

Draft Lead Report Workshop

September 30, 2005

9 am to 1 pm

Byron Sher Auditorium

Cal/EPA Headquarters

Report Purpose

Improve understanding of lead's history

- Past and current uses

Summarize recent information

- Lead in the environment and wastes
- Health effects, particularly for children

Compare to prior assumptions

- Past & current regulatory initiatives

Inform decisionmaking

- Hazardous waste threshold
- Alternative management standards

Uses of Lead

- Ancient times
 - Plumbing
 - Pigments
 - Medicines
 - Cosmetics

Uses of Lead

- Recent Past
 - Ammunition
 - Brass and pewter
 - Paint, pigments and glazes
 - Glass and crystal
 - Plumbing
 - Fuel additive

Uses of Lead

- Current U.S. Lead Consumption (2000)
 - Batteries: 86.6%
 - Ammunition: 3.6%
 - Paint/pigments, glass, ceramics & chemicals 3%
 - Sheet lead 1.4%
 - Type metal & other products 1.3%
 - Solder 0.7%

Lead Production

- Primary sources
 - Mines in Missouri & Alaska
 - 457,000 tonnes (2000)
- Secondary sources
 - 77% of refinery production (2000)
 - 1,130,000 tonnes (2000)
 - 90% from battery recycling

Lead in the Environment

- Naturally Occurring
- Concentrations vary widely – difficult to distinguish natural sources only
- Chronological records estimate marked increase over time
- Small compared to anthropogenic sources
 - 4.5% of total air emission in California (1996)

Lead in the Environment

Air Emissions

- Mobile sources (1996)
 - On road: <1% nationwide
 - Non road: 22% nationwide
 - Other: 33% California
- Stationary point sources
 - California (ARB, 2000): 31,000 lb
 - California (TRI, 1999): 37,000 lb
- Area sources
 - California (ARB, 2000): 1.6 million lb

Air Emissions Industrial Sources

- Stationary Point Sources in California:
 - Inorganic chemicals
 - Secondary nonferrous metals
 - Storage batteries
 - Electronic components
 - Gold & metal ores
 - Blast furnaces & steel mills
 - Fabricated metal
 - Mills, minerals & wood products

Air Emissions Industrial Sources

- Area Sources in California:
 - Unpaved road travel dust
 - Paved road travel dust
 - Fugitive dust from unpaved roads
 - Building construction/demolition dust
 - Road construction/demolition dust
 - Military jet fuel
 - Fugitive agricultural dust

Lead in the Environment

Releases to Soil

- Lead-based paint
 - Near foundation/dripline
 - Wide range: 1-22,000 ppm
- Point source emitters
 - Mining, smelting, battery facilities, waste
- Deposition from air emissions
 - Past and current leaded fuel combustion
- Lead wheel weights
 - 3,730 kg/year (Albuquerque)
- TRI data – releases to land, California (1999)
 - Lead: 691,966 pounds
 - Lead compounds: 1,937,640 pounds

Lead in the Environment

Releases to Water

- Industrial or process wastewater discharge
 - Usually treated
 - Suspended solids and sewage sludge
- Wet or dry deposition of airborne emissions
- Runoff
- Leaching to water supply
 - Pipes, solder, plumbing
- TRI data – surface water discharges, Calif (1999)
 - Lead: 12 pounds
 - Lead compounds: 733 pounds

Lead in the Environment

Contaminated Sites

- Cal Sites data (2001)
 - 463 sites where lead is potentially present
 - 61 sites where lead is confirmed
 - Includes military facilities, plating shops, railroad, marine/port facilities, among others
 - Mostly soil contamination
 - Wide range of lead concentrations
 - <1 mg/kg to >80,000 mg/kg for sample of sites

Lead in Waste Streams

- Cogeneration and incinerator ash
- Spent abrasive blasting material
- Metal drosses, sludges and slags
- Spent foundry sand
- Refinery tank bottoms
- Machining scrap
- Spent etching solution
- Used oil
- Galvanizing waste
- Sewage sludge
- Auto shredder waste
- Contaminated soil

