Policy Analysis

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OSHA's Ergonomics Litigation Record
Three Strikes and It's Out

by Eugene Scalia

Executive Summary

In November 1999 the Occupational Safety and Health Administration proposed an ambitious "ergonomics" rule that would regulate the pace of work in American businesses, the level of staffing, rest periods, the length of shifts, and the design of equipment and entire facilities. OSHA says it will finalize the rule in 2000.

The premise of ergonomic regulation is that physical exertion is hazardous and causes "musculoskeletal disorders" such as carpal tunnel syndrome, which purportedly is caused by typing. Ergonomists advocate radical redesign of the workplace to avert these supposed "repetitive motion injuries," or "cumulative trauma disorders."

Ergonomists are not physicians—they are engineers—and their medical theories are controversial. Some of the world's leading medical researchers deny that repetitive motion causes injury. Ergonomists themselves concede fundamental flaws in their theories. They acknowledge that musculoskeletal pain has many causes other than work, and, while contending that physical exertion is hazardous, they also acknowledge that some degree of physical activity is healthful and that they cannot identify the point at which exertion ceases being good or benign and instead becomes a workplace hazard that must be regulated by the government.

Ergonomics may seem to be a bewildering topic. It certainly has bewildered OSHA. But there is a very simple way of appreciating the folly of ergonomics "science" and regulation: studying OSHA's own attempts to apply ergonomics in the three cases it litigated to judgment. In one, the 1995 *Beverly Enterprises* case, OSHA could not establish that lifting causes back injury. In the second, the 1998 *Dayton Tire* case, OSHA charged that nearly two dozen jobs in a single facility were hazardous but at trial could not establish the presence of a single hazard. OSHA's "experts" in the case repeatedly disagreed with one another's assessments of supposed job hazards; ultimately, their testimony was thrown out of court under the Supreme Court's "junk science" test. In the third case, the 1997 *Pepperidge Farm* case, OSHA and the world's leading ergonomists could not identify changes needed to eliminate supposed ergonomic hazards. The Occupational Safety and Health Review Commission ruled that Pepperidge Farm had a good ergonomics program; OSHA and its experts had simply not been able to tell.

If OSHA and the world's leading ergonomists cannot make sense of ergonomics, how can American business be expected to?

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Ergonomic Theory and Its Pitfalls

Ergonomics, Ergonomists, and Their Aims

The dictionary definition of ergonomics is "an applied science concerned with designing and arranging things people use so that the people and things interact most efficiently and safely."[1] Ergonomics is synonymous with "human factors engineering," and ergonomists—to the extent they have any specialized education—are engineers. Ergonomics' current prominence, however, comes from its association with a medical theory—the claim that repetitive motion and other demanding physical labor cause "repetitive motion injuries" (RMIs), also called "cumulative trauma disorders" or "repetitive strain injuries." Proper "ergonomic" design of the workplace is thought to avert these ailments.

It actually is an understatement to say that ergonomists consider demanding physical labor the cause of RMIs. The tasks they consider hazardous include activities that are not demanding at all: "[u]sing the hands to wring out a mop," for instance, and "[h]olding a jar in one hand while attempting to remove the lid with the other hand" are both identified as occupational hazards in OSHA's proposed rule.[2] "Awkward postures" and "cold temperatures" also are ergonomic "risk factors."[3] Even more confusing, too little activity, as well as too much, is said to be ergonomically dangerous. Thus, OSHA's proposed rule warns not only against "[b]ending or twisting" but also against "maintaining [the] same position or posture" and "[s]itting for a long time"; it warns against gloves that are "too large or too small" and—not unreasonably—against "[u]sing hand as a hammer."[4] OSHA considers it per se hazardous to use hands for what they're made for—"handling."[5]

Given those premises, it is no surprise that the research arm of OSHA—the National Institute for Occupational Safety and Health (NIOSH)—believes that ergonomic hazards exist in all industries.[6]

Ergonomists' proposed solutions follow directly from their premises and are staggering in their consequences. They include slowing the pace of work so that employees engage in less repetitive motion and increasing staffing and rest periods so that, again, each employee works less hard. Since lifting heavy objects is deemed hazardous, ergonomists propose reducing the weight of objects to be lifted and installing lifting equipment to lessen the demands on workers. "Awkward postures" must be addressed by redesigning tools or entire workstations.

In the absence of an ergonomics rule, OSHA has prosecuted what it considers ergonomic hazards under a provision of the Occupational Safety and Health Act known as the "general duty clause." The clause prohibits employers from exposing employees to "recognized hazards that are . . . likely to cause death or serious physical harm."[7] OSHA settled or dismissed all but three of its general duty clause ergonomics cases, but the remedies it sought reflect the sweeping changes that OSHA and ergonomists have in mind. In one case, OSHA directed a luggage manufacturer to "reduce the number of job tasks" in order to "increase rest time." OSHA also ordered the company to "redesign assembly." In other cases, the agency instructed a tool manufacturer to "redesign" the job and sought to force a shipping company to reduce by half the weight of packages it accepted for delivery. Such measures go straight to a company's bottom line. Individual businesses have estimated that ergonomic measures OSHA has sought would cost them hundreds of millions of dollars annually.[8]

OSHA's proposed rule identifies no specific changes employers must make; instead, it identifies a series of steps they must follow if "work-related musculoskeletal disorders" occur. Employers' obligations under the rule are triggered by "signs" and "symptoms" of musculoskeletal disorders, which OSHA defines to include "pain," "numbness," and "tingling." When those symptoms occur, employers are to examine the employee's job

to determine whether it is "reasonably likely" to be ergonomically hazardous. If it is, the employer is to implement the kind of abatement measures described above—reduce assembly line speed, redesign equipment, and so on—until the hazard is gone or no further changes are feasible. The rule also provides for an "incremental abatement process" under which an employer may make some job adjustments, see whether the employee is feeling better, and, if not, continue making adjustments until the employee's condition improves. An astonishing provision of the rule would require employers in some circumstances to give employees up to six months' leave at 90 percent of their pay if their MSD symptoms (e.g., "tingling") do not go away. Or employees could demand to be placed in light-duty jobs under the provision, in a manner similar to the practice under the Americans with Disabilities Act but with fewer constraints.[9]

The Problems of Ergonomics

Given the enormous burdens of ergonomic regulation, one would expect compelling scientific evidence to underlie OSHA's proposal. But the "science" of ergonomics is notoriously doubt-ridden and controversial.

