Appendix A: Extended Summaries of Retrospective Case Comparisons A

OSHA's Final Regulatory Impact Estimates vs. Post-promulgation Outcomes

HEALTH RULES

▮ Vinyl Chloride

Promulgated October 4, 1974 (39 FR 35890).

Industry sectors examined: vinyl chloride monomer (VCM) synthesis, polyvinylchloride (PVC) polymerization (the principally affected industries).

The new standard reduced the prevailing time-weighted average exposure over an 8-hour workshift (TWA8) permissible exposure level (PEL) from 500 parts per million (ppm) to 1 ppm. Other provisions included requirements for routine medical surveillance and exposure monitoring, regulated areas, hazard signs/labels.

Feasibility: In setting a stringent, "technology forcing" PEL, OSHA went against the grain of its own consultant's findings and the affected industries' arguments, both of which reflected an "it's infeasible" perspective. Nonetheless, the agency's judgments proved largely accurate, as the principally affected industries achieved full compliance with comparative dispatch in the 18 months following enactment.

Industry Adjustment: Most of the actions implemented to reduce exposure levels were anticipated in the rulemaking: these included reducing leaks and fugitive emissions, improved ventilation systems, modified reactor designs and chemistry, and process automation. Not foreseen, however, was the proprietary "stripping" process commercialized within a year of promulgation, which provided a significantly improved means for PVC resin production along with lowering the potential for vinyl chloride exposures.

Compliance Costs: In promulgating the final rule, OSHA did not provide its own estimate of the affected industries' compliance costs. The most credible figures considered in the rulemaking were those of the agency's technical consultant, which placed total costs at around $1 billion (1974$), including capital expenses for new equipment, replacement of lost capacity, and incremental operating expenses. Actual spending, however, appears to have amounted to only about a quarter of this estimate, $228 million to $278 million.

Other Impacts: Arguments made during the rulemaking debate suggested the standard would greatly increase business costs and threaten the viability of the vast majority of the industries' establishments. In reality, costs did increase and

production capacity was eroded, but only to a modest extent. Also, there was little evidence that the affected industries' financial status or ability to respond to customer needs had been strained.

Judicial Review: Soon after promulgation, Industry challenged the standard in several respects, on issues related to the health justification of the 1 ppm PEL and the agency's authority to impose a "technology forcing" standard needing control actions not yet commercially evident in the industry. In the latter matter, the U.S. Court of Appeals (2nd Circuit) concluded generally that the agency could, with sufficient evidence, promulgate "technology forcing" rules and that the agency had provided an adequate demonstration.

Comments: OSHA's Vinyl Chloride rulemaking is widely and justifiably remembered for the considerable inaccuracy of the "it's infeasible" arguments presented by industry representatives and the agency's technical consultant, which, in the end, OSHA policymakers elected to reject. Nevertheless, this case is less useful in commenting on the agency's present practices, because procedural changes introduced in the succeeding years have worked to minimize some of the problems that were particularly glaring. Such changes include: 1) the widened opportunities for stakeholders to review and extensively comment on the agency's feasibility and impact estimates at a relatively early stage, which arose with the regulatory impact analysis steps established in the later 1970s; and 2) the more extensive analyses of feasibility and impact matters that became normal at about the same time, which provided a more explicit basis for debate on the appropriate analytical assumptions.

Cotton Dust

Promulgated June 23, 1978 (43 FR 27350).
Industry sectors examined: textile manufacturing (including all the principally affected industries).

The new final rule tightened the existing TWA8 PEL from 1,000 micrograms per cubic meter (µg/m^3) to 200 µg/m3 for yarn manufacturing operations, 750 µg/m3 for slashing and weaving, and 500 µg/m3 for other operations in which airborne cotton dust was created. Other provisions included requirements for routine medical surveillance and exposure monitoring, employee training, and regulated areas.

Feasibility: The promulgated standard proved clearly feasible in both technological and economic terms, although these judgments were the subject of extensive debate during the rulemaking. For yarn manufacturing operations, OSHA elected, on technological feasibility grounds, not to set a PEL more stringent than the 200 µg/m^3 specified. For slashing and weaving operations, the agency defended its decision to establish a substantially less stringent PEL on both economic feasibility and health risk grounds. The post-promulgation evidence largely confirmed both judgments.

