

The Economics of Intervention: Protecting Workers Who Come in Contact With Wet Portland Cement

Updated August 2002

Prepared for

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Executive Summary

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Frequent hand washing is a simple and cost-efficient way to prevent contact dermatitis for construction workers exposed to wet Portland cement. The disease costs workers, insurers, and the government between \$135 million and \$679 million per year. By contrast, in addition to sparing workers the suffering associated with the disease, it would cost less than \$1.5 million to prevent these illnesses. In purely economic terms \$90 to \$450 would be saved for every dollar spent.

Of the nearly seven million construction workers in the United States, 8 to 22 percent are likely to come into contact with wet Portland cement. Approximately 600,000 workers have frequent contact, and there are many more construction workers who, while not specializing in cement work, use it during their work and are exposed to it as they build highways, commercial and residential buildings, or brick and tunnel projects. In fact, more than 1,300,000 American workers, in 30 occupations, are thought to be regularly exposed to wet cement, perhaps as many as 1.8 million. Without intervention and prevention activities, these workers are at a high risk of developing irritant and allergic contact dermatitis and acute chemical burns. According to some estimates, 5 to 15 percent of construction workers -- most of them masons -- develop dermatitis during their work lives. This would suggest that 350,000 to 1,050,000 current construction workers will, at some point in their careers, develop some type of occupational dermatitis, many of them from exposure to wet Portland cement.

Occupational skin diseases and cement burns, while often difficult to treat and cure, are preventable. One way to prevent such diseases is to identify the sensitizing or irritating agent so that successful interventions can be designed and implemented. The National Institute for Occupational Safety and Health (NIOSH) is funding The Center to Protect Workers' Rights (CPWR) to assess the effectiveness of interventions to protect workers from contact dermatitis. This portion of the CPWR study focuses on economic costs of these interventions and the economic benefits that would result from prevention and healthier workers.

Based on the studies summarized in this paper, an estimated 1,700 to 8,500 cases of cement-related dermatitis occur each year, with 1,100 to 5,300 workers at risk of allergic dermatitis. Many workers stay on the job while suffering from skin diseases, but when the disease becomes severe and they do lose work time, the time lost is likely to be longer than the typical lost time episode for a construction worker generally, which is three

days. Based on published data, this report estimates that lost work days associated with an incident of occupational dermatitis typically range from 4 days to 13 days.

Hand washing is the most important prevention against cement-induced dermatitis. Prevention is further promoted through use of pH neutralizing products. Working time for hand washing and purchase of pH neutralizer products can cost less than a dollar per worker per day.

One case of irritant or allergic dermatitis can devastate to the life of a cement worker. It may even threaten the means to earn a living and support a family. The net financial loss to a worker can be significant. A variety of possible illness scenarios, developed in this paper, shows individual costs, once a dermatitis illness requires medical attention, range anywhere from \$110 to \$43,000 a year – in a combination of medical costs, other out-of-pocket expenses, and foregone wages. The cost to government and Workers' Compensation systems, in these scenarios, is anywhere from zero to \$37,000 per case per year. These costs include, where applicable, Workers' Compensation medical coverage, Workers' Compensation cash payments, Unemployment Insurance, food stamps, Temporary Assistance to Needy Families (TANF) payments, and job retraining.

For a year, if the number of cement-related dermatitis cases is 1,700 to 8,500 (as estimated in the report that follows), then the total burden to affected workers is likely to be \$73 million to \$366 million, with a cost to government and Workers' Compensation systems of \$63 million to \$315 million. And this assumes that no one becomes permanently disabled and dependent on Social Security's Supplemental Security Income program, which could cost the government over the remaining working life of one individual, as much as \$1 million. Also not included in the cost estimates are those associated with severe cement burns, which, as described in law suits, can costs tens of thousands of dollars, even more.

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Of the nearly seven million construction workers in the United States,¹ 8 to 22 percent are likely to come into contact with wet Portland cement.² More than 600,000 workers have frequent contact, and there are many more construction workers who, while not specializing in cement work, use it during their work and are exposed to it as they build highways, commercial and residential buildings, or brick and tunnel projects. In fact, more than 1,300,000 American workers, in 30 occupations, are thought to be regularly exposed to wet cement,³ perhaps as many as 1.8 million.⁴ Without intervention and prevention activities, these workers are at a high risk of developing irritant and allergic contact dermatitis and acute chemical burns. According to some estimates, 5 to 15 percent of construction workers -- most of them masons -- develop dermatitis during their work lives.⁵ This would suggest that 350,000 to 1,050,000 current construction workers will, at some point in their careers, develop some type of occupational dermatitis, many of them from exposure to wet Portland cement.