A first and most basic problem with ergonomics is that leading physicians and medical organizations dispute that RMIs actually occur. These physicians do not deny that people experience pain and discomfort in their backs, limbs, and other parts of the musculoskeletal system. On the contrary, musculoskeletal discomfort is ubiquitous. Fifty percent of Americans experience back pain every year, for instance.[10] What the physicians dispute is that physical exertion is the cause of musculoskeletal injury or illness. Carpal tunnel syndrome is an affliction of the hand and wrist that ergonomists claim is caused by typing, for instance, yet the American Society for Surgery of the Hand opposes ergonomic regulation. It explains: "[T]he current medical literature does not provide the information necessary to establish a causal relationship between specific work activities and the development of well-recognized disease entities."[11] Similarly, the world's leading experts on back problems deny that job tasks are an important cause of back pain.[12]

A second basic problem with ergonomics is that, even accepting its premises, ergonomists admit great difficulty diagnosing an RMI in any given instance. As noted, musculoskeletal discomfort is ubiquitous, and ergonomists concede it has many causes other than work: it occurs (and dissipates) naturally and also is correlated with aging, obesity, and genetic predisposition, among other things.[13] Ergonomists' difficulties identifying supposed RMIs are exacerbated by the fact that, whereas physicians typically rely on objective criteria to make diagnoses, ergonomists rely on subjective symptoms. In one leading study by NIOSH, musculoskeletal conditions were "diagnosed" by jerking workers' hands and arms around and asking whether it hurt a lot or just a little bit.[14] OSHA's proposed rule treats "fatigue" as synonymous with injury.[15]

Importantly, if an ergonomist fails to determine the cause of a worker's musculoskeletal disorder, then the disorder cannot be classified as an RMI, since the term "repetitive motion injury" indicates a conclusion as to cause.

Ergonomists' third great difficulty is identifying effective ergonomic solutions. As leading ergonomist Stover Snook puts it, "It is difficult to try and prevent . . . back injuries when no one really knows what causes them."[16] NIOSH sensibly states that the first step in determining whether a job is ergonomically hazardous is comparing "job demands . . . to known human capacities." Yet the agency confesses in the same document, "For most biomechanical factors, the limits of human capacities have not been defined."[17] Scientists call this an inability to identify "dose-response relationships"; ergonomists do not know how much repetition, force, or weight is too much and therefore do not know the level to which those things should be reduced to avert supposed ergonomic ail-

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ments. Obviously, this is a critical shortcoming since the things OSHA claims are hazardous—movement, force, sitting, and standing, for example—are crucial to work, daily living, and health itself.

Perhaps the most conspicuous hole in ergonomists' theories is "psychosocial factors." Much of the literature on back pain and other musculoskeletal complaints finds no correlation with job demands but does indicate a significant tie to job satisfaction and general happiness. One of the most thorough studies ever conducted on back pain tracked 3,020 Boeing workers over four years. The workers performed a variety of jobs with quite different physical demands, but the study found no significant correlation between reported back pain and job tasks. It also found no association between reported back pain and lifting strength.[18] Instead, other than prior back problems, the factors most strongly correlated with reported back pain were employee responses to questions from the Minnesota Multiphasic Personality Inventory, a standard psychological exam. Negative responses to statements like "I am satisfied with the way my fellow workers respond to my emotions, such as anger, sorrow, or laughter" were better predictors of reported back pain than was frequent lifting on the job.[19]

Similarly, a 1992 NIOSH study at US West found a high level of supposed musculoskeletal disorders at that "Baby Bell" company. (NIOSH's "diagnoses" relied entirely on employees' subjective reports of pain and discomfort.) The agency suspected that typing-intensive jobs were the cause of the reported disorders but discovered that "[a]lmost all of the physical workstations observed in [the] study were of high ergonomic quality."[20] And, just as new chairs and wrist pads were not the answer to musculoskeletal complaints in the study, so changing job demands was not the solution. The two occupational factors associated with lower rates of injury were overtime worked in the two years prior to the study and increased hours per day spent performing data entry.[21] That is, workers subjected to more "repetitive stress" had fewer musculoskeletal complaints. What work-related factors were positively associated with supposed musculoskeletal disorders? Psychological variables such as "fear of being replaced by computers, . . . little decision making opportunity, . . . lack of co-worker support, and lack of supervisor support."[22] Altogether, 10 such psychosocial factors were correlated with reported musculoskeletal disorders in the NIOSH study.

The large role of psychosocial factors ought to trouble ergonomists for two reasons. First, ergonomists blame musculoskeletal disorders on the physical demands of jobs, but the studies that take account of psychosocial factors show the influence of physical factors to be weak. Second, ergonomists rely heavily on subjective reports of pain and discomfort in "diagnosing" musculoskeletal disorders, yet those subjective reports often will be unreliable, given the influence of psychosocial factors. OSHA concedes this at one point in its proposed rule, stating that a particular study on shoulder tendonitis should "be interpreted with caution" since "[s]houlder tension is strongly affected by psychosocial factors."[23] Generally, however, the proposed rule brushes off psychosocial factors, making the irresponsible and undocumented claim that physical factors play a far greater role in reported musculoskeletal disorders.[24] The proposal uses subjective symptoms to diagnose supposed musculoskeletal disorders.[25]

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The many weaknesses of ergonomics have resulted in testimony by "expert" ergonomists being rejected repeatedly by the federal courts under the Supreme Court's "junk science" test. In *Daubert v. Merrell Dow Pharmaceuticals, Inc.* (1993), the Supreme Court directed lower court judges to act as "gatekeepers" and exclude supposed "expert" testimony from trial when it is not based on "scientifically valid principles."[26] Under *Daubert*, judges consider such factors as whether the proposed expert testimony has been scientifically tested and peer reviewed and whether it has achieved acceptance in the

scientific community. Testimony that fails to meet those criteria or that has a high "potential rate of error"[27] will be deemed lacking scientific validity and evidentiary reliability and will be excluded from trial.[28] OSHA ought to be profoundly troubled that it is basing a rule of general applicability on a science that cannot meet those minimal criteria.

The California Debacle: A Cautionary Example

In the current rulemaking OSHA claims that ergonomics is a simple matter of "common sense" and implementing "reasonable measures." But it is instructive to look at the recent experience of the Occupational Safety and Health Standards Board in California. A last-minute rider to a 1993 workers' compensation bill required that agency "to adopt standards for ergonomics in the workplace designed to minimize the instances of injury from repetitive motion."[29]

The initial drafts of California's rule were prepared by the state's Division of Occupational Safety and Health and—like the current federal proposal—reflected ergonomists' inability to identify the ailments targeted by the rule, what causes them, and what measures will remedy them. The initial proposal required employers to alter jobs and job stations whenever "any 'work-related CTD [cumulative trauma disorder] risk causes or aggravates CTD symptoms.'"[30] "CTD symptom[s]" were defined to include "pain from movement . . . [or] pressure" that is "persisting or recurring."[31] Thus, as under the federal proposal, an employee could have a condition that did not result from "repetitive motion," did not originate at work, and was not an "injury"—a sore arm from throwing a football, for instance. But if the condition resulted in pain while moving at work, the employer would have been required to treat the condition as a work-caused musculoskeletal disorder.