Lead in Waste Streams

- TRI data (1999) – total waste managed, Calif.
 - Mostly recycled offsite

	Lead (lbs)	Lead cmpds (lbs)
Primary metals	1,549,220	2,988,957
Electrical equip	128,063	23,207,669
Fabricated metals	284,817	-

Manifest data (1999) – California

DOO8: 98,135 tons

Environmental Fate

- Solubility varies with species and pH
 - Typically low water solubility
- Air deposition
 - Particle size
 - Atmospheric conditions
- Movement in soil
 - Tends to stay near surface
 - Mechanical movement & erosion

Exposure

Inhalation:

- Fine particles & fumes
- Air lead concentrations vary
 - Emission sources
 - Contaminated soils & dusts
 - Weather conditions
- Adult pulmonary deposition rate of 30-50%
- Children inhale greater volume of air/unit of body weight than adults and their pulmonary deposition rate is higher

Exposure

Ingestion

- Food, water, soil, dust, paint chips
- Absorption and bioavailability varies:
 - Age & health status
 - Ingestion patterns
 - Particle size, solubility & species of lead
- Absorption is higher in children than adults
- Nutritional deficiencies increase absorption

Exposure

Lead in food:

- Environmental
 - deposition or uptake
- Processing or packaging
 - Can solder
 - Wrappers
- Amount declining:

FDA Total Diet Study	1982-1984	1994-1996
Children (2-5 years)	30 $\mu\text{g}/\text{day}$	1.3 $\mu\text{g}/\text{day}$
Adults	38 $\mu\text{g}/\text{day}$	2.5 $\mu\text{g}/\text{day}$

Exposure

Lead in drinking water:

- Source water
- Corrosion of lead-containing plumbing
 - Water service mains & lines, pipes & connections, solder and faucets
 - Water corrosivity, age & condition of system & solder joints, contact time
- Average concentration in U.S. (1988): 17 $\mu\text{g/L}$
- MCL for lead updated in 1991:
 - goal of zero, treat to control source water corrosivity
 - 15 $\mu\text{g/L}$ action level

Exposure

Lead in soils and dusts

- Deposition from airborne emissions
- Flaking, weathering & scraping of lead-based painted surfaces
- Interior dusts can be inhaled or ingested
- Contaminates foods during storage, meal prep and consumption
- Ingested during hand-to-mouth behavior

Exposure

Lead in soils and dusts (cont)

- Children commonly ingest soil & dust via typical child behaviors (declines after 5-6 yrs):
 - Finger & thumb-sucking
 - Frequent hand-to-mouth exploration
 - Mouthing non-food items & surfaces
 - Eating dropped or soiled food
 - Playing on or near bare soil
- Difficult to estimate child soil ingestion, several to hundreds of mg of soil/day

Exposure

Lead in other products:

- Crockery, dishes, leaded crystal
- Remedies & cosmetics
- Hobby items: ammunition, fishing weights
- Vinyl miniblinds, wire coating, lunchboxes
- Costume jewelry & charms

Exposure

Measurement:

- Blood lead levels (BLLs) – $\mu\text{g}/\text{dL}$
 - Reflects recent exposure
 - Directly related to symptoms
- NHANES – shows declines in BLL over time

Children, 1-5 years	Mean BLL	% BLL > 10 $\mu\text{g}/\text{dL}$
1976-1980	15 $\mu\text{g}/\text{dL}$	88%
1988-1991	3.6 $\mu\text{g}/\text{dL}$	8.9%
1991-1994	2.7 $\mu\text{g}/\text{dL}$	4.4%
1999-2002	1.9 $\mu\text{g}/\text{dL}$	1.6

Health Effects

- Neurotoxic and neurodevelopmental effects
- Cognitive impairment and behavioral disorders
- Impaired heme synthesis & anemia
- Kidney disease
- Inhibited growth & development