Industry Adjustment: The engineering controls envisaged throughout the rulemaking as central to reducing dust levels—retrofits of existing production machinery, such as additional enclosure, added local exhaust ventilation, enhanced general ventilation and filtration—all clearly played a role in achieving compliance. But this emphasis missed the substantial extent to which dust control was achieved as a by-product of an aggressive modernization drive by the textile manufacturing industry, driven by sharply intensifying competition from foreign companies. In numerous operational areas, the industry's existing, older equipment was either rebuilt with modern functions or replaced outright with modern equipment, much of which enabled faster production speeds, consolidation of operations, more effective use of floor space, reduced labor, and improved product quality, all along with lower levels of dust.

Compliance Costs: OSHA's estimate in the Final Regulatory Impact Analysis (RIA) placed the textile manufacturing sector's cost of compliance at $280.3 million annually (1982$, including amortized capital spending, incremental operations and maintenance, and other new spending). Actual spending is estimated to have been only about a third this level, $82.8 annually

(also 1982$). A chief reason for this large disparity relates to the advantageous economics of the plant modernization the sector implemented. (Estimates produced earlier in the rulemaking process, which were vastly higher, would have been even further off the mark, although, preliminary versions of the standard contained substantially more stringent dust control provisions.)

Other Impacts: Concern was expressed at promulgation that smaller textile firms could encounter substantial constraints in raising capital for compliance-related improvements and that the standard would tilt the sector's competitive center toward newer and more modern plants. (However, neither of these circumstances was considered large enough to warrant a "thumbs down" economic feasibility judgment for the industry as a whole.) Suppliers of control equipment also argued during the rulemaking that serious bottlenecks would arise in trying to retrofit the industry's equipment in short order, but the actual effects proved to be more modest and generally bearable in all these regards.

Judicial Review: The 1978 standard was extensively challenged in court. Notably, in 1979, the U.S. Court of Appeals (DC Circuit), in addressing an industry petition, affirmed OSHA's technological and economic feasibility findings for the textile manufacturing sector.

Comments: OSHA's more qualitative observations in the Final RIA largely anticipated the lower-cost, modernization adjustment to the standard that did occur. But more conservative assumptions (emphasizing chiefly retrofit measures) were used to develop the technological and economic feasibility determinations for the rulemaking. Furthermore, it does not appear likely that a more accurate anticipation of the industry's actual compliance response would have substantially altered the content of the standard's provisions.

Occupational Exposures to Lead

Promulgated November 11, 1978 (43 FR 52952).
Industry sectors examined: secondary smelting (one of the more than three dozen industries affected by the standard, but one of the handful that had high existing exposures and were likely to need major changes in existing processes to achieve compliance).

The new standard tightened the existing TWA8 PEL from 200 µg/m³ to 50 µg/m3. Other provisions included requirements for routine medical surveillance and exposure monitoring, housekeeping procedures, protective clothing, respirator use, hygiene facilities, preventive maintenance, employee training, medical removal protection, regulated areas.

Feasibility: Numerous control equipment and operating practices were identified during the rulemaking to reduce exposures, including greatly increased enclosure and ventilation of solids handling operations, automation of operations (particularly battery breaking), increased isolation of employees from processing areas, and improved maintenance practices. There was wide agreement among the rulemaking parties that aggressive use of these conventional measures could greatly reduce average exposures, and substantial evidence that most facilities could reach a PEL of 100 µg/m³ on this basis. Achieving a 50 µg/m3 PEL principally through engineering and work practice controls (as the standard ultimately specified), however, was controversial. In promulgating the more stringent exposure level (set on health protection grounds), OSHA appealed to the aggressive adoption of existing conventional measures; major process redesign (including new plants built with the best available emissions control, such as the design outlined by Gould); and to foreseeable new technology (particularly the process improvements in scrap lead smelting then being introduced by Bergsoe and, over the longer term, a shift to hydrometallurgy). Recognizing that a 50 µg/m3 exposure level would not be immediately achievable, OSHA specified an extended phase-in period (5 years for secondary smelters), during which, the agency judged, the industry's physical plant could be substantially rebuilt, if necessary, and appropriate new technologies brought to the marketplace. In the interim, the final rule called for the adoption of all feasible engineering and

work practice controls, supplemented as needed by respiratory protection.