Under this initial proposal, employers' obligations also turned on the existence of "CTD risk," defined as frequency, force, posture, or other factors present "in such a manner and to such an extent that a CTD is substantially likely to result."[32] (The federal proposal has a similar provision.) Since ergonomists admit not knowing dose-response relationships—that is, the point at which repetitive motion or heavy lifting becomes hazardous—employers were left to guess when measures were necessary. The California draft indicated generally that appropriate measures included reducing the "work pace," "redesign[ing] . . . work duties," and "[p]hysical modifications to work stations, equipment, tools, [and] production processes . . ."; covered workplaces were to implement such measures "as necessary to eliminate or reduce CTD risk."[33] Again, since ergonomists themselves do not know the changes necessary to eliminate supposed "CTD risk," employers were left to guess at their obligations.

In California the Division of Occupational Safety and Health ordinarily drafts regulations, and the state's Occupational Safety and Health Standards Board then decides whether to approve them. The board unanimously rejected the division's draft ergonomics rule. The proposal treats "all symptom[s] as being a CTD related problem," objected one board member in a public hearing.[34] Another member asked whether there was a way under the rule "to relate the symptoms to the workplace," and a third queried whether it was appropriate that "*symptoms* should trigger control measures [instead of] a diagnosed condition."[35] Members protested the vague and open-ended nature of the rule's requirements. One member said that it was impossible for employers to know "if they have done enough" to comply with the rule, and another protested that "employers don't know [what do to] until the Division [which drafted the rule and also conducts prosecutions under it] comes out and tells them what they think"; instead, that member stated, "employers must be given enough instruction to know what the baseline is."[36] All of those criticisms may be made of the current federal proposal.

Having rejected the draft prepared by the Division of Occupational Safety and Health, the Occupational Safety and Health Standards Board took the unusual step of

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drafting the rule itself. (As noted, California law required that some rule be put in place.) En route to finalizing the rule, the board made statements of ignorance, frustration, and futility that one hopes are unprecedented in the history of agency rulemaking. There is "a lack of scientific consensus and supporting documentation" for an ergonomics standard, the board said.[37] The problem, it said, is that "RMIs are *unlike known health and safety hazards* where there is sufficient scientific data to establish and predict a cause-effect relationship . . . "; "there is a lack of . . . scientific basis for determining a cause-effect relationship for RMIs."[38] Indeed, there is "uncertainty . . . whether repetitive motion injuries are really related to the work place or the artifact of something resulting from someone's personal life or experiences of their lifestyle."[39] Further, "[t]here is a lack of science . . . to state which repetitive motions are hazardous," and "there is currently no way to identify where RMIs might occur since there are no other proven criteria or dose response relationships."[40] The board was led to these conclusions partly by physicians and medical organizations that opposed the rule. The head of the California Orthopedic Association testified in public hearing that "[t]here are no convincing scientific studies to show that repetitive strain injury exists" and elaborated in written comments, "[T]here are no conclusive scientific studies showing objective findings that there is a causal relationship between specific work activities and the development of complaints termed 'repetitive strain injury.'"[41]

The California Administrative Procedures Act directs agencies to determine the economic impact of new rules.[42] But the board was so uncertain about when ergonomic measures might be necessary, and what measures should be taken and to what extent, that it reached no estimate of its rule's effect on California business. Rather, it again made statements of extraordinary uncertainty and futility: "The Board has not determined the [standard's] immediate costs. . . . Since there is no valid data to make reasonable cost estimates and no specific cost information was provided or obtained in 1994 during the previous rulemaking process for a comprehensive ergonomic proposal, Board staff was unable to determine the cost effect of this proposal. . . . [T]he Board is aware of the lack of cost data available and has continually requested such data to be provided, but such data were not provided."[43] Thus went into effect one of the most comprehensive rules in the history of California OSHA, without compliance with one of the most important features of the state's Administrative Procedures Act.[44]

OSHA's Ergonomics Litigation Record

OSHA acknowledges the difficulties of identifying musculoskeletal disorders and determining their cause and solution. It contends that those problems are not insurmountable, however, and cites an extensive literature by ergonomists and some corporate safety and health officers who claim that ergonomics programs have been successful. To those who lack the time to examine the underlying evidence, the debate between ergonomists and their critics can seem a standoff between experts, with no clear standard for judging which side is right. OSHA's ergonomic theory already has been judged, however—three times in a court of law. OSHA has litigated three ergonomics cases to judgment and suffered devastating losses in each. It could not prove that workers had musculoskeletal injuries caused by work, could not prove what aspect of work caused their musculoskeletal complaints, and could not establish what ergonomic interventions would correct the supposed hazard. One need not wade into the debate between ergonomists and their critics to appreciate the inappropriateness of the ergonomic regulation—one need only examine OSHA's dreadful performance in the ergonomics cases it litigated to judgment.

To date, OSHA has brought ergonomics

cases under the general duty clause of the Occupational Safety and Health Act of 1970. That clause imposes a general obligation on employers to protect workers from "recognized hazards" of "death or serious physical harm" and functions as a sort of catch-all under which OSHA may regulate clear and present dangers that existing OSHA rules (or "standards") do not reach. Cases under the general duty clause ordinarily are thought to have little bearing on the viability of OSHA standards, since the general duty clause is an open-ended provision that places the burden of proof on OSHA, whereas OSHA standards tend to be fairly detailed and put the burden on employers. In the case of OSHA's proposed ergonomics standard, however, the key questions will be little different than in the ergonomics cases OSHA has litigated to date, with this important twist: in the cases discussed below, OSHA had the burden of identifying hazardous job conditions and showing how to correct them, but under OSHA's proposed rule that is what employers must do.

Heavy Lifting: The *Beverly Enterprises* Case

In *Secretary of Labor v. Beverly Enterprises*, OSHA sought to prevent nursing home employees from lifting residents to care for them and to move them about their rooms.[45] (The agency would have preferred carting the elderly residents about in mechanical hoists, a method more suited to cattle than to people.)[46]

In a 31-day trial before an administrative law judge in 1994, OSHA marshaled extraordinary resources, but its defeat was total.[47] It presented four expert witnesses in the case. One, Arun Garg, was a leading ergonomist with principal responsibility for drafting the widely used 1991 NIOSH "lifting guidelines." A second expert, Dr. Roger Jensen, had been with NIOSH for 22 years and formerly was chief of its accident and injury epidemiology branch. Both of those experts had Ph.D.s. A third expert called by OSHA, Gunnar Andersson, held a Ph.D. and a medical degree, was acting head of the orthopedic surgery department of Rush-Presbyterian-St. Luke's Medical Center in Chicago, and is one of the nation's leading ergonomic theorists. The fourth expert, Bernice Owen, a Ph.D. and professor of nursing, visited five Beverly nursing homes to study how the lifts were performed.[48] Two of the experts had conducted "extensive research" on lifting in nursing homes, and a third had conducted epidemiological research specifically addressed to injuries of nursing home personnel.[49] OSHA also introduced nearly 400 exhibits into evidence, including 60 scientific articles.[50]

