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Occupational Safety and Health Administration
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[on board]

Office of the Assistant Secretary

Scrap Meeting 9/20/78

MEMORANDUM FOR SECRETARY RAY MARSHALL

FROM: EULA BINGHAM, ASSISTANT SECRETARY OCCUPATIONAL SAFETY AND HEALTH

Eula Bingham

SUBJECT: Final standard for employee exposure to lead.

We expect to issue a final standard for employee exposure to lead in the next few weeks. This memo briefly summarizes the evidence on health effects of lead and the decisions which form the final standard.

I. History of the Standard

The present OSHA standard for lead sets an employee exposure limit of 200 µg/m3 as an eight-hour time-weighted average. The standard was adopted in 1971 from the American National Standards Institute under section 6(a) of the Occupational Safety and Health Act.

In January 1973, NIOSH submitted a Criteria Document which recommended lowering the permissible exposure limit for lead to 150 µg/m3.

On August 4, 1975, NIOSH forwarded a letter to OSHA which revised the recommended exposure limit from 150 µg/m3 to lower ranges. The letter was the culmination of a joint effort by the staff of both OSHA and NIOSH to analyze and review new scientific data.

On October 3, 1975, the Secretary of Labor published a proposed standard to limit employee exposure to lead to 100 ug/m3. Public hearings on the proposed standard for exposure to lead were held in Washington, D.C. beginning March 15, 1977. Regional hearings were held in St. Louis, Missouri and San Francisco, California beginning April 26, 1977 and May 3, 1977 respectively. Public hearings on the issue of medical removal protection were held November 1-11 and December 22, 1977.

II. Health Effects

The record demonstrates that lead has profoundly adverse effects on the health of workers in the lead industry. Inhalation, the most important source of lead intake, and ingestion result in

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ments in the standard. This action level will initiate biological monitoring. If the results of initial biological monitoring indicate that employee blood lead levels are within the 30-40 µg/100g range, monitoring would be repeated yearly. If the results of initial monitoring show blood lead levels in excess of 40 µg/100g, then monitoring would continue on a bi-monthly basis. If blood lead levels are at, or above 60 µg/100g, the employee must be removed from the workplace. (Lead standard will include medical removal provisions-see below). In addition to a PEL the final standard will provide stringent provisions for personal hygiene facilities, personal protective equipment, and housekeeping provisons all of which are designed to minimize worker ingestion of lead.

IV. Feasibility

OSHA has determined that the permanent standard is feasible when implemented in accordance with a compliance schedule contained in the standard.

This schedule establishes compliance deadlines which vary by industry on the basis of the extent of the engineering and work practice controls needed to comply. Attainment of an intermediate milestone of 100 µg/m3 will be required in five industries--primary smelting, secondary smelting, battery manufacture, pigment manufacture and nonferrous foundries--where compliance with the PEL will take more than one year.

The compliance schedule for installation of engineering controls and work practices is as follows:

Exposure Level	Industry	Years from effective date
200 µg/m^3	All industries	Immediately on effective date
100 µg/m^3	Primary Smelting	3
	Secondary Smelting	3
	Battery Manufacture	2
	Pigment Manufacture	3
	Nonferrous Foundries	1
50 µg/m^3	Primary Smelting	10
	Secondary Smelting	5
	Battery Manufacture	5
	Pigment Manufacture	5
	Nonferrous Foundries	5
	All other Industries	1

damage to the heme (a complex molecule used for oxygen transport in the blood and subcellular respiration), nervous, urinary and reproductive systems. The adverse effects of lead on the nervous system are potentially the most serious to the health of the worker. Fatal cases of lead encephalopathy may occur with epileptic-like seizures, followed by coma, cardio-respiratory arrest, then death. Milder forms of encephalopathy also include such symptoms as verbal obstruction, dizziness, impaired memory and insomnia. Neuropathy, a disease of the peripheral nerves, may also be found in lead workers. Symptoms may range from reduced nerve conduction velocities through the classic "wrist drop" and "foot drop," to total paralysis. Less obvious, but still part of the impairment of the nervous system are performance and behavioral disorders, such as personality changes and diminished neuromuscular response.

Kidney damage is also an early reaction to lead. This damage is shown both by reduced renal function and histopathological sections of the kidneys. With continued exposure, renal disease systematically, and irreversibly will progress through the stages of kidney disease, and ultimately dialysis would be required. Closely associated with impaired renal function are such diseases as gout and hypertension, which may also be disabling.

Reproductive effects reach far beyond the workplace, as evidenced by increased stillbirths, miscarriages, and greater infant mortality. Moreover, those infants which do survive the lead intoxication of their parents may be mentally retarded or physically disabled. Lead also has the potential to interfere with conception through impotence and infertility .