Occupational skin diseases, while often difficult to treat and cure, are preventable. One way to prevent such diseases is to identify the sensitizing or irritating agent so that successful interventions can be designed and implemented. The National Institute for Occupational Safety and Health (NIOSH) is funding The Center to Protect Workers' Rights (CPWR) to assess the effectiveness of interventions to protect workers from contact dermatitis. This portion of the CPWR study focuses on economic costs of these interventions and the economic benefits that would result from prevention and healthier workers.

This paper, after a brief discussion of the health risks from wet cement, estimates the number of workers exposed and the likelihood that they might become injured or ill. After a discussion of how the disease is treated, the costs of treatment and other economic burdens are estimated and compared to the costs of prevention through hand washing.

¹ U.S. Bureau of Labor Statistics, <http://146.142.4.24/cgi-bin/surveymost>, downloaded July 23, 2001.

² U.S. Bureau of the Census, 1997 Economic Census, "Industry Summary: Construction," January 2000. These are the employees in NAICS: 1) Masonry, Stone Setting 174100, 2) Concrete Work, Special Trade Contractors, 177110 and 177120.

³ FOF Communications, "Safety and Health Practitioner's Guide to Skin Protection -- For Work With Wet Cement in Construction," 1999.

⁴ Based on numbers developed in Section II of this paper.

⁵ Pekka Roto, "Case Studies: Prevention of Occupational Dermatoses Among Workers Exposed to Cement Dust," Encyclopedia of Occupational Safety and Health: Chapter 93 - Construction, <http://www.cdc.gov/niosh/elcosh/docs/d0200/d000293/d000293.html>, April 10, 2001.

I. Health Risks From Wet Cement

Jobs that put workers at risk of developing contact dermatitis include concrete pouring, leveling, finishing, and repairing.⁶ Wet Portland cement can cause acute chemical burns because of its alkaline nature. It also causes irritant and allergic contact dermatitis.

Cement causes irritant contact dermatitis because it is alkaline, hygroscopic,⁷ and abrasive. Irritant dermatitis results from direct damage to the skin caused by the combination of wetness, chemical corrosiveness, and abrasiveness of cement in concrete and mortar. Allergic dermatitis results when workers become sensitized to chromium salts in the cement.⁸ One kilogram of normal cement dust contains 5 to 10 mg. of water-soluble chromium. Chromium in the cement derives both from raw materials used to make cement as well as from production processes, mainly the steel structures used in production.⁹

Hexavalent chromium, a strong sensitizing agent, is responsible for cement dermatitis in cement workers.¹⁰ Other sensitizing agents for cement workers include epoxy adhesives, sealants, and other admixture¹¹ chemicals used with cement and plaster.¹² Hexavalent chromium has been known as an extreme sensitizer for decades. About half of a group of 23 human subjects, as far back as the 1960's, were sensitized to trivalent chromium and all 23 to hexavalent chromium. On a scale of 1 to 5, in which 5 is the most potent allergen, trivalent chromium was graded as 3 and hexavalent as 5; i.e., an extreme

⁶ Christian Avnstorp, "Risk factors for cement eczema," Contact Dermatitis, 1991:25, p. 85.

⁷ A hygroscopic material is one that attracts moisture from its surroundings. In this case, cement absorbs moisture from exposed skin.

⁸ Health and Safety Executive, "Cement," <http://www.hse.gov.uk/pubns/cis26.htm>, downloaded January 13, 2000.

⁹ Pekka Roto, "Case Studies..."

¹⁰ Other sensitizing agents include various epoxy adhesives and sealants, in addition to additives in rubber gloves and various chemicals present in the admixtures used with cement and plaster. (OPCMIA, "Physician's Alert: Occupational Contact Dermatitis Among Plasterers and Cement Masons, 1996.)

¹¹ Admixtures are concrete additives used to produce specialized properties that enhance the durability of concrete. The additives, for instance, can reduce concrete shrinkage by 50-80%, strengthen durability by 30%, and prevent erosion or washout when concrete is being used for foundations in water. (Eng-Tips Forums, <http://www.eng-tips.com/gviewthread.cfm/lev2/26/lev3/72/pid/591/qid/700>, downloaded May 24, 2001.)

¹² The Center to Protect Workers' Rights, "Physician's Alert," Electronic Library of Construction Occupational Safety and Health, <http://www.cdc.gov/niosh/elcosh/docs/d0200/d000281/d000281.html>, downloaded April 11, 2001.

sensitizer.¹³ Chromium compounds, particularly hexavalent ones, are carcinogens, corrosives, delayed contact sensitizers, and they put the kidney at risk.¹⁴ Hexavalent chromium is recognized by the International Agency for Research on Cancer and by the US Toxicology program as a pulmonary carcinogen.¹⁵ Carcinogenicity appears to be associated with the inhalation of the less soluble or insoluble hexavalent chromium compounds; however, the risk of lung cancer occurs primarily from worker exposure to hexavalent chromium dust during the refining of chromite ore and the production of chromate pigments.¹⁶