With all that evidence and expertise, OSHA still could not prove that lifting jobs are hazardous. "[T]here is no reliable epidemiological evidence establishing lifting as a cause of [low back pain]," the judge concluded.[51] "[S]cience has not been successful in showing when and under what circumstances lifting presents [a] significant risk of harm," and none of OSHA's vaunted experts "could say with reasonable medical certainty that any injury claimed by Beverly employees was caused by their job tasks."[52] Though heavy lifting is widely supposed to cause back injury, OSHA's leading expert, Gunnar Andersson, had conducted a study that found the "lifetime incidence of back pain" for teachers was higher than that for nursing assistants.[53] In his testimony Andersson conceded, "[I]t could not be concluded that 'nurses and nursing aides . . . have more back pain than the population in general.'" He also acknowledged that lifting was not "as strongly associated with back pain as psychological variables."[54]

The judge's decision is a powerful indictment of the "lifting guidelines" published by NIOSH and similar guidelines issued by Liberty Mutual Insurance Company. The agency had relied heavily on the guidelines in that case and in many other enforcement actions; the guidelines also are widely used in industry to identify purported lifting hazards. But both sets of guidelines are seriously flawed and are not intended or suited to identify actual workplace hazards, as the judge found. OSHA's expert had "assumed that the transferring methods were hazardous based on the recommended limit pro-

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mulgated by [NIOSH]," the judge wrote, yet "[t]he Secretary did not establish that any of these bases on which the experts based their opinions were valid. That is, he did not establish that any of them defined a significant hazard as contemplated by § 5(a)(1) of the Act."[55] "The NIOSH criterion" posited that "770 pounds of compressive force on the L5/S1 disk [i]s a safe upper limit" for lifting, for instance, but that criterion "is too speculative to demark violations of § 5(a)(1)."[56] One of OSHA's ergonomics experts applied the guidelines to the nursing assistant jobs at issue and determined that, with the exception of two lifts, "no female had sufficient strength to perform any of the lifts analyzed" at Beverly's facilities. "This is remarkable," the judge retorted, "given the facts that the video tapes clearly show the lifts being performed and the testimony to the contrary of the nursing assistants themselves."[57]

Indeed, the judge noted, the 1991 lifting guidelines acknowledge their reliance on speculation and uncertainty. "[T]he amount of lifting, in terms of either frequency or amount of weight lifted, that is hazardous has not been quantified," the guidelines state.[58] "Ideally, the criteria chosen to establish the lifting equation should be based on a scientifically supported, quantitative relationship between the criteria and the actual risk of lifting-related musculoskeletal injury or [low back pain]. Since this approach is not currently feasible, the lifting criteria, for the most part, are based on secondary or surrogate measures of injury or [low back pain]."[59] NIOSH charitably described the guidelines as reflecting "a unique compromise between empirical findings and expert judgment, particularly when results were contradictory, inconsistent, or simply limited,"[60] and warned in publishing them that "[a]ll methods need validation. For the 1991 lifting equation, validation will require an extensive collaborative effort. Appropriate studies must be designed and conducted to determine whether the methods presented here effectively reduce the morbidity associated with manual materials handling."[61]

The popular Liberty Mutual Guidelines also do not identify job hazards, the judge found. "Only one of the studies introduced [as epidemiological support for the guidelines] was adequately designed and conducted to provide a basis for drawing any conclusions with regard to causation of [low back pain]."[62] As Stover Snook, ergonomist and author of the Liberty Mutual Guidelines, has noted, "It is difficult to try and prevent . . . back injuries when no one really knows what causes them."

The judge in *Beverly Enterprises* identified a final weakness in OSHA's case that will be equally problematic to OSHA's proposed rule: OSHA could not intelligibly identify the "recognized hazard" it was prosecuting. The agency's complaint in the case targeted "lifting patients in an unsafe manner and other strenuous activities," and OSHA struggled over the course of a year to give meaning to that conclusory phrase. Initially, it offered the no more helpful "patient handling which could cause undue stress to the employee," and then, lifting loads that are "too heavy," with "improper body mechanics," lifting a "combative patient without using proper precautions" or "when the load is not close to the nursing assistant's body," "asymmetric" lifting, and "twist[ing] their torsos during the lift." OSHA later added to Beverly's supposed transgressions lack of training, "improper body mechanics," the performance of "solo lifts" of more than 50 pounds, and manually lifting patients who have fallen to the floor. (Perhaps the agency would have preferred patients to lie prostrate while a forklift was brought around.)[63]

The judge concluded from those fumblings that OSHA had failed its obligation to "define the hazard in such a way as to advise Beverly of its obligations and identify the conditions and practices over which Beverly may exercise control so as to reduce or eliminate the hazard."[64] Clearly identifying employers' obligations is a requirement not only under the Occupational Safety and Health Act's general duty clause but also under the U.S. Constitution. In the Supreme

Court's words, statutes and regulations must "give the person of ordinary intelligence a reasonable opportunity to know what is prohibited," and therefore an opportunity to "steer between lawful and unlawful conduct."[65] Courts repeatedly have wielded this principle to hold OSHA regulations unconstitutionally vague when employers—and in one instance OSHA itself—could not fathom the regulations' requirements.[66] Any rule premised on the congeries of myth, speculation, and guesswork that constitute ergonomics today is certain to present similar constitutional problems.

Junk Science: The *Dayton Tire* Case

Manufacturing is a principal target of ergonomic regulation, and OSHA launched a broad attack on 22 different manufacturing jobs in a single tire-manufacturing plant in *Secretary of Labor v. Dayton Tire, Bridgestone/ Firestone*, which was decided in 1998.[67] Once again, the agency deployed extraordinary resources. It assigned three compliance personnel to a six-month inspection and investigation of the facility. At trial before the administrative law judge it called more than three dozen witnesses, including 31 employees, 4 doctors from the facility, 3 OSHA investigators, and 2 (purported) experts.[68] Trial lasted six months, even though the company called only one witness. Pretrial preparation also had been intense. One of OSHA's experts took more than 28 hours of videotape of employees at work and prepared a "lengthy final report" analyzing the jobs.[69] A second expert—a university professor—assembled a team of three faculty colleagues and six resident doctors to review 333 medical records from a four-year period; they reviewed videotape of 22 different jobs as well as material prepared by OSHA's in-house ergonomist.