Industry Adjustment: Since more than a decade ago when the standard took full force to the present (1994), the industry's compliance response has differed substantially from the concept that underwrote promulgation. Most producers have adopted some additional engineering controls (particularly for point and area ventilation, along with increased automation). But the greater emphasis has been on respiratory protection programs, which virtually all producers now use, and improved employee hygiene (protective clothing, change houses, personal hygiene practices). Temporary removal from the workplace of employees whose blood lead levels exceeded a specified limit also has been used at one time or another by about half the industry, although present use of this measure is infrequent because fewer levels exceed the limit. Despite the final rule's mandate, however, few producers have invested in engineering controls to the full extent anticipated for PEL compliance. Airborne lead levels in plants, while lower now than in the late 1970s, still remain well above the PEL. (Indeed, most plants remain out of compliance with the previous 200 µg/m^3 PEL, with decades of further progress, given the slow rate of improvement that has prevailed to date, needed to reach the now prevailing 50 µg/m^3 PEL.) Furthermore, the "new technologies" envisaged by OSHA at the time of rulemaking have rather visibly not progressed; the single U.S. secondary smelter using the Bergsoe process went bankrupt in the mid-1980s, and hydrometallurgy still remains "on the horizon." The new capacity that has come on line in recent years (which has been substantial since the mid-1980s, particularly in the "integrated" end of the business, where old batteries are broken, smelted, and used to manufacture new units) has relied on conventional technology (but with closer attention to plant layout, material transfer/handling, and process operability with respect to emission and exposure considerations).

Compliance Costs: At promulgation, OSHA's "best" estimate placed the industry's capital requirements for compliance with a 100 µg/m^3 exposure limit at $34.1 million (1976$), or 2.5 cents annually per pound of production on a pre-tax basis, including amortized capital and operation/maintenance expenses ($77.7 million and 5.7 cents/lb., respectively, in 1992$). Corresponding estimates for the 50 µg/m^3 PEL were not presented, however, as the agency indicated that figures could not be determined at the time, given that "the industry face[d] several options for long-run compliance." However, an outer bound of about $91 million (1976$) in total capital spending was mentioned, based on a complete rebuilding of the industry using the Bergsoe smelter technology (considered then to be the most cost-effective option). In an early 1980s revision of the estimates, OSHA placed the cost of PEL compliance at a capital requirement of $125 million (1982$), or 1.3 cents annually per pound of production ($150 million and 1.6 cents/lb in 1992$). Nevertheless, the industry's actual spending to date (through early 1994) has been well below these levels. Cumulative capital investment appears to total no more than $20 million (1992$), and some of this overlaps with expenditures to meet the various environmental requirements to which the industry has also been subject (i.e., the Clean Air Act, National Ambient Air Quality Standards, Clean Water Act, Resource Conservation and Recovery Act, and Superfund liabilities). Annual compliance spending appears to be averaging in the range of 0.5 to 1.0 cent/lb (1992$), and perhaps as low as 0.3 cent/lb. Such levels are well below OSHA's expectations at the time of the rulemaking, and in large measure reflect the industry's strategy of minimizing expenditures on engineering controls and relying much more heavily on respirator and hygiene programs to reduce exposures.

Other Impacts: The real price of lead dropped sharply (and unexpectedly) after 1979, not returning to a similar level until late in the 1980s. Numerous smaller, independent smelters, that had limited financial resources and faced the combined effects of increased costs for both EPA regulations (emission controls and liabilities for future cleanups) and OSHA requirements,

elected to leave the industry. The remaining producers benefited from increased utilization of capacity but, nonetheless, had to aggressively reduce labor costs and improve productivity to compensate for the upward cost pressures. The industry today is smaller and, indeed, the most productive in the highly competitive global market. At the time of the rulemaking, OSHA acknowledged the limited extent to which most secondary smelters could pass on new compliance costs, and correctly judged that some consolidation would occur after promulgation, as producers with high marginal costs exited the industry. But OSHA did not anticipate the steep drop in lead prices that occurred. It now appears likely that the industry's consolidation would have been a good deal more severe had the level of compliance spending the agency estimated at promulgation proved nearer the actual circumstance.