A. Cement-Induced Skin Conditions

As a consequence of exposure to cement, workers may develop any or all of the following skin conditions:

1. Dry Skin and Irritation may result from exposure to cement. This condition includes scaling, itchiness, burning, and redness of the skin.
2. Cement Burns appear within a short period of time after exposure to such products as fresh mortar, concrete, and grout that contain Portland cement. Cement burns produce blisters, dead or hardened skin, and the skin may look black or green. One 1997 survey found cement burns among 35 percent of apprentice cement masons.¹⁷ While cement burns can lead to allergic dermatitis, chromate sensitivity, in turn, can also exacerbate the severity of cement burns. Severe burns can cause scarring, and the affected worker may even require skin grafts. Cement burns, in some cases, lead to disability.
3. Contact Dermatitis can be acute or chronic. Over time workers suffering from irritant dermatitis may become increasingly sensitized and develop an allergic form of the disease -- a condition harder to treat than basic contact dermatitis. Approximately 25 percent of occupational dermatitis is allergic.¹⁸ In cement work, as much as 62 percent of cement-related dermatitis becomes allergic contact dermatitis.

¹³ A. M. Kligman, "The identification of contact allergens by human assay," J Invest Derm, 1996, Vol. 47, p. 393 as cited in L. Kanerva, Finnish Institute of Occupational Health, "A review of skin sensitization caused by chromium," The Chromium File, International Chromium Development Association, October 1996, <http://www.chromium-asoc.com/crfile2oct96.htm>, downloaded July 5, 2000.

¹⁴ S. C. Gad, "Acute and Chronic Systemic Chromium Toxicity," Science and Total Environment, October 1989, Volume 86, No. 1-2, pp. 149-157.

¹⁵ D. G. Barceloux, "Chromium," Journal of Toxicology and Clinical Toxicology, Vol. 37, No. 2, 1999, pp. 173-194.

¹⁶ Ibid.

¹⁷ M. Larson and R. Wolford, "Survey of Apprentice Cement Masons," FOF Communications, Report to NIOSH/CPWR Consortium, 1997.

¹⁸ <http://www.hazmat.com/workers.htm>, downloaded July 19, 2000.

a. Irritant Contact Dermatitis is a disease affecting only the skin area in direct contact with an irritant. Individuals exposed to the irritant are generally affected and the reaction may occur the first time contact occurs.

b. Allergic Contact Dermatitis is an acquired sensitivity developed when an individual is exposed to a causative agent; in this case, wet Portland cement. The development of occupational hand eczema is affected by many factors, such as the concentration of the allergen, duration of exposure, work processes, and the need for improved hand washing.¹⁹

The sensitization type of (eczematous contact) dermatitis usually occurs 5 to 7 days, and occasionally as long as 20 days, after initial contact, at the site of the contact. There are no circulatory or otherwise detectable antibodies produced, although there is local tissue allergy. Allergies cannot be cured. Once they occur, the only way to prevent reactions is to avoid contact with the allergen.

Wet Portland cement is the most common cause of chromium-induced contact dermatitis. A diagnosis of cement-induced contact dermatitis (allergic or irritant) should be considered for all patients working with cement or plaster. Cement dermatitis carries a bad prognosis, so prevention is imperative.²⁰ One study showed that 75 percent of patients with occupational contact dermatitis developed chronic skin disease.²¹

Relapses and chronic contact dermatitis, which cause economic as well as health hardships, are the result of:

1. Re-exposure
2. Skin whose barrier function may be impaired for months or even years after a dermatitis episode, thereby leaving the skin less able to tolerate irritants
3. Over-zealous use of cleaners, antiseptics, and herbs in treating the initial disease
4. Secondary infection from the primary dermatitis disease.

The risk of relapse to allergic dermatitis persists throughout life.²² If the allergy develops, very low future exposure can cause itching and a skin rash.²³ Because cement

¹⁹ Ibid., p. 86.

²⁰ Multiple citations from L. Kanerva, Finnish Institute of Occupational Health, "A review of skin sensitization caused by chromium," The Chromium File, International Chromium Development Association, October 1996, <http://www.chromium-asoc.com/crfile2oct96.htm>, downloaded July 5, 2000.

²¹ National Institute for Occupational Safety and Health, National Occupational Research Agenda (NORA), "Allergic and Irritant Dermatitis," <http://www.cdc.gov/niosh/nrderm.html>, February 15, 2001.

²² <http://www.emedecine.com/PED/topic2569.htm>, downloaded July 19, 2000.

dermatitis is associated with chromate sensitivity, the avoidance of exposure or the “elimination” of chromate in cement would decrease the number of cases of cement dermatitis.