The OSHA witnesses had extensive experience with ergonomics. One was an OSHA analyst whose "primary job" for the past six years had been "conduct[ing] ergonomic analys[e]s" by reviewing videotapes of "work processes and identifying 'ergonomic stressors.'"[70] OSHA's medical expert, Roy DeHart, was a university professor with "impressive academic credentials" whose specialty was occupational medicine and who was "experienced in matters involving 'ergonomics.'"[71] Its ergonomics expert, Lawrence Schulze, also was a university professor with "impressive academic credentials."[72]

Yet, with all that expertise and preparation, OSHA failed in the most basic tasks of ergonomic analysis: It could not establish that employees in the plant had musculoskeletal disorders caused by work and, assuming they did, could not establish what aspect of the job caused the purported disorders. In determining whether the reported injuries were work related, the 10-person university medical team failed to control for personal characteristics widely known to be related to musculoskeletal complaints, including sex, age, obesity, physical conditioning, prior injuries, and, perhaps most important given ergonomists' theories, psychosocial factors.[73] The team also failed to control for nonwork activities associated with musculoskeletal discomfort, including sports and yard work.[74] Altogether Dayton Tire's lawyers identified 16 fundamental weaknesses in the agency's data, including, for instance, medical records that failed to provide "the information necessary to determine whether an employee's reported injury was ergonomically related."[75] OSHA's own medical expert, DeHart, confessed that "if [he] had been the treating physician, he would not have felt comfortable making a diagnosis" of the conditions' nature and cause.[76] "For the majority of the medical complaints reflected in the records," this professor—a man with "impressive academic credentials," "specializ[ing]" in occupational medicine, "experienced in . . . 'ergonomics,'" and assisted by three faculty colleagues and six residents—"was simply unable to determine the etiology, or cause, of the [employee's] complaint."[77]

What the medical team did purport to offer was an analysis of the "relative risk" of the Dayton Tire jobs, comparing the rate of reported musculoskeletal disorders among

OSHA failed in the most basic tasks of ergonomic analysis: It could not establish that employees in the Dayton Tire plant had musculoskeletal disorders caused by work.

OSHA's in-house ergonomist determined that a job lifting tire treads was safe, but the agency's retained expert concluded that the job would not be safe until the weight employees lifted was reduced to zero pounds.

Dayton Tire employees with the rate of all reported injuries in the tire industry. OSHA claimed the comparison showed an "association" between the reported musculoskeletal injuries and "ergonomic stressors." But, under questioning by the administrative law judge hearing the case, medical expert DeHart conceded "two major flaws" in his work: First, his study demonstrated no correlation between particular musculoskeletal conditions and particular jobs; second, it compared putative ergonomic ailments with other, quite different conditions.[78] The study did no more than "present a red flag" that "something . . . may be" wrong, DeHart conceded. The judge held that this method was not "trustworth[y]," "scientifically valid," or "scientifically reliable"—even though OSHA claimed the method was "generally accepted" among ergonomists. "'[C]onjectures that are probably wrong are of little use,'" the judge countered.[79] At one point in trial the judge turned to the government's witness and demanded, "Doctor, of what value is your study? Without trying to diminish your work here, but I have to put this in some sort of context."[80]

Ultimately, the judge concluded that DeHart's study "fail[ed] to meet the minimal requirements for evidentiary reliability" established in *Daubert v. Merrell Dow Pharmaceuticals, Inc.* (1993),[81] the Supreme Court decision that requires judges to exclude "expert" testimony that uses scientifically invalid methodology or reasoning.

As for OSHA's retained ergonomics expert, the agency characterized his method as "widely used and generally accepted" among ergonomists. It described his work as follows:

> During his plant entry, [Dr. Schulze, the ergonomist] observed and videotaped each job; determined what tools were used; measured forces, noise, weights, heights and distances; and documented the tasks with photographs. . . . Dr. Schulze completed his analysis by analyzing the video footage and the data he had collected of each job task. With this information, he created an operation process chart to determine what percentage of time the employees spent in their activities, identified risk factors and ergonomic problem areas, made abatement recommendations, and then formulated a written report. . . .[82]

On the basis of those steps, OSHA then invoked the ergonomist's "personal observation" to establish the dangerousness of the workplace.[83]

The judge rejected the testimony of this expert also under *Daubert*'s "junk science" standard. The so-called observational method, which OSHA claimed was "widely used" by ergonomists, was mere "ipse dixit," the judge ruled; it was "conjectural," "unreliable," and "untrustworthy."

While the judge struck the experts' conclusions from the record, he described their analysis of the 22 Dayton Tire jobs in footnotes throughout his opinion. The patent weakness of their testimony is even more damning than the fact that the judge struck it. Medical expert DeHart stipulated that "work is healthy" and that the activities the agency was prosecuting "can actually be beneficial under certain circumstances"; the key, he indicated, was "the frequency or repetition, and in some cases, the force, with which these tasks are executed that transforms them from seemingly benign movements into ergonomic 'stressors' which can have an adverse affect on the body."[84] Given this, the judge observed, "[P]roving the existence of the hazard . . . requires the Secretary to identify with some certainty the levels of force, frequency, and/or repetition, at which injury becomes a possibility." Yet that is exactly where the agency and its experts confessed ignorance: "none of the Secretary's witnesses were able to identify the exact point at which these activities pose the potential for harm . . . or indeed, that the activities, without considering such factors as age, gender, history of injury, or lifestyle, will cause injury at all."[85] And so, the judge concluded, "With no con-

sensus on the record regarding the point at which long periods of standing [or other activities] will pose a hazard . . . , the Secretary has failed to prove how these activities pose the potential for harm."[86]

The judge repeatedly noted the lack of "consensus on the record."[87] This lack of consensus was among OSHA and its own witnesses, who repeatedly differed in their analyses of job hazards. The agency charged in its citation that the hazard in one job was "elevated and extended reaches" and "long periods of standing." The expert ergonomist retained by the agency "admitted, however, that neither activity is likely to result in injury."[88] With regard to another job, OSHA charged that "long periods of standing" exposed workers to "recognized hazards that were causing or likely to cause death or serious physical harm" for purposes of the general duty clause, but the expert ergonomist did not mention that "risk" in his report; it was not of "'prime importance,'" he wanly explained.[89] OSHA's citation charged that workers in a third job were afflicted by "frequent pinching" and sitting too long; the retained expert did not identify those as hazards but did identify "wrist deviation," which was not determined to be a problem by OSHA's in-house expert.[90] In another job, one ergonomist identified the hazard as "torso flexions" and "twisting," but the second ergonomist identified "static posture" as among the job's principal hazards; the "static posture" involved operating a foot pedal.[91]

The ergonomists' analyses of lifting jobs diverged widely. OSHA's in-house ergonomist used a "lifting equation" and determined that a job lifting tire treads was safe; the agency's retained expert, however, concluded that the job was not safe and would not be until the weight employees lifted was reduced to zero pounds.[92] (For OSHA, evidently, light as a feather is sometimes not light enough.) In the case of another job, the in-house ergonomist and retained expert reversed roles; this time it was the expert who found the job's lifting tasks acceptable, and the in-house ergonomist who found the job unsafe.[93] Both ergonomists "performed lifting analyses assuming low frequency levels, but reached very different conclusions" about the job's hazardousness, one finding a 24-pound lift acceptable, the other finding no more than 15 pounds acceptable.[94] Evaluating yet another job, one ergonomist found it acceptable to lift no more than 25 pounds while the other set a 4-pound limit.[95] Altogether, Dayton Tire filed a 17-page appendix of inconsistencies in the testimony of OSHA's medical expert, its expert ergonomist, and its in-house ergonomist.[96]