Judicial Review: The 1978 standard was extensively challenged in the courts soon after promulgation by both labor and industry, with various remands and amending actions by OSHA continuing into the 1990s. The adequacy of OSHA's demonstration of the technological feasibility of the standard for secondary smelters was upheld by the U.S. Court of Appeals (DC Circuit) in 1980, along with that for nine other industries. (However, the judges were badly split on the decision, as in the lack of consensus over feasibility in the rulemaking earlier.)

Comments: The blood lead levels of this industry's workers have come down appreciably since the late 1970s, the combined result of the modest reduction in air lead levels (from new engineering controls), improved hygiene and work practices, and the general reduction in environmental lead levels. Nonetheless, the considerable distance yet to be crossed to bring air lead levels in line with the PEL (long after the requirement took effect) contrasts strikingly with the assumptions at promulgation. While judged in the end to be achievable, OSHA recognized that compliance would pose particular challenges for this industry, given its economic/technical maturity and limited ability to pass on new costs. One mitigating consideration is that OSHA's enforcement of the engineering control requirement appears to have been limited in several significant respects (both in its productive engagement of the industry and in comparison with EPA's contemporaneous regulatory actions). On the other hand, the rulemaking's analysis did not well grasp the nature of the burden that the joint OSHA and EPA compliance requirements would entail, or ways in which these intertwined needs might have been better optimized. The unexpected drop in lead prices made the full extent of engineering control investment envisaged by OSHA more difficult than anticipated. And the "new technologies" to which OSHA appealed as a longer-term compliance solution proved overly optimistic. Capable analysts differ widely in their interpretations of the lessons of this rulemaking. Nonetheless, the post-promulgation events to date hardly put to rest the feasibility debate that preoccupied the rulemaking in the beginning.

Ethylene Oxide

Promulgated June 22, 1984 (49 FR 25734).

Industry sectors examined: hospitals (one of a half-dozen affected industries, but the sector with the vast majority of exposed workers).

The new standard reduced the prevailing TWA8 PEL from 50 ppm to 1 ppm. Other provisions included requirements for routine medical surveillance and exposure monitoring, employee training, emergency planning, hazard communications.

Feasibility: Within a year and a half after promulgation, the vast majority of hospitals were operating with ethylene oxide (EtO) exposure levels in compliance with the new PEL. Indeed about three-quarters had taken steps to reduce exposures to a point well below the specified level. Clearly, OSHA had correctly gauged the feasibility of the requirements the standard imposed. Some credible parties to the rulemaking argued, on health risk grounds, for a substantially more stringent PEL, at about 0.1 ppm. OSHA determined, however, that 1 ppm was the

lowest exposure level then technically feasible; the limiting constraint was the availability of acceptably reliable exposure measurement methods. This judgment proved correct in the period immediately after promulgation, but not long after, improved technologies, stimulated by the concern about EtO exposures, largely removed this barrier.

Industry Adjustment: The predominant responses were well in line with the engineering and work practice controls that OSHA outlined in the feasibility analysis, including retrofits of post-cycle evacuation and local exhaust ventilation devices to existing sterilizer units, various changes in existing work practices. Nevertheless, some hospitals did pursue other courses of action, such as exploiting existing equipment and facilities (e.g., relocating sterilizer equipment to a room with a high rate of ventilation) or constructing new facilities with highly stringent EtO exposure reduction capabilities. A number of significant improvements in control technology, particularly sterilizers with exposure controls built-in and greatly improved exposure measurement capabilities, did emerge in the period after the standard's enactment. But the timing of these advances was beyond the main period (1984-85) of the sector's adjustment to the new standard's compliance requirements.