Health Effects

- Pregnant women and children are most sensitive receptors
- Children
 - More likely to ingest non-food sources
 - Higher absorption
 - More susceptible to adverse impacts due to rapid growth and development
- Child BLL of 10 $\mu\text{g}/\text{dL}$ - CDC level of concern
 - Cognitive and developmental impairments seen at low BLLs

Standards Applicable to Lead Cleanup and Screening Levels

- Site-specific
- School site initial cleanup value (DTSC)
 - 255 mg/kg soil lead
- Residential soil thresholds (U.S. EPA)
 - 400 ppm in bare soil in play areas
 - 1,200 ppm in bare soil elsewhere
- Lead-contaminated soil (DHS)
 - 400 ppm in bare soil in play areas
 - 1,000 ppm in bare soil in other areas

Standards Applicable to Lead Hazardous Waste Thresholds

In California a waste is hazardous if:

- It meets the statutory definition (HSC 25117)
- It is listed or characteristic according to federal criteria
- It exhibits any characteristic of toxicity, reactivity, ignitability or corrosivity according to state criteria

Standards Applicable to Lead Hazardous Waste Thresholds

- Federal toxicity threshold for lead
 - 0.5 mg/l (TCLP)
- California toxicity thresholds for lead
 - Soluble threshold limit concentration (STLC)
 - 0.5 mg/l (WET)
 - Total threshold limit concentration (TTLC)
 - 1,000 mg/kg

Table 4-1 – Overview of Standards, Regulatory levels, and Guidance Levels for Lead – California

Regulatory Level	Reference and Authority	Toxicological Basis, Routes of Exposure and Pathways	Models, Assumptions and Parameters	Comments
<i>Total Threshold Limit Concentration, TTLC</i>				
1,000 mg of lead/Kg of waste	Ref: 22 CCR 66261.23(a)(2) Auth: H&SC, 25141 & 25159	<u>Basis:</u> STLC of 5 mg/L <u>Route:</u> Ingestion <u>Pathway:</u> Direct contact	<u>Assumptions:</u> 100- fold uncertainty factor and children should not be exposed to soil-lead concentrations above 1,000 mg/kg	TTLC = 100 x STLC, adjusted to coincide with 1,000 mg/kg threshold for child exposure
<i>Soluble Threshold Limit Concentration, STLC</i>				
5 mg of lead/L of waste extract solution (using Waste Extraction Test)	Ref: 22 CCR 66261.23(a)(2) Auth: H&SC, Sections 25141 & 25159	<u>Basis:</u> MCL of 50 µg /L <u>Route:</u> Ingestion of drinking water <u>Pathway:</u> Drinking water derived from groundwater or surface water	<u>Models:</u> Battelle (1976) and U.S. EPA (1980) <u>Assumptions:</u> 100-fold attenuation factor as reported by Battelle (1976) and U.S. EPA (1980)	STLC = 100 x MCL
<i>Statutory Limit:</i>				
350 mg of lead/Kg of waste	H&SC, Section 25157.8	Unknown	Unknown	A waste that meets the criterion specified in this statute but is not otherwise a California hazardous waste is required to be disposed of in a Class I (hazardous waste) landfill. However, some landfill operators have balked at accepting such waste, as it is technically not a hazardous waste. In addition, manifesting of such waste does not appear necessary for the same reason.
<i>School Sites Initial Screening Value, Proposed:</i>				
255 mg/Kg, corresponding to the 99 th percentile		<u>Basis:</u> Threshold blood lead concentration of 10-µg/dL <u>Routes:</u> Ingestion, inhalation and dermal contact <u>Pathways:</u> Dietary intake, drinking water, soil and dust ingestion, inhalation, and dermal contact	<u>Models:</u> LeadSpread, Version 7 <u>Assumptions/Parameters:</u> Regional and statewide air concentrations of lead; 15 µg lead/L in drinking water	Exposure scenario assumes exposure to children at school sites developed on “formerly residential or uncontaminated commercial properties.”
<i>Accreditation, Certification, and Work Practices for Lead-Based Paint and Lead Hazards</i>				
400 ppm in children’s play areas;1000 ppm in other areas	Ref: 17 CCR 35036 Auth: H&SC sections 105250(a)&(b), 124160(b), 124165	Unknown	Unknown	Definition of Lead-Contaminated Soil

