.63 | <0.01 | 0.33 |
| | All Incin. | 11.30 | 0.42 | 10.86 | <0.01 | 0.44 |
| Commercial Dairy Farmer | CK | 10.82 | 0.29 | 10.96 | <0.01 | -- |
| | LWAK | 10.77 | 0.03 | 10.42 | <0.01 | 0.35 |
| | All Incin. | 11.37 | 0.71 | 11.48 | 0.03 | -- |
| Commercial Beef Farmer | CK | 11.13 | 0.21 | 10.63 | <0.01 | 0.50 |
| | LWAK | 10.84 | <0.01 | 10.70 | <0.01 | 0.14 |
| | All Incin. | 11.24 | 0.45 | 10.80 | <0.01 | 0.44 |
| Subsistence Fisher | CK | 11.18 | 0.62 | 10.84 | 0.03 | 0.34 |
| | LWAK | 10.87 | <0.01 | 10.83 | <0.01 | 0.04 |
| | All Incin. | 11.40 | 0.66 | 10.87 | 0.03 | 0.53 |
| Subsistence Farmer | CK | 11.25 | 0.59 | 10.81 | 0.03 | 0.44 |
| | LWAK | 11.12 | 0.03 | 10.77 | <0.01 | 0.35 |
| | All Incin. | 12.04 | 1.42 | 10.66 | 0.03 | 1.38 |

Notes:
1. Summarized from Tables IV-A1 through Tables IV-H5, "Risk Assessment Support to the Development of Technical Standards for Emissions from Combustion Units Burning Hazardous Wastes, Human Health and Ecological Risk Results: Baseline and MACT," Prepared by Research Triangle Institute, Prepared for U.S. Environmental Protection Agency, September 1998.
3. Lead exposure levels of concern are defined as being 10$\mu$g/dL or above. The exposure level at which particular health effects will occur depends greatly upon individual circumstances.
4. Only children ages 0-5 are evaluated because that is the age group for which risks associated with lead poisoning are the greatest.
5. Cumulative exposures represent incremental lead exposure from HWC facility emissions plus background levels from other sources, like lead-based house paint. Cumulative exposures shown reflect those experienced by the 1% of children in the receptor group with the highest levels of lead exposure.

## REFERENCES

U.S. Department of Commerce, Bureau of the Census. *Statistical Abstract of the United States 1997*, Table No. 14, "Resident Population, by Age and Sex: 1980 to 1996."

U.S. EPA. 1998. *EPA's Rule Writer's Guide to Executive Order 13045: Guidance for Considering Risks to Children During the Establishment of Public Health-Related and Risk-Related Standards, Interim Final Guidance*.

U.S. EPA. 1996. *Environmental Health Threats to Children* (EPA 175-F-96-001).

Research Triangle Institute. 1998. *Risk Assessment Support to the Development of Technical Standards for the Emissions from Combustion Units Burning Hazardous Wastes, Human Health and Ecological Risk Results: Baseline and MACT*. Prepared for U.S. Environmental Protection Agency, Office of Solid Waste.