For ergonomists, it's nothing new to be bounced out of court under the Supreme Court's *Daubert* decision, which directs judges to exclude expert testimony not based on scientifically valid principles. In two-thirds of the reported cases where a *Daubert* challenge was made to ergonomics "experts" in private litigation, the "expert" testimony was rejected in full or in part.[97] (Many of the cases were product liability suits charging computer manufacturers with causing carpal tunnel syndrome or other supposed cumulative trauma disorders.) The judges' assessment of ergonomics in these cases has been devastating. An ergonomist's testimony "border[ed] on sheer speculation and is therefore neither reliable nor relevant," one judge stated.[98] In another case, the judge barred ergonomists' testimony on causation because the putative experts relied on an "unreliable" methodology that "fail[ed] to provide any insight as to the specific cause" of plaintiff's supposed injuries and "ignore[d] or [were] unable to satisfactorily discount alternative causes."[99] Another judge found testimony by the plaintiff's engineer/ergonomist to be "rank speculation" because, among other things, the expert "[did] not say what amount of force is considered safe or excessive relative to causing or preventing [carpal tunnel syndrome]," could "point to no scientific data or research that supports the alleged causal link between the characteristics of the proof encoder and [carpal tunnel syndrome]," and failed to present "any empirical evidence supporting the

One ergonomist found it acceptable to lift no more than 25 pounds while the other set a 4-pound limit.

assertion that, had a foot rest been provided, the chance of developing [carpal tunnel syndrome] would have been reduced."[100]

In *Dayton Tire*, methods that OSHA claimed were "widely accepted" by ergonomists were held by the judge to be junk science. The agency did not even appeal the decision. If OSHA cannot find ergonomists to conduct reliable job analyses, how will employers do so under the agency's proposed rule?

In *Dayton Tire*, methods that OSHA claimed were "widely accepted" by ergonomists were held by the judge to be junk science.

OSHA's Pyrrhic "Victory": The *Pepperidge Farm* Case

OSHA's *Pepperidge Farm* case is the only ergonomics case to be decided by the full Occupational Safety and Health Review Commission.[101] OSHA considers the 1997 *Pepperidge Farm* decision a victory of sorts: the Democrat-dominated commission accepted some of the major premises of ergonomics, finding that repetitive workplace motions were causing carpal tunnel syndrome, tendonitis, and other putative MSDs. And the commission purported to graft onto the general duty clause the core components of "ergonomics programs": Pepperidge Farm was obliged to engage in a "process" that included record keeping, education and training, medical care, "workplace analysis to assess the potential hazard and steps to abate it," and "further actions, to the extent feasible, to materially reduce the hazard."[102] OSHA also won a part of the case, to which neither party paid much attention, concerning supposed lifting hazards.[103]

But in the central part of the case concerning supposed repetitive motion injuries, the commission ruled that the agency failed to show that its proposed ergonomic measures were appropriate. That decision is devastating, since OSHA had enlisted enormous resources and leading experts to show what the company should have done to avoid running afoul of the general duty clause. Yet OSHA and its experts could not prove what works, again raising the question of how American business can be commanded under penalty of law to determine what OSHA and the world's foremost experts could not.

The facts of *Pepperidge Farm* illustrate ergonomists' ambitions and the costs they would impose. The risks of "death or serious physical harm" that OSHA identified in the case were "capping" cookies (employees lifted the top of a sandwich cookie from one assembly line and placed it on top of the bottom of the cookie on another assembly line) and "cupping" cookies (employees flicked a paper cup onto a conveyer belt with the thumb and then placed a cookie in the cup).[104] To abate those seemingly benign conditions, OSHA ordered the company to increase staffing on the job, slow assembly line speeds, increase rest periods, or simply automate the entire operation.[105]

At trial, OSHA failed to demonstrate that those ergonomic measures were appropriate means of reducing musculoskeletal disorders putatively caused by the worksite. Some ergonomic measures had been implemented by the company, the commission held, and the additional measures proposed by the agency's expert ergonomists were not shown to be feasible and effective. Thus, leading ergonomist Vern Putz-Anderson testified that a method "used quite commonly by ergonomists" was to reduce assembly line speeds by 10 percent to see if workers became more comfortable. "However," the commission found, "Dr. Putz-Anderson did not testify to any specific instance where that method had been tried successfully."[106] The OSHA ergonomists also sought to have the agency "add . . . workers to each of the [assembly] lines," another commonly proposed ergonomic measure.[107] But again, according to the commission, OSHA failed to show that this "would materially reduce the hazard."[108] The commission did not see much value to OSHA's proposal that the Pepperidge Farm workers take "micropauses" in their work, since the uncontraverted testimony was that, while the workers were taking these brief rest periods, the cookies they were making would be sitting in the oven, burning.[109] Finally, OSHA's proposal to rotate workers among positions failed because the agency could not identify positions to which personnel could be rotated.[110]

OSHA might argue that *Pepperidge Farm* vindicated some ergonomic measures—those implemented by the company prior to OSHA's inspection—because the commission commented favorably on those controls in ruling for the company. That argument fails for two reasons, however. First, it remains the fact that OSHA and leading ergonomists were so certain that the steps taken by Pepperidge Farm were insufficient that they prosecuted a multi-million-dollar action against the company. If the world's leading experts cannot tell when a company has adopted appropriate ergonomic measures, how is the average employer to know what steps to take? Second and more to the point, OSHA did not establish the effectiveness of the measures Pepperidge Farm had taken. It sought to prove the ineffectiveness of Pepperidge Farm's measures, not their adequacy. OSHA thus failed to show the effectiveness of a single ergonomic measure in *Pepperidge Farm*, and there is no basis to believe that, if the company had taken no measures at all, OSHA would have been able to establish any measures Pepperidge Farm should have implemented.

Indeed, the commission unwittingly suggested the ineffectiveness of the measures Pepperidge Farm did take, by making two contradictory findings: First, the hazardousness of Pepperidge Farm jobs was evidenced by the high number of injuries they were causing, the commission held. But second, the commission ruled, Pepperidge Farm should win the case because the measures it had taken on its own had abated the ergonomic hazard. Thus, in the crucial part of its decision, the commission identifies a series of ergonomic measures the company had implemented before the OSHA inspection began in June 1988; many of those changes were instituted in 1987.[111] Yet OSHA's star witness—ergonomics doyen Barbara Silverstein—reported that from 1987 (when many of the measures were implemented) to 1988 the incidence of carpal tunnel syndrome increased nearly 70 percent, from 7.5 cases per 100 workers to 12.5. That is, the company's "abatement" of the hazard was followed by a 70 percent increase in the injuries the hazard purportedly caused. Some abatement!