Compliance Costs: OSHA's Final RIA estimates placed the sector's total compliance costs at $23.7 million annually (1982$), $12.5 million of which was related to amortized capital spending for the necessary control equipment. The available field data suggest that the unit cost figures for the principal control technologies that OSHA assumed in its compliance estimates were reasonably accurate. However, the sector's actual overall spending appears to have at least modestly exceeded the agency's estimate, because of spending on modifications to existing ventilation systems (which were assumed to be zero in the estimate) and because many hospitals elected to reduce exposures to a point substantially below the promulgated PEL (reflecting, for the most part, concerns about the health risks of long term, low level ethylene oxide exposures that remained salient beyond OSHA's promulgation of the permanent standard and hospital managers' desire to mimimize vulnerability to possible future tort liability claims).

Other Impacts: Because the estimated average spending for compliance per hospital was amount to tally no more than $1,500 to 3,500 annually, there was little concern at the time of the rulemaking that the standard would entail substantial financial/economic consequences for the industry or nation. There is no evidence that anything other than these expectations actually occurred; even a substantially larger compliance spending total than now appears to have been the case would have amounted to a barely visible share of the overall increase in expenses that all hospitals bore over the primary period of adjustment to the EtO standard.

Judicial Review: Debate on the content of the 1984 EtO standard continued into the late 1980s, with the chief issue whether the exposure limit provision should be amended to include a short-term exposure limit (STEL) in addition to the PEL. Some of these matters ended up in the courts. Nevertheless, OSHA's original feasibility determinations were not the subject of challenge.

Comments: It appears likely that the arguments of those pushing for a PEL more stringent than 1 ppm would have been strengthened if it had been better appreciated during the course of the debate just how quickly the technology for exposure measurement would improve in the period soon after promulgation. Also, the extent to which so many hospitals would act to achieve exposure levels well below the PEL requirement was unexpected, although this action mainly reflects considerations beyond the OSHA requirements and is not something a normally implemented regulatory impact analysis would explicitly seek to recognize.

▮ Formaldehyde

Promulgated December 4, 1987 (52 FR 46168).

Industry sectors examined: metal foundries (one of more than three dozen industries/industry groups identified as affected, but the industry

with a high expected level of compliance costs and a large number of workers with existing exposures above 1 ppm).

The new standard tightened the existing TWA8 PEL from 3 ppm to 1 ppm. Other provisions included requirements for routine medical surveillance and exposure monitoring, protective clothing/equipment, hygiene facilities, emergency planning, hazard communications. (Note: OSHA amended the PEL to 0.75 ppm on May 27, 1992. The case discussed here focuses, however, on the 1987 action.)

Feasibility: The foundries sector was subject to considerable economic pressures (from weak demand and strong foreign competition) throughout the 1980s, including late in that decade when formaldehyde compliance actions were mandated. OSHA concluded from its analyses, nonetheless, that suitable control steps were reasonably available to the industry, at a generally acceptable cost. These judgments proved accurate. The feasibility of engineering controls to achieve a PEL substantially below 1 ppm was discussed in the course of the rulemaking, but no consensus on the matter emerged among the major rulemaking parties. The PEL was ultimately set at 1 ppm on "significant risk" grounds and, as a practical matter, the debate became moot.

Industry Adjustment: OSHA's technological feasibility finding was based on the conclusion that numerous engineering controls were already commercially available to reduce existing exposure levels: additional ventilation (fresh air curtains, general dilution ventilation, local ventilation), enclosure (e.g., ladle covers, side baffles, ventilated cooling enclosures), changes in resin and catalyst formulations (to reduce the level of free formaldehyde present in the resin binder or released as a consequence of the curing chemistry), and isolation of scrap materials. The agency's economic feasibility analysis assumed, however, that compliance would be achieved predominantly through the added ventilation and enclosure avenues. As things turned out, however, only a few foundries adopted the "ventilate and enclose" strategy; most opted for low-formaldehyde resins.

Compliance Costs: In the Final RIA, OSHA estimated the industry's compliance costs to be $11.4 million annually (1987$). (Cost savings of $1.7 million annually from avoided medical expenses also were identified). Actual spending appears to have been about half this level, $6.0 million annually. Part of this is explained by the industry's adoption of low-formaldehyde resins (which avoided the need for major new capital expenses), rather than added ventilation and enclosure. But in some important portions of the calculations (particularly, for ventilation system improvements), OSHA's figures substantially underestimated actual spending.