The interference of lead on the production of hemoglobin by the red blood cells of the bone marrow has been shown to occur at very low blood lead levels. When hemoglobin formation is reduced and the red blood cell number is decreased, the oxygen supply is impaired and the debilitating disease of lead anemia occurs.

A summary of the effects of exposure to lead have been put into table form and are included at the end of this memorandum.

III. The Final Standard

(a) Permissible Exposure Limit. The final standard establishes a PEL of 50 µg/m3 (See tables 1 and 2, Summary of Existing Exposure data). In addition OSHA would establish a 30 µg/m3 action level. Those firms whose initial monitoring record air lead levels below 30 µg/m3 will be exempted from further require-

Should firms in any of these industries choose a compliance strategy for the PEL which is inconsistent with meeting the interim level, the standard provides for waiver of the interim level through the variance procedure.

Industry has alleged that even the interim level of 100 ug/m3, threatens the economic operation of one of the six primary lead smelters, of a few marginal secondary smelters and of over 100 small battery plants. OSHA has determined that these allegations are grossly overstated and the only operations for which closure can reasonably be predicted are those marginally efficient producers whose long run economic viability would be problematic in the absence of any change in the current lead standard.

The record indicates that for primary smelters, the cost of achieving the interim level is less than $.01/pound and that all primary smelters could pay the entire capital cost out of an average year's profit even without an increase in the price of lead. Retrofitted technology may not be sufficient even when combined with administrative controls or other work practices to achieve the 50 µg/m3 PEL in all operations. The record contains evidence of various kinds of new process and control technology in developmental stages which hold great promise for solving worker exposure problems. Additionally, OSHA has determined that it is advisable to permit flexibility to the industry in developing compliance strategies for this long run problem. Accordingly, the implementation schedule incorporates a "planning horizon" sufficient to permit the recapitalization by existing primary lead smelters if such extreme measures prove to be the most cost-efficient solution.

Secondary smelters are of varying size, age and complexity. They recycle lead scrap and the average compliance cost is expected to be passed back to scrap dealers as are other costs. The price of scrap moves with fluctuations in the domestic lead market. A few high-cost producers may elect to cease operations rather than absorb that part of the compliance costs which cannot be passed back.

The record contains testimony that retrofitting of some plants will achieve the PEL. Other older, more primitive facilities may face technical difficulties in reaching 50 ug/m3. However, both economic and technical problems may be solved by a very efficient

new process developed in Denmark and currently in operation in at least 8 locations around the world. [The process and fuel efficiency achieved in these smelters strongly suggests that this technology may soon be dominant in the American industry even in the absence of a new workplace standard]. The imlementation schedule would permit conversion should that prove to be most cost-effective.

The small battery firm is an endangered species for reasons separate from the issues of workplace safety and health. The trend in retail marketing of replacement batteries dooms the small firm to a shrinking market share. The seven largest of about 135 producers currently account for over 90% of industry capacity.

The cost estimates established prior to rulemaking which formed the basis for the dire predictions of the demise of over 100 small firms were faulty on several counts. First they assumed no cost to comply with the current standard which may account for as much as 1/3 of the total cost. Second, they erroneously assumed that all engineering controls currently in place would be useless and that smaller producers would not avail themselves of less expensive equipment.

However, the most important factor in our conclusion that there will not be a massive shut-down of small plants comes from a change OSHA has made in the permissible methods of compliance. The proposed rule established a hierarchy of compliance methods in which engineering controls had to be implemented in preference to work practices and administrative controls. The final standard broadens the methods of compliance to permit use of the latter two methods which can be substantially less costly and equally protective means for reducing worker exposure. For example a small battery plant may be able to alter production schedules and/or rotate workers in order to reduce the time-weighted average exposure below the interim level or final PEL. These alternative strategies are particularly adaptable to the operations of the 95 small battery companies which employ 20 or fewer workers and do not presently engage in all aspects of battery manufacture on an around the clock basis.

For pigment manufacturers and nonferrous foundries, compliance with the PEL will require extensive modifications of the process and control systems, requiring several years to implement. Increased costs of production due to the standard will be able to be passed on to users in the form of higher prices for lead pigments and brass and bronze castings. Some marginal firms in each industry are expected to close, slightly decreasing competition, but no substantial impacts are expected.

Many other industries have employees exposed to lead. At least 50 industries have been identified as having lead exposure and approximately 775,000 employees may be exposed. In almost all cases, exposure levels are believed to be very low and compliance with the 50 ug/m3 standard will not be difficult or expensive since only minor engineering control, most likely local exhaust ventilation, will be required.