Similarly, in the part of the case involving supposed lifting hazards, the commission held that lifting objects weighing between 16 and 38 pounds was a "recognized hazard of death or serious physical harm" under the Occupational Safety and Health Act. But, in discussing another job, the commission held that reducing a 100-pound lift to 50 pounds was an effective ergonomic adjustment. Why is 50 pounds safe if 16 pounds is not? The commission's conflicting rulings cannot be reconciled.[112]

Pepperidge Farm is a devastating demonstration of OSHA's inability to identify effective ergonomic measures. OSHA's inspectors were in Pepperidge Farm's facility for months.[113] The agency then assembled the nation's leading ergonomists and treated the Occupational Safety and Health Review Commission to an expert seminar on what ergonomic measures employers should implement. Yet those experts' prescriptions were judged erroneous—the company had an adequate ergonomics program and the nation's leading experts didn't recognize it, the commission held. Having failed in these laboratory conditions, how can OSHA claim the ability to formulate a rule of general applicability to guide all workplaces? It cannot.

Conclusion: Not Ready for Prime Time

From its embarrassing losses in the three ergonomics cases it litigated to judgment, OSHA has concluded that it should cease enforcing ergonomics under the general duty clause and issue an ergonomics rule instead. The agency has it half right: It should cease its general duty clause litigation. But, for the same reasons, an ergonomics rule is folly as well. In *Beverly Enterprises*, *Dayton Tire*, and *Pepperidge Farm*, OSHA deployed squads of experts and extraordinary resources and targeted them on what it considered particularly hazardous worksites. Yet the agency could not determine what if anything was wrong, or how to correct it. Employers should not be commanded to make scientific determinations that consistently have eluded OSHA.

If the world's leading experts cannot tell when a company has adopted appropriate ergonomic measures, how is the average employer to know what steps to take?

Notes

1. *Merriam Webster's Collegiate Dictionary*, 10th ed. (Springfield, Mass.: Merriam Webster, 1998), p. 393.

2. Ergonomics Program; Proposed Rule, 64 Fed. Reg. 65,768, 65,817 (1999).

3. See, for example, Proposed Rule § 1910.918.

4. 64 Fed. Reg. at 65,806, 65,817.

5. With its bureaucratic taste for redundancy, OSHA calls handling—with one's hands—"manual handling." Proposed Rule § 1910.901(b).

6. Comments of the National Institute for Occupational Safety and Health (submitted in response to OSHA's Advance Notice of Proposed Rulemaking, 57 Fed. Reg. 34,192 [1992]).

7. 29 U.S.C. § 654(a)(1). The "general duty clause" is discussed later in this paper.

8. See the initial comments of United Parcel Service in the California ergonomics rulemaking, which are reprinted in the record on appeal in *Pulaski v. California Occupational Safety & Health Standards Board*, 75 Cal. App. 4th 1315, 90 Cal. Rptr. 2d 54 (1999), at Clerk's Transcript 001386-91 (cited hereafter as CT).

9. See Proposed Rule § 1910.922 and §§ 1910.929–35.

10. William L. Cats-Baril and John W. Frymoyer, "The Economics of Spinal Disorders," *Adult Spine* 1 (1991): 95.

11. Editorial, *Journal of Hand Surgery*, May 1995.

12. See, for example, Stanley J. Bigos et al., "A Prospective Study of Work Perceptions and Psychosocial Factors Affecting the Report of Back Injury," *Spine* 16 (1991): 1.

13. Peter A. Nathan et al., "Obesity as a Risk Factor for Slowing of Sensory Conduction of the Median Nerve in Industry," *Journal of Occupational Medicine* 34 (April 1992): 382.

14. National Institute for Occupational Safety and Health (NIOSH), *Health Hazard Evaluation Report*, HETA 89-299-2230: US West Communications, Phoenix, Arizona, Minneapolis, Minnesota, Denver, Colorado 2 (Washington: U.S. Department of Health and Human Services, July 1992), p. 4 (cited hereafter as NIOSH US West Study).

15. 64 Fed. Reg. at 65,903.

16. Stover H. Snook, "The Design of Manual Lifting Tasks," *Ergonomics* 21 (1978): 964.

17. Comments of the National Institute for Occupational Safety and Health at 16 (emphasis added).

18. Stanley J. Bigos and Michele C. Battié, "Risk Factors for Industrial Back Problems," *Seminars in Spine Surgery* 4 (1992): 8.

19. Stanley J. Bigos et al., p. 1.

20. NIOSH US West Study, p. 4.

21. Ibid., p. 12.

22. Ibid., p. 13.

23. 64 Fed. Reg. at 65,880.

24. Ibid. at 65,927. That OSHA belittles psychosocial factors in this manner is astonishing, given the extensive medical literature on psychosocial factors, including a 1997 NIOSH study, cited throughout the rulemaking, which states that in "office settings physical factors may be less important . . . than psychosocial factors . . . in their relationship with" carpal tunnel syndrome. *Musculoskeletal Disorders and Workplace Factors* (Washington: NIOSH, 1997), p. 7-6.

25. In other regulatory proposals, ergonomists have simply broadened their reach to regulate psychosocial factors as well as physical factors. For instance, a committee of the influential American National Standards Institute (ANSI) proposed a model ergonomics standard that identifies MSDs' causes to include "work organizational factors" such as "pay, benefits, . . . prestige and status" of the job; in workplaces where MSDs emerge, these are among the job elements employers would be expected to alter under the proposed ANSI standard. Accredited Standards Committee Z365, *Control of Cumulative Trauma Disorders*, National Safety Council Working Draft, June 1997, Section 2, "Work Organization Factors Defined" §§ 4.1, 4.2.7.

26. 509 U.S. at 597.

27. Ibid. at 593–94.

28. Ibid. at 590 n. 9.

29. 1993 Stat. ch. 121 (A.B. 110) § 71 (July 16, 1993), codified at Cal. Lab. Code § 6357.

30. *Pulaski*, 75 Cal. App. 4th at 1338 n. 11, 90 Cal. Rptr. 2d at 68 n. 11, CT 000035.

31. CT 000031–32.

32. CT 000031.

33. CT 000031–32.

34. Summary, Business Meeting, August 25, 1994, p. 21.

35. Ibid. at 27 (emphasis added).

36. Ibid. at 28.

37. CT 000870.

38. CT 000865, 000889 (emphasis added).

39. CT 001127.

40. CT 000886, 000877.

41. CT 001205; and CT 001204, 001206.

42. Cal. Gov't Code § 11346.3(a).

43. CT 000956, 000799, 000887.

44. Fortunately for the state economy, the rule does supply a defense to ergonomics' uncertainties by providing that an employer that takes some steps to address perceived ergonomic hazards cannot be penalized for failing to take additional measures unless the agency shows those measures to be "substantially certain" to cause a greater reduction in RMIs without imposing "additional, unreasonable costs." Cal. Code Regs. tit. 8 § 5110.

Labor and business interests both challenged the California rule under the state APA. The rule was upheld by the state Court of Appeal, except for a provision that had exempted small business. See *Pulaski*, discussed above.

45. *Secretary of Labor v. Beverly Enterprises, Inc.*, OSHRC Docket Nos. 91-3344, 1995 OSAHRC LEXIS 158, at *90, directed for review (November 9, 1995).