Other Impacts: The industry continued to consolidate in the second half of the 1980s, with the number of establishments in business declining at a substantial pace. But there is little evidence that more than a few foundries closed their doors as a consequence of the more stringent control of formaldehyde; hence the basic accuracy of OSHA's feasibility determinations was vindicated and industry arguments made during the rulemaking were rebutted.

Judicial Review: Both industry and labor challenged the standard (on differing grounds) soon after promulgation; one outcome was that the PEL was amended in 1992 to a more stringent 0.75 ppm. None of this debate, however, questioned OSHA's 1987 feasibility, cost, and impact findings.

Comments: Much of the contentious debate in this rulemaking related to exposure levels and the extent of reduction needed to remove significant risk, matters in which the agency's examination of control options and their costs and other impacts were not major players. The agency's tallying of feasible control steps did include all the principal actions the industry ultimately adopted. And it is puzzling why the compliance cost estimates did not more directly consider the use of low-formaldehyde resins, as the technology was commercially well known at the time.

SAFETY STANDARDS

Grain Handling Facilities

Promulgated December 31, 1987 (52 FR 49592). Industry sectors examined: grain elevators and grain mill facilities (the principally affected industries).

The new standard mandated the development and implementation of a "housekeeping" plan to reduce dust emissions and provide for periodic removal of accumulated dust. However, grain elevator "priority areas" (i.e., work areas with equipment and activities where the potential for accidental ignitions was substantial) had to implement immediate cleaning/removal once accumulated dust reached a one-eighth inch dust level. Other provisions dealt with the preparation of emergency plans; employee training and contractor knowledge about relevant safety considerations; permitting procedures for managing "hot work" and worker entry into bin, silo, and tank areas; and various process equipment requirements to minimize the prospect for circumstances capable of igniting accumulated grain dust.

Feasibility: The final rule ultimately promulgated was only modest in its stringency. Many of the provisions did not involve technology, and those that did relied on actions and components already in general use. While the affected industries were particularly sensitive to new expenses, compliance was not generally expected to cause generally unbearable economic burdens. The industries' success at compliance to date confirms that OSHA's feasibility determinations were essentially correct. Early in the policymaking debate, however, a far more stringent action level (one-sixty-fourth inch) for cleaning/removal of accumulated grain dust received consideration and was vigorously advocated by some parties as essential for removing most significant risk. On the basis of the available evidence at the time, however, OSHA concluded that such a diminutive level was likely to be neither technologically nor economically feasible, and dropped the option from consideration.

Industry Adjustment: Housekeeping activities to clean and remove grain dust accumulations are now clearly recognized, throughout the grain-handling sector, as an essential work practice. Pneumatic dust control systems are also widespread, though manual cleaning with brooms is still used and regarded as an effective dust control method. Treating grain with edible oils, to lower dust generation and flammability, is fairly frequently employed. Office facilities, welding activities, and employee smoking have generally been relocated away from prime dust generation areas. Designs for new elevators and plants now incorporate a range of fire/explosion safety features, although there have been relatively few new facilities constructed in recent years. All of these outcomes were generally expected, at the time of the rulemaking, to result from the compliance provisions of the new standard.

Compliance Costs: In the Final RIA, OSHA estimated the sector's total compliance costs in the range of $41.4 million to $68.8 million annually (1985$; spanning the incremental need for equipment and actions across the 13 separate provisions) and avoided property losses at $35.4 million annually (as compliance reduced the number of facility explosions and serious fires), yielding an estimated net cost of compliance in the range of $5.9 million to $33.4 million annually. The agency went on to monetize the expected benefits from reduced employee injuries and deaths at $75.5 million annually; thus, from a societal perspective, these benefits more than balanced the expected new costs imposed on the affected industries. Little in the way of useful field information was available to enable OTA to directly check these estimates—an unfortunate circumstance, because these figures were intensely debated in the course of the rulemaking, where a "battle of the benefit-cost analyses" between OSHA's numbers and industry's lower benefits and higher costs figures prevailed for some time. However, now that nearly five years have passed since full compliance with the terms of the 1987 standard should have been achieved, the evidence is that few, if any, facili-