Incremental Benefit of Compliance with the Final Standard

The health benefits of the lead standard include decreases in the incidence and severity of the various adverse health effects of lead exposure (e.g., neurological damage, kidney damage, etc). However, although OSHA had concluded that (1) the evidence for health inpairment over 60 µg/100g is compelling, and (2) that there are grounds for concern for workers with blood lead levels over 40 µg/100g for prolonged periods, the available data does not allow meaningful quantitative estimation of the degree of prevention of the different forms of health damage likely to be achieved by lowering worker air exposures and blood lead levels by various amounts for various periods of time. The record evidence does allow estimates to be made of the blood lead levels likely to result from compliance with alternative air standards. In lieu of better health effects data, judgments of the relative health benefits achievable with different lead standards can be based on the expected reductions in the number of workers with dangerously high blood lead levels.

The results will be expressed in terms of the number of workers expected to fall in particular blood lead level ranges over 40 µg/100 g at any one time after the establishment of long term equilibrium, before consideration of the effects of the medical removal provisions of the lead standard. We think this is the single most convenient proxy for benefits for use in facilitating comparisons of different assumed compliance levels, and the consequences of differences in other assumptions (e.g. air blood/blood lead relationships).

Figure I summarizes our best point estimates of the ultimate effects of achieving various air lead compliance levels (a-d). The left side of the figure shows the results of parallel computations of the number of workers in various blood lead level ranges. The right side of the figure shows the incremental benefits (reduction of the number of workers in each blood level range) of the "b", "c" and "d" compliance levels compared to the baseline defined by the "a" compliance level.

It can be seen from Figure I that assuming compliance with the present standard (the "a" compliance level), large numbers of workers could be expected to have potentially hazardous blood levels. At any one time, we anticipate that about 50,000 workers would have blood lead levels over 60 µg/100 g, and about 170,000 would have blood levels over 40 µg/100 g, in the absence of other remedial measures. Achievement of the "b" compliance level would reduce the numbers of workers over 60 ug/100 g, but would leave the number of workers in the 50-60 ug/100 g, and 40-50 ug/100 g range substantially unchanged. Achievement of the "c" compliance level would be expected to make reduction to about 6,000 in the number of workers over 60 ug/100 g, and would be expected to produce some reduction in the numbers of workers in the 50-60 ug/100 g blood lead level range to 32,000. The "d" compliance level would reduce the total number of workers over 40 µg/100 g to slightly under 65,000, as compared over 160,000 for the "b" scenario. The incremental benefit of "d" over "a" in terms of workers over 40 ug/100 g would be 103,292 and for workers over 60 ug/m3 the benefit would be 47,684. These are clearly substantial reductions and would represent marked benefits to lead exposed workers.

MRP IN THE LEAD STANDARD

The standard requires employers to implement a Medical Removal Protection (MRP) program for employees at risk of sustaining material impairment to health. This MRP program involves two key elements--the temporary medical removal of workers at risk, and economic protection for those removed. Employers must temporarily remove from significant lead exposure any worker who (1) has an excessive blood lead level, (2) has been found by an examining physician to be at risk of sustaining material impairment to health due to other factors, or (3) is pregnant and has an elevated blood lead level. Removal will take the form of a temporary transfer, or the worker being sent home until a transfer opportunity arises. During the period of removal, the employer must assure that the employee suffers no loss of

earnings, seniority status, or other employment rights or benefits by virtue of the removal. Economic protection is essential to effectuate voluntary, meaningful worker participation in offered medical surveillance. Without MRP, many workers will refuse or resist participation in biological monitoring and medical examinations since adverse health findings could result in substantial loss of earnings due to a transfer, or even a lay-off or discharge. Economic protection for removed workers is also an appropriate allocation of the control costs of temporary medical removals. Temporary medical removal is a fall back mechanism to protect individual workers in circumemoved workers.

Most employers have opposed OSHA's adoption of MRP on legal grounds, arguing that (1) OSHA lacks authority to promulgate such a provision, (2) MRP is little more than a system of federal workers' compensation, and (3) MRP impermissably conflicts with existing collective bargaining agreements. Appellate review of MRP is a certainty, but OSHA is confident of the legal soundness of the provision due to (1) the central preventive, protective nature of MRP, (2) the compensatory, as opposed to preventive, nature of traditional workers' compensation law, and (3) the extent to which MRP defers to existing collective bargaining relationships to implement the mechanics of temporary removals. The potential costs of MRP have also been at issue, but MRP will be phased-in over a four-year period to minimize its economic impact. The phasing in of MRP is designed such that a diligent employer can monitor its employees and provide individual attention to workers, so that temporary medical removals need rarely occur. As a result, MRP is a powerful economic incentive for employers to comply with the lead standard, since employers can effectively minimize MRP costs through good faith, diligent efforts to comply.