B. Incidence and Prevalence of the Disease

Skin diseases are the leading non trauma-related occupational illness in the United States. Of all occupational skin diseases, irritant and allergic contact dermatitis are the most common, and totally preventable.²⁴ Contact dermatitis of all sort results in 5.6 million doctor visits each year in the U.S., representing 15 to 20 percent of all occupational diseases reported to the Centers for Disease Control.²⁵ Cement-induced disease is a major example.

While there are no clear estimates for the number of workers who are exposed and those who develop contact dermatitis from exposure to wet Portland cement,

based on the studies summarized below, this paper estimates 1,700 to 8,500 cases of cement-related dermatitis a year, with 1,100 to 5,300 construction workers at risk of allergic dermatitis.

- A 2001 report by NIOSH found construction workers at heightened risk of dermatitis. Whereas the overall rate for dermatitis cases in all industry was 0.8 per 10,000 workers in 1996 for concrete construction work it was 2.5 times as high, at 1.98 per 10,000.²⁶
- One Singapore-based study²⁷ examining occupational chromate allergy, found that of 257 workers with occupational allergic dermatitis, 34 percent (87) had positive reaction to chromate on patch testing. Cement (61 percent) was the most common source of chromate allergy in the workers with occupational allergic dermatitis (21 percent of the 257). Of workers allergic to chromate from cement, 96 percent (51 of 53) came from the construction industry. That is, 20 percent of construction workers studied, had allergic dermatitis related to cement exposure.

²³ New Jersey Department of Health and Senior Services, “Hazardous Substance Fact Sheet: Chromium,” January 2000.

²⁴ National Occupational Research Agenda (NORA), “Allergic and Irritant Dermatitis,” 2001.

²⁵ <http://www.proteque.com/documents/report.htm>, downloaded July 19, 2000.

²⁶ U. S. Department of Health and Human Services, NIOSH, A NIOSH Look at Data From the Bureau of Labor Statistics: Worker Health by Industry and Occupation, DHHS (NIOSH) Publication No. 2001-120, p. 86.

²⁷ S. S. Wong, M. T. Chan, S. L. Gan, S. K. Ng, and C. L. Goh, “Occupational Chromate Allergy in Singapore: a study of 87 patients and a review from 1983 to 1995,” American Journal of Contact Dermatitis, 1998, Vol. 9, No. 1. (Abstract)

- In 1995, the Bureau of Labor Statistics (BLS) recorded 64,200 cases of occupational skin disorders, and this is considered a significant undercount. BLS data indicate a steadily increasing number of cases for 1996 and 1997.²⁸

In 1993, based on Bureau of Labor Statistics (BLS) numbers, there were 60,200 reported cases of occupational skin disease in the U.S. and an incidence rate of 7.6 cases per 10,000 full-time workers. But because of several limitations²⁹ of the BLS survey, the National Institute for Occupational Safety and Health estimates the number of occupational skin diseases may be 10 to 50 times higher than reported by BLS – between 500,000 and three million. There were a total of 372,000 occupational illnesses recorded by BLS for 1999 of which 44,600 (12 percent) were skin diseases/disorders, an incidence of 4.9 cases per 10,000 workers.³⁰

- A 1982 study, reviewing literature on routine patch testing for chromium salts, found an incidence of 7.9 percent for sensitization to potassium dichromate in the 200 patients tested.³¹
- In a study of 850 workers at a clinic in Singapore, between January 1990 and December 1995, 75 percent (633) had contact dermatitis and 40 percent (257) of them had allergic contact dermatitis.³²
- An Australian study,³³ of 117 cement workers, found the prevalence of irritant contact dermatitis was 4.2 percent and the prevalence of allergic contact dermatitis was 2.6 percent.

²⁸ From the Bureau of Labor Statistics, Survey of Occupational Injuries and Illnesses, 1997, as reported in Joel Kaufman, Martin Cohen, Martin, Susan Sama, Joanne Shields, and John Kalat, “Occupational Skin Diseases in Washington State, 1989 Through 1993: Using Workers’ Compensation Data to Identify Cutaneous Hazards,” American Journal of Public Health, July 1998, Vol. 88, No. 7, p. 1047.

²⁹ BLS data exclude self-employed individuals, small farms, and government agencies. They also depend on misinterpretable definitions of reportable occupational injuries and illnesses; rely to a large extent on employees reporting conditions to the employers, and do not provide information on the etiology of skin diseases. National Institute for Occupational Safety and Health, “Occupational Dermatoses – A Program for Physicians,” <http://www.cdc.gov/niosh/ocderm1.html>, downloaded April 26, 2001.

³⁰ NIOSH, “Occupational Dermatoses ...”

³¹ J. R. Nethercott, “Results of routine patch testing of 200 patients in Toronto, Canada,” Contact Dermatitis, 8, 1982, p. 389 as cited in L. Kanerva, Finnish Institute of Occupational Health, “A review of skin sensitization caused by chromium,” The Chromium File, International Chromium Development Association, October 1996, <http://www.chromium-assoc.com/crfile2oct96.htm>, downloaded July 5, 2000.