ties have ceased operation as a result of the standard—in contrast to the implications of the industry's figures. (Nonetheless, the sector has certainly been subject to substantial economic pressures for other reasons over this period.) Furthermore, the data on grain dust explosions/fires, deaths, and injuries for the post-promulgation period suggest that grain-handling facilities have become safer roughly to the degree anticipated by OSHA's impact estimates, although a longer time series of data is needed to confirm this effect.

Judicial Review: The rulemaking on grain dust was long and particularly contentious. Challenges were mounted by both industry and labor representatives soon after promulgation. Notably, OSHA's economic feasibility determination and associated analysis were subjected to scrutiny by the U.S. Court of Appeals (Fifth Circuit) in 1990, where the agency's findings were affirmed in full.

Comments: Sentiment remains today that the dust cleaning/removal action level should have been set more stringently then it was and that political considerations at the time overwhelmed a decision that should have more nearly been made on the substantive merits. Unfortunately, however, post-promulgation developments (which have been in response to the less stringent action level promulgated) do not provide a basis to examine the adequacy of OSHA's early infeasibility finding regarding a more stringent action level.

▮ Mechanical Power Presses (Presence Sensing Device Initiation)

Promulgated March 14, 1988 (53 FR 8322).

Industry sectors examined: manufacturing generally, but particularly fabricated metal products, non-electrical machinery, and electrical/electronic equipment.

This rulemaking amended the existing standard to allow voluntary use of an electronic presence sensing device (instead of operators having to move a switch) to actuate power press strokes. Other provisions included various revised requirements for the performance of system/safety components, regular inspection and maintenance procedures, employee training, periodic certification and third party validation.

Feasibility: Despite considerable successful experience with the technology (in Europe and elsewhere) and compelling economic advantages, presence sensing device initiation (PSDI) has yet to be installed on compatible U.S. mechanical power presses. Surprisingly, a "third party" has not yet come forward to take on the independent validation/certification role specified by the standard. The apparent reason is that potential "third parties" (e.g., insurance companies, underwriting organizations) do not perceive enough of a business opportunity to compensate for the economic risk involved, particularly that related to exposures to liability litigation. In part, OSHA's feasibility findings, based on analyses and testimony in the record circa 1984 and not updated for promulgation in 1988, did not adequately take into account the concerns of insurers and other potential independent parties that workers could defeat (either deliberately or through accident) the machine safety systems. Also, the surge in litigation related to product liability had only begun in 1984. Furthermore, beginning in the late 1980s, insurers' earnings became far more variable than had previously been the case, causing many to rethink their thresholds for risk bearing and the economics of the products offered.

Industry Adjustment: None to date. Moreover, there is evidence that the market for PSDI is currently being eroded by alternate technology, particularly by "quick trip" light curtains with no-touch sensors, which provide safety and productivity improvements but can be adopted without "third party" certification/validation.

Compliance Costs: OSHA's Final RIA estimated the total cost of adopting PSDI (among both existing and new power presses) at $49 million to $77 million annually (1984$; for equipment modifications/enhancements and compliance with the other provisions of the standard, including the various certifications and validations). Cost savings from productivity

improvements were estimated at about $182 million annually, that is, the anticipated cost savings substantially exceeded the expected costs. Little has happened thus far in the industry to validate these expectations, other than, of course, that OSHA (and most of the other parties to the rulemaking) misjudged the economics of the "third party" certification/validation role in the later-1980s-and-on world.

Other Impacts: OSHA's analyses concluded that small establishments would not bear a disproportionate burden in affected industries' adoption of the PSDI technology. Also, a wider economic benefit was expected to arise from the productivity enhancement underwritten by the technology. But, again, not enough has happened to date to check these expectations.

Judicial Review: To date none of the standard's provisions have been challenged.

Comments: Unforeseen developments routinely confound forecasting efforts in most realms. Nonetheless, had OSHA's feasibility analysis been updated nearer to the time of promulgation (1988), it appears likely that at least the prospect of serious problems with the business-worthiness of the "third party" role would have been clear.