Table 4-2 – Overview of Standards, Regulatory levels, and Guidance Levels for Lead – Federal

Regulatory Level	Reference and Authority	Toxicological Basis, Routes of Exposure and Pathways	Models, Assumptions and Parameters	Comments
<i>Toxicity Characteristic for D008:</i>				
5 mg/l (using the Toxicity Characteristic Leaching Procedure)	40 CFR Section 261.24	<u>Basis:</u> MCL of 50 µg /L in drinking water. <u>Route:</u> Ingestion of drinking water <u>Pathway:</u> Drinking water derived from groundwater or surface water	<u>Models:</u> Battelle (1976) and U.S. EPA (1980) <u>Assumptions:</u> 100-fold dilution attenuation factor	Threshold = DAF X MCL
<i>Toxic Substances Control Act (TSCA) Values:</i>				
400 ppm of lead in bare soil in children's play areas or 1200 ppm average for bare soil in the rest of the yard	40 CFR Section 745.65	<u>Basis:</u> The level at which 5% of potentially exposed children will have blood lead concentrations in excess of 10 µg/dL <u>Routes:</u> Inhalation and ingestion <u>Pathways:</u> Air, drinking water, food (including homegrown food), soil, and dust	<u>Models:</u> IEUBK model with default parameters and guidance manual for soil concentrations	The purpose of this standard is to provide residential dust and soil threshold values for lead above which children may be at risk of having elevated blood lead levels.
<i>CERCLA Sites and RCRA Corrective Action Screening Levels:</i>				
400 ppm for lead in residential soil	Guidance only	<u>Basis:</u> Blood lead concentration of 10-µg/dL <u>Routes:</u> Ingestion and inhalation	<u>Model:</u> IEUBK model <u>Assumptions:</u> Use site-specific information, if available. Takes into account multiple environmental sources of lead.	The exposure scenario assumes exposure of children to lead from various environmental media.

Standards Applicable to Lead Hazardous Waste Thresholds

- STLC
 - Proposed in 1978
 - Exposure route is ingestion of drinking water
 - Applied a 100-fold attenuation factor to MCL for lead at the time (50 $\mu\text{g}/\text{L}$)
 - Intended to approximate the potential for soluble substances from improperly disposed wastes to migrate to drinking water supplies or aquatic wildlife environments

Standards Applicable to Lead Hazardous Waste Thresholds

- TTLC
 - Proposed in 1978
 - Exposure route is ingestion, inhalation or dermal contact with waste
 - Applied a 100-fold uncertainty factor to STLC values for “initial” TTLCs – later adjusted for five constituents, including lead
 - Intended to approximate the potential for direct contact with improperly disposed waste

Standards Applicable to Lead Hazardous Waste Thresholds

- Initial draft of the TTLC for lead: 500 mg/kg
- British study findings (1980):
 - Heavy contamination: 10,000 mg/kg
 - Acceptable soil levels: 550 – 1,500 mg/kg
- DHS study recommended background levels >1,000 mg/kg should be unacceptable due to potential for ingestion by children via pica
- Final promulgated TTLC for lead: 1,000 mg/kg

Standards Applicable to Lead Hazardous Waste Thresholds

- More recent soil lead recommendations:

<100 - <150 ppm	protect pica children
255 mg/kg	school sites
300 – 500 ppm	keep BLL <25 $\mu\text{g}/\text{dL}$
400 ppm	residential play areas
600 ppm	increase in BLL of 5 $\mu\text{g}/\text{dL}$
1,000 – 1,200 ppm	other residential areas