³² Wong et al., 1998.

³³ G. A. Varigos and D. R. Dunt, “Occupational dermatitis: An epidemiological study in the rubber and cement industries,” Contact Dermatitis, 1981, 7:105-110, as reported in Boris Lushniak, “The Public

If, as NIOSH concludes, there are 1.98 cases per 10,000 concrete workers³⁴ and an estimated 1.7 million construction workers do concrete work, then there are an estimated 337 cases reported by employers each year. (See Tables 1, 2, and 3.) If, due to underreporting, there are really 10 to 50 times as many cases, then in actuality there are 3,410 to 17,050 cases a year. Even if only half of these dermatitis cases are due to exposure to wet Portland cement, there are 1,705 to 8,525 cases of dermatitis per year, but there may be as many as 17,000. If 62 percent of those with contact dermatitis develop allergic dermatitis (Australia study), then 1,057 to 5,286 of all the workers with cement irritant contact dermatitis, each year, are expected to develop allergic dermatitis as well. If, as Nethercott suggests, 7.9 percent of exposed workers have chromate sensitivity, this puts more than 136,000 construction workers at risk of developing an allergic reaction over their working lives.

1. Lost Work Days Associated With Occupational Dermatitis

Based on the studies reported below, this report estimates that lost work days associated with an incident of occupational dermatitis range from 4 days to 15 days. Workers continue to work with many skin diseases, but when the disease becomes severe and they do lose work time, the time lost is likely to be much longer than the typical lost time episode for a construction worker generally, which is three days.

A number of studies, both national and international, estimate lost work days associated with dermatitis. Two statistics are most common – the number of days per worker per year and the average number of lost work days per lost work episode. Results range from 0.04 to 0.15 days per worker per year and from 4 to 15 days per episode. A study in the early 1970's in Britain,³⁵ found a sickness absence rate for occupational dermatoses averaged 0.001 spells per worker per year and 0.04 days per worker per year. The average number of days absent per spell due to occupational dermatoses for the period 1953-1969 was 15 days.

- A 2001 NIOSH report found that median days away from work was 33 percent higher for concrete work (4 days) than for all private industry (3 days).³⁶

Health Impact of Irritant Contact Dermatitis,” Contact Dermatitis, Volume 17, Number 3, August 1997, p. 351.

³⁴ NIOSH, “Occupational Dermatoses ...”

³⁵ M. L. Newhouse, “Sickness absence due to industrial dermatitis,” Trans St John’s Hosp Derm Soc, 58, 1972 as cited in C. L. Goh, “Sickness absence due to occupational dermatoses in a prefabrication construction industry,” Contact Dermatitis, 15, 1986, p. 30.

³⁶ NIOSH, “Occupational Dermatoses ...”

- A Dutch study in 1979 found that at least 148,000 work days were lost as a result of skin disease in the Dutch construction and building industry.³⁷
- A Singapore study calculated 12,600 annual lost workdays among 84,000 workers in 1983 as a result of occupational dermatitis in the construction industry in Singapore, but considered the number an underestimate, primarily because of the likelihood that foreign workers were excluded from the survey. Another reason was that many construction workers, especially those with relatively mild dermatoses, never sought medical attention and continued working.³⁸
- In a 1986 study³⁹ of 360 construction workers in a prefabrication construction factory, three workers had allergic contact dermatitis and required medical leave. Fifty-three days or nearly 11 work-weeks were lost in the study year in five separate leave periods. This averages to 0.01 incidents per worker per year, 0.15 days per worker per year, and 15 days per incident.
- According to The Center to Protect Workers' Rights, when concrete workers were away from work because of skin disorders, they were away a median of 13 days, rather than the median three days for construction workers generally – more than four times the median. Masonry workers, when away from work for skin disorders, were away a median of 5 days,⁴⁰ still significantly longer than the median for construction workers.

Irritant contact dermatitis without further exposure, usually resolves in four to six weeks. With further exposure the disease may not resolve and a sensitization leading to allergy may result. Allergic contact dermatitis may take years to resolve and in some cases never resolves. A worker sensitized and allergic in his twenties has forty working years negatively affected, due to a preventable skin disease. There are impacts on a worker's career, but there is also lifelong suffering from the disease.

³⁷ P. J. Coenraads, "Sickness and absence from work due to skin disease in the construction industry: review of literature," Unpublished Thesis, State University of Groningen, Netherlands, 1983: 50-84, as cited in C. L. Goh, "Sickness absence due to occupational dermatoses in a prefabrication construction industry," *Contact Dermatitis*, 15, 1986, p. 30.

³⁸ Goh, "Sickness absence ..."