Powered Platforms for Building Maintenance (Alternate Systems for Horizontal Stabilization)

Promulgated July 28, 1989 (54 FR 31408).
Industry sectors examined: high-rise building owners/developers and building maintenance service providers (the principally affected industries).

This action amended the existing standard to widen the acceptable technologies for horizontal stabilization of high-rise work platforms. Other provisions included revised requirements for platform equipment performance capabilities, emergency planning, personal fall protection equipment, employee training, regular inspection and maintenance procedures.

Feasibility: OSHA's amendment of the existing standard dealt with technologies that were already market proven and provided demonstrated economic advantages. Thus, at the time of the rulemaking, feasibility was neither controversial nor uncertain.

Industry Adjustment: The amended standard has had the intended effects, vis-à-vis widening the options for stabilization methods available to building owners/developers and increasing the incidence of safe work practices. However, the overall number of alternate stabilization systems installed to date has been well below OSHA's expectation at the time of the rulemaking, principally because the number of new high-rise buildings constructed has been considerably under the estimate on which the regulatory impact calculations were based. (The estimates presented at the standard's promulgation in 1989 were based chiefly on a consultant's study prepared in 1983; as a result, they missed the considerable slowdown in commercial building construction that has prevailed in the United States since the late 1980s.)

Compliance Costs: OSHA's figures in the Final RIA placed the total incremental costs of the amended standard at somewhat over $1.4 million annually (1987$; including the various incremental expenses for both building owners and contractors). However, the greater flexibility in stabilization system choice conferred an estimated cost savings (entirely to building owners/developers) of about $3.1 million annually. Thus adoption of the standard was projected to provide an overall cost savings of around $1.7 million annually. With one significant exception, the case study research largely confirmed the reasonableness of most of the unit compliance cost figures used in the regulatory analysis calculations, the exception being a considerable underestimate of the cost of one of the several competing stabilization systems on one of principal building materials in the marketplace. A far more substantial disparity, however, is the aforementioned slowdown in new high-rise building construction, with the actual annual pace since the beginning of the 1990s only 20 to 40 percent of the rate OSHA expected. In consequence, the overall cost savings to date appear to be substantially lower than expected—$600,000 annually, assum-

ing the higher side of the range in the pace of new building construction, or perhaps even a *net cost* of $400,000 million annually, assuming the lower side of the range.

Other Impacts: During the rulemaking, concern was expressed by industry commentators that some erosion of productivity could accompany the widespread use of the stabilization system particularly favored by the amended standard (the intermittent tie-in system). In contrast, OSHA's analyses did not conclude this effect would be significant. The outcomes thus far have confirmed the agency's conclusion on this matter. Also, the safety-related provisions of the standard were expected to yield some reduction in the safety risks of work activities on powered platforms. Here the number of accidents (involving fatalities or hospitalized injuries) has been "down" since promulgation. But there is still too little of a time series record to fully confirm the anticipated effect.

Judicial Review: To date none of the standard's provisions has been challenged.

Comments: This is another case of surprise developments in critical variables affecting the impact calculations. The long length of time between the analyses on which the final economic estimates were based is an appropriate subject for criticism. Nevertheless, given the timing of the end of lengthy business expansion of the 1980s, even a substantial update of the analysis in late 1988 or early 1989 (the standard was promulgated in mid 1989) would probably not have identified the depth of the slowdown in commercial building that subsequently occurred. Furthermore, the analysis does appear to have in the main correctly identified the essential technological and economic issues related to adoption at the unit building level.

SOURCE: Office of Technology Assessment, 1995. The findings for the Vinyl Chloride, Cotton Dust, and Ethylene Oxide standards draw from existing retrospective studies (which OTA reviewed at length). Original evaluative research was conducted by OTA for the Occupational Lead, Formaldehyde, Grain Handling facilities, Mechanical Power Presses, and Powered Platforms standards. Each case study is discussed at greater length in a comprehensive OTA working paper on the case research findings and in the separate case study reports (see Appendix B for citations).