Standards Applicable to Lead Hazardous Waste Thresholds

- Ideas for updating the TTLC
 - Apply 100-fold uncertainty factor to STLC without subsequent correction
 - Calculate a health-based concentration using LeadSpread exposure model
 - Calculate a health-based concentration using the IEUBK exposure model
 - Replace totals extraction test with in vitro physiologically-based extraction test that estimates bioavailability
 - Do Nothing

Standards Applicable to Lead Hazardous Waste Thresholds

- Potential effects of updating the TTLC
 - Likely to be minimal
 - Soluble concentrations of lead typically drive hazardous waste characterization
 - Rule of thumb: factor of 10 to 30
 - Highly variable
 - Example:
 - A soluble concentration < 5 mg/L associated with total concentration of 50 – 150 mg/kg



Alternative Management Standards

HSC 25150.6

- Authorized by AB 2877 (2004)
 - Health and Safety Code section 25150.6(f)
- Allows exemption of a hazardous waste management activity from specified requirement(s) of Chapter 6.5 if:
 - The waste is specified in list
 - The waste is identified as a universal waste
 - The standards for universal waste management are amended
 - The activity is not required by federal law

Alternative Management Standards

HSC 25150.6(f)(1)(E)

- Applicable to lead-based painted debris that is a hazardous waste
- Extension of prior exemption applicable to lead-painted wood debris
 - expired January 1, 2003

Alternative Management Standards

HSC 25150.6(a)

- Prepare preliminary analysis
- Demonstrate one of the following:
 - The exempted requirement is not significant to prevent potential hazard or ensure compliance
 - Another agency provides equivalent protection
 - Conditions or limitations provide equivalent protection
 - Conditions or limitations accomplish same regulatory purpose without increasing potential risk
- Impose conditions and limitations
- Give public notice

Alternative Management Standards

Preliminary Analysis *HSC 25150.6(b)*

- Characterize types and amounts of affected hazardous wastes
 - Identify hazards posed by reasonably foreseeable mismanagement of wastes
- Characterize complexity of activity
- Characterize chemical or physical hazards associated with activity
- Identify reasonably foreseeable accidents
 - Likely consequences & accident history
- Types of locations where activity may occur
 - Estimate number of locations & types of hazards posed by proximity to sensitive land uses

Alternative Management Standards Lead-Based Painted Debris

- Reduce exposure to lead-based paint
 - Low level child exposure
- Facilitate lead paint abatement, particularly in child-occupied buildings
 - Limited funding

Alternative Management Standards Lead-Based Painted Debris

- Universal waste
 - Hazardous waste
 - Large number & variety of generators
 - Typically one-time generation
- Opportunities for recycling
 - Limited
- Opportunities for treatment
 - Stabilization
 - Limit particle size reduction (sanding, grinding, crushing)

Alternative Management Standards Lead-Based Painted Debris - Ideas

Disposal to nonhazardous waste landfill with conditions on disposal

- Liner and leachate collection & removal system
- Dedicated cell within the landfill
- No mixing or contact with municipal solid waste
- Soil or geosynthetic tarp for daily cover
- No recirculation of landfill leachate over dedicated cell
- Monitoring & reporting of leachate, groundwater and storm water



Topics for Discussion

- Comments on report
 - Significant topics missing?
 - Available data missing?
 - Erroneous assertions or conclusions?
 - Unclear information?

Topics for Discussion

- Comments on updating TTLC
- Reaction or comment on DTSC options?
 - Recalculate without correction
 - Health-based models (LeadSpread or IEUBK)
 - Bioavailability calculation
- Other models or calculations to consider that account for direct exposure to waste?
- Additional data regarding potential impacts?

Topics for Discussion

- Comments on ideas for alternative management standards
 - Data regarding LBP debris volumes?
 - Additional data regarding LBP debris characteristics?
 - Other ideas or suggestions for AMS?
 - Innovative treatment or recycling options?

Future activities

- Update and finalize Lead Report
- Determination regarding TTLC
 - Potential rulemaking with peer review and additional workshops
- Determination regarding AMS
 - Preliminary report and public notice
 - Potential rulemaking with additional workshops

Contact Information

Submit comments by November 1, 2005 to:

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