³⁹ *Ibid.*, p. 28.

⁴⁰ The Center to Protect Workers' Rights, *The Construction Chart Book*, CPWR, Washington, DC, 1998, p. 41.

Studies have shown that cement induced allergic eczema is chronic even in the absence of further cement contact.⁴¹ Once sensitized, an individual usually carries the allergic potential for years, sometimes for life. The condition is usually, though not invariably, lifelong.⁴² In an Australian study,⁴³ more than half the patients who changed their occupation and rigorously attempted to avoid chromate, still continued to have symptoms. This is called persistent post-occupational dermatitis. After five years, half the Australian patients still had contact dermatitis.⁴⁴ Six to 22 months after the five years, 25 percent of patients were well again and 50 percent had improved, but 25 percent were the same or worse.⁴⁵

2. Underreporting of Dermatitis Cases

Contact dermatitis cases are underreported to agencies that collect data and are responsible for insurance or medical benefits. Underreporting is documented for the National Health Interview Survey and Workers' Compensation, and corroborated by NIOSH research.

Reports reviewed below estimate that the actual number of cases is seven to fifty times as many as those reported.

In addition, many work while sick, even though contraindicated by medical advice.

- As previously reported, BLS estimates that occupational skin disease is ten to fifty times more prevalent than what reported.⁴⁶
- According to the National Health Interview Survey of 1988, based on telephone interviews and self-reports of dermatitis, about 1.87 million workers reported rash due to occupational exposures. This indicates that the prevalence of occupational

⁴¹ J. Foussereau, C. Benezra, H. I. Maibach, and N. Hjorth, "Bricklayers," Occupational Contact Dermatitis: Clinical and Chemical Aspects, Philadelphia, Pennsylvania, W. B. Saunders Company, 1982, pp. 142-149, (abstract), <http://toxnet.nlm.nih.gov/cgi-bin/sis/search/f?./temp/~AAARfaG1K:15>, downloaded June 5, 2001.

⁴² Electronic Textbook of Dermatitis, "Contact Dermatitis - Sensitizer Type," <http://www.telemedicine.org/stamford.htm>, February 15, 2001.

⁴³ A. R. Halbert, K. A. Gebaues, and L. M. Wall, "Prognosis of occupational chromate dermatitis," Contact Dermatitis, 27, 1992, p. 219.

⁴⁴ <http://www.emedicine.com/PED/topic2569.htm>, downloaded July 19, 2000.

⁴⁵ Ibid.

⁴⁶ See discussion associated with footnote 25.

dermatitis is about 17-fold more than the incidence reported to Workers' Compensation.⁴⁷

- Another study,⁴⁸ reviewing 76 cases of occupational skin conditions, could find only 14.5 percent of them (11 cases) in Workers' Compensation records, suggesting that Workers' Compensation data may underestimate the magnitude of the problem by sevenfold.

A NIOSH researcher, writing in 1997, found the following reasons for underreporting:⁴⁹

1) Contact dermatitis is not a reportable disease; 2) Because contact dermatitis does not commonly lead to mortality or hospitalization, fewer records are available; 3) The disease is seen and treated by medical professionals in multiple specialties, thus making review of physician-based data sources inefficient; 4) The disease often goes untreated and undiagnosed; 5) The disease may be treated by a company's own occupational health personnel and not involve lost wages, thus avoiding a Workers' Compensation claim.

The number of workers with severe dermatitis is larger than what is reflected in lost work time. A Norwegian study⁵⁰ in 1970 found that of 37 workers studied, many had severe dermatitis, which, in the opinion of the dermatologist, should have kept them away from work for some weeks, but they were still working – thus posing lifelong health risks.

⁴⁷ As reported in Kaufman et. al., 1988.

⁴⁸ D. P. Discher, G. D. Kleinman, and F. J. Foster, "Pilot Study for Development of an Occupational Disease Surveillance Method," DHEW publication NIOSH 75-162, 1975 as reported in Kaufman et. al, p. 1050.

⁴⁹ Lushniak, pp. 346-347.

⁵⁰ Hovding, "Cement eczema and chromium allergy, an epidemiological investigation," Thesis, University of Bergen, Norway, 1970, as cited in C. L. Goh, "Sickness absence ..."

II. The Number at Risk: Number of Workers in the Construction Industry Exposed to Wet Portland Cement

Those at risk of dermatitis from exposure to wet Portland cement, are mostly construction workers, the sole focus of this study. (Some engaged in the manufacturing sector are also exposed.) Most frequently exposed are the half million cement masons, concrete finishers, and terrazzo workers,⁵¹ workers who specialize in cement work. Many more workers in highway, tunnel, and construction of buildings are also exposed.