46. Ibid. at *91.

47. OSHA has appealed the decision to the Occupational Safety and Health Review Commission, but a decision is not expected from the short-staffed commission for some time.

48. *Beverly Enterprises*, 1995 OSAHRC LEXIS 158, at *105.

49. Ibid.

50. Ibid. at *88.

51. Ibid. at *140.

52. Ibid. at *93, 150. Accord ibid. at *155 ("The Secretary failed to establish that any of the injuries suffered by Beverly's nursing assistants were work related, let alone that they were caused by specific 'unsafe lifts' performed by those assistants").

53. Ibid. at *133.

54. Ibid. at *135.

55. Ibid. at *101, 123.

56. Ibid. at *122.

57. Ibid. at *125. Accord ibid. at *126 (noting "obvious discrepancy between Dr. Garg's determinations and the routine practice of nursing assistants").

58. Ibid. at *141.

59. Ibid. at *142 (emphasis added).

60. Ibid. at *141.

61. Ibid. at *143. The union for the nursing assistants entered an appearance in the case and made great concessions about scientific knowledge about back pain and injury. The union conceded that "[low back pain] is a prevalent problem in the U.S., usually does not result from serious physical harm, and is difficult to relate to any specific patho-anatomic damage." Ibid. at *103 n. 17.

62. Ibid. at *111.

63. See ibid. at *102, 104 n. 18.

64. Ibid. at *104.

65. *Grayned v. City of Rockford*, 408 U.S. 104, 108 (1972).

66. See, for example, *Dravo Corp. v. OSHRC*, 613 F.2d 1227, 1232 (3d Cir. 1980) (stating that "an occupational safety and health standard must give an employer fair warning of the conduct it prohibits or requires, and it must provide a reasonably clear standard of culpability to circumscribe the discretion of the enforcing authority and its agents"); and *Kent Nowlin Constr. Co. v. OSHRC*, 593 F.2d 368, 371, 7 O.S.H. Cas. (BNA) 1105 (10th Cir. 1979) (Due Process Clause prevents OSHA from enforcing standard where OSHA representatives disagree among themselves on steps needed to comply with standard).

67. *Secretary of Labor v. Dayton Tire, Bridgestone/Firestone*, OSHRC Docket No. 93-3327, 1998 OSAHRC LEXIS 23 (January 26, 1998).

68. Ibid. at *13–15.

69. Ibid. at *18.

70. Ibid. at *10, 5–6.

71. Ibid. at *39, 52.

72. Ibid. at *39.

73. Ibid. at *59.

74. Ibid. at *60.

75. Ibid. at *61.

76. Ibid.

77. Ibid. at *62–63. The medical expert and his crack team recorded the following as musculoskeletal injuries: getting foreign objects in the eye, burns, and lacerations. See, for example, ibid. at *24, *26 ("one of the musculoskeletal injuries rated as having a high probability of being ergonomically related to the job is a foreign object in the right eye of a tire builder").

78. Ibid. at *73.

79. Ibid. at *70, 71, 73, 74 (citation omitted).

80. Ibid. at *73.

81. 509 U.S. 579 (1983), cited at ibid. at *75.

82. 1998 OSAHRC LEXIS 23, at *64.

83. Ibid. at *65.

84. Ibid. at *95–96.

85. Ibid. at *96.

86. Ibid. at *99.

87. See, for example, ibid. at *199, 220.

88. Ibid. at *88 n. 40.

89. Ibid. at *112 n. 54.

90. Ibid. at *135, 195 n. 92.

91. Ibid. at *69.

92. Ibid. at *100, 120 n. 57.

93. Ibid. at *151 n. 71. See also ibid. at *233 n. 108.

94. Ibid. at *239, 184 n. 86.

95. Ibid. at *216, 216 n. 103.

96. Ibid. at *66. The confusion was not limited to OSHA and its experts: one worker claimed a job caused a low back injury, while another worker—called by OSHA—testified that the same job "strengthened his back muscles and 'substantially decreased' the back pain he felt prior to taking the job." Ibid. at *172.

97. The search was conducted in the LEXIS database in 1999 using the terms "Daubert and ergonomic! or cumulative trauma disorder or repetit! str! injur! or repetit! motion injur!"

98. *Bennett v. PRC Public Sector, Inc.*, 931 F. Supp. 484, 500 (S.D. Tex. 1996).

99. *Reiff v. Convergent Techs.*, 957 F. Supp. 573, 583 (D.N.J. 1997).

100. *Hopkins v. NCR Corp.*, No. 93-188-B-M2, 1994 U.S. Dist. LEXIS 17273, at *35, 36, 43 (M.D. La. Nov. 17, 1994), affirmed, 53 F.3d 1281 (5th Cir. 1995). See also *Dennis v. Pertec Computer Corp.*, 927 F. Supp. 156, 161–62 (D.N.J. 1996), affirmed, 135 F.3d 764 (3d Cir. 1997) (testimony by three of four ergonomists excluded under *Daubert;* the methodology of one constituted "unsupported speculation"); and *Schneck v. IBM Corp.*, No. 92-4370 (GEB), 1996 U.S. Dist. LEXIS 17486, at *99 (D.N.J. June 25, 1996) (summary judgment for the employer since the plaintiff's experts "could not give a quantitative measure" of when "intensive" keyboard use became hazardous and also "cannot offer specific remedial measures which, if followed, would avoid the alleged dangers surrounding the activity of typing").

101. *Secretary of Labor v. Pepperidge Farm Inc.*, 17 O.S.H. Cas. (BNA) 1993, 2028–29 (1997).

Beverly Enterprises and *Dayton Tire* were decided by administrative law judges, whose decisions may be appealed to the commission. Appeal is pending in *Beverly Enterprises.* As just noted, none was taken in *Dayton Tire.*

102. 17 O.S.H. at 2034.

103. Ibid. at 2002–09. On the lifting tasks, the company conceded a central element of its case by not challenging the administrative law judge's finding the tasks were a recognized hazard of death or serious physical harm. See ibid. at 1995 ("Pepperidge did not seek review of the judge's finding that a hazard exists"). The commission explicitly stated in a footnote that it was not addressing "the issue of whether serious physical harm can result from lifting tasks." Ibid. at 2003 n. 26. Accordingly, the decision is of scant precedential import on whether lifting poses a recognized hazard.

104. Ibid. at 2010.

105. Ibid. at 2038; and Eugene Scalia, *Ergonomics: OSHA's Strange Campaign to Run American Business*, NLCPI White Paper 6 (August 1994).

106. 17 O.S.H. Cas. (BNA) at 2039.

107. Ibid. at 2038.

108. Ibid. at 2035, 2040.

109. Ibid. at 2039.

110. Ibid.

111. Ibid. at 2036–37.

112. The frequency of the lifts does explain the discrepancy. The 16- to 38-pound tins were lifted only "twice in a three minute period, once when full and once when empty." 17 O.S.H. Cas. (BNA) at 2003. The tins weighed 27 to 38 pounds full, 16 pounds empty.

113. Ibid. at 1994.

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