According to the 1997 NAICS-based industry statistics, and its 28 U.S. industry divisions within the construction sector, three 6-digit industry divisions are assumed to have workers that are 100 percent involved in concrete work and are exposed to wet Portland cement. (See Table 1.) For the purposes of this paper, thirteen industry divisions within construction are considered to have perhaps 50 percent of its employees that do some concrete work, probably no more than half of their work time. (See Table 2.) The remaining 12 industry divisions have construction workers assumed not to be involved in concrete work. (See Table 3.)

Based on the cited tables, there are 466,267 cement workers and 1,256,250 other construction workers who are also exposed to wet Portland cement. Thus, 1,722,517 construction workers are at danger of cement burns, irritant dermatitis, and allergic dermatitis. Extrapolated to 2000 construction employment levels of 6,791,000, the numbers would be 560,000 cement workers and 1.8 million other exposed construction workers.

Those workers most exposed to wet Portland cement are:

- Cement masons who place and finish concrete
- Concrete finishers who continue after cement masons have leveled and floated the concrete
- Terrazzo workers who create attractive walkways, floors, patios, and panels by exposing marble chips and other fine aggregates on the surface of finished concrete
- Bricklayers and stone masons who work in trades closely related to cement work
- Laborers who provide much of the physically demanding labor at construction projects, tunnel and shaft excavations, hazardous waste removal projects, and demolition sites. They clean and prepare sites, dig trenches, mix and place concrete, and set braces to support the sides of excavations.

⁵¹ This information is based on Department of Labor, Bureau of Labor Statistics, Occupational Outlook Handbook, downloaded June 7, 2000 and August 14, 2000.

- Many Other Construction Workers – whether residential, commercial, heavy highway, or other – work with wet Portland cement at some time. Clearly there are more workers exposed to wet Portland cement than those who specialize in the trade. While these workers may not be exposed as often, they may face increased risk because of lower awareness of risks associated with exposure to wet Portland cement.

III. The Industry

A. Construction in General

According to the 1997 Bureau of Census, there were more than 650,000 construction establishments with payroll in the United States employing more than 5.5 million workers.⁵² (See Table 4.) More than 80 percent of these establishments had fewer than 10 employees; more than 60 percent had 4 employees or less. Approximately 30 percent of all masons and 15 percent of concrete workers are self-employed.⁵³

B. Cement

Cement is the main ingredient in concrete and concrete is the most consumed substance on earth, with the exception of water.⁵⁴ Cement is the essential binding ingredient found in virtually all forms of construction. Processed cement was discovered by Joseph Aspdin in 1824 and was called Portland cement because it resembled a gray stone mined from the island of Portland off the coast of England.

There are several types of cement besides Portland cement. These include low-alkali, high early setting, oil well, masonry, and mortar cement. There are also slag cements, blended cements, stucco cements. There are also several kinds of Portland Cement. One company, Lafarge (the largest cement manufacturing company in Canada and third largest in the U.S.), manufactures three types of Portland cement: Normal Portland Cement Type I (CSA10), High Early Strength Portland Cement Type III (CSA Type 30), and Sulfate Resistant Portland Type V (CSA Type 50).

There are several methods for measuring water-soluble chromate in cement. Probably the most commonly used is the Danish Standard method DS 1020, established in 1984. Results are usually cited in parts per million or grams per ton. Measurements in Australia, as cited on material safety data sheets there, show ranges of 0-5 ppm, less than 20 ppm, and 0-20 ppm.⁵⁵ If a job is likely to involve skin contact, in the Commonwealth of Australia, the recommendation is to not use a product with water-soluble chromate level over 20 ppm.⁵⁶

⁵² U.S. Bureau of the Census, 1997 Economic Census, "Construction Subject Series," April 2000.

⁵³ CPWR, The Construction Chart Book, pp. 20, 24.

⁵⁴ Lafarge North America, "How Cement is Made," <http://www.lafargenorthamerica.com/lafargeNA.nsf/AboutProductsLN>, downloaded March 26, 2002

⁵⁵ Commonwealth of Australia, "Cement Dermatitis," ISBN 0 644 24559 X, 1993, p. 3.

⁵⁶ *Ibid.*, p. 6.

C. Cement Work

The cement industry has two major types of establishments: those that manufacture cement and those that do cement work. Fewer workers are at risk in cement manufacturing than in construction, though much of the manufacturing risk is dry cement dust on sweaty skin which also causes burns and dermatitis.

1. Cement Manufacturers. Portland cement is a primary component of concrete, which also contains sand, gravel, and water. It is a class of hydraulic cements that are odorless gray powders containing less than 1 percent crystalline silica. It is the foundation for many products, from decorative patios and floors to huge dams and miles of roadways. In the United States, 45 companies operate 119 cement plants in 39 states.⁵⁷ Worldwide, the United States ranks third in cement production, behind China and India, with annual shipments valued at approximately \$6.6 billion. As of the end of 1999, foreign companies owned approximately 69 percent of U.S. cement capacity, up significantly from approximately 22 percent in 1980.

2. Cement Consumption. In 1999, U.S. Portland cement consumption reached 105 million metric tons, up from an all-time record of 99 million metric tons in 1998. Cement consumption in 1999 was the sixth consecutive year of record volume and record growth.⁵⁸

Cement consumption is spurred by strong performance in the construction industry as a whole; however, cement is somewhat protected from extreme cycles because it is used in nearly every type of construction. Individual sector growth, such as highway construction, affects cement consumption more heavily.

3. Establishments Doing Cement Work. Approximately 60,000 companies specialized in cement work in 1997.⁵⁹

Masonry and Stone Contractors (235410):	22,614	establishments
Concrete Contractors (235710):	30,417	establishments
Tile, Marble, Terrazzo, and Mosaic Contractors (235430):	6,847	establishments
	Total	59,878 establishments ⁶⁰

⁵⁷ Portland Cement Association, "Cement Industry: Industry Overview," http://www.portcement.org/cem/cementindustry_industryover.asp, downloaded May 24, 2001.

⁵⁸ Ibid.

⁵⁹ U.S. Bureau of the Census, 1997 Economic Census, "Bridge Between NAICS and SIC, Core Business Statistics Series," 1997, pp. 10-11.

⁶⁰ Table 4, using somewhat different categories, suggests 54,155 establishments.

With an estimated 466,267 cement workers in 1997, the average establishment in this sub sector has fewer than eight workers.

4. Cement Workers. Most cement masons and concrete finishers work for concrete contractors or general contractors on highway, bridge, shopping mall, factory, school, or hospital projects. Some work for special trade contractors and some are self-employed. Masons and concrete workers are less than 3 percent of total construction employment. Of these workers, 19 percent of concrete workers and 24 percent of masons are organized into trade unions.⁶¹

Apart from being used in the occupational setting, Portland cement is also used by do-it-yourself homeowners or very small contractors (self-employed or two to three workers), for jobs that do not require extensive work. These individuals may be at increased risk of developing dermatitis because of lack of information on how to protect themselves from the hazards posed by wet Portland cement. Masons and concrete workers who do cement-related jobs at home may also be exposed to hexavalent chromium and other allergens and then be exposed again at their regular jobs. All exposures to wet Portland cement increase the risk of irritant dermatitis becoming a lifelong allergy.

D. Earnings of Cement Workers

According to the Bureau of Labor Statistics, average hourly earnings for all construction were \$17.86 in 2000 (up from \$16.61 in 1998). Union workers tend to have higher average hourly earnings. Including benefits, in 1998, average hourly earnings for union cement masons ranged between \$15.40 and \$46.80. Cement masons often work overtime, with premium pay, because once concrete is placed, the job must be completed. For masonry workers, average hourly earnings in 1999 were \$17.18,⁶² or just below the 2000 mean for construction work generally, at \$17.76. For concrete work the mean was lower, \$15.42 in 1999, or \$15.94 in 2000 dollars.

Hourly earnings in 2000 in the industry categories employing the largest numbers of workers exposed to wet Portland cement were:⁶³

Highway and street construction	\$17.64
Heavy construction, except highway	\$16.98
Nonresidential building construction	\$18.59
Special trade contractors	\$18.25

⁶¹ CPWR, The Construction Chart Book, pp. 13-14.

⁶² <http://stats.bls.gov/oes/1999/oesrci.htm>, downloaded July 25, 2001. Not all series of numbers are available for every year. Hence the need to draw from data 1997-2000.

⁶³ Bureau of Labor Statistics, <http://146.142.4.24/servlet/SurveyOutputServlet?jrunsessionid=995315925086308153>, downloaded July 16, 2001.

Construction workers have an average work week of 40.5 hours.⁶⁴

Most masons lack health and pension benefits. Construction employees are less likely to have health insurance (72 percent) than other U.S. workers (84 percent) and masons are less likely to have employer- or union-sponsored health insurance than other construction workers -- 33 percent vs. 45 percent. Only 25 percent of masons have employer- or union-sponsored pension plans.⁶⁵

E. Age of Cement Workers

Cement workers, masons, and concrete workers are, on average, 38 years old compared to 37 for construction workers generally. They retire, on average, at age 58. Organized workers are, on average, slightly older than unorganized workers. The average age of retirement for production construction workers is 58 compare to 56 for the entire work force.⁶⁶

⁶⁴ CPWR, The Construction Chart Book, p. 25. (Not all data are available for 2000.)

⁶⁵ Ibid., pp. 26, 27.

⁶⁶ Ibid. pp. 15, 19.

IV. Treatment of Dermatitis

In order to initiate correct treatment for occupational dermatitis, there must first be a correct diagnosis; in this case, that the dermatitis results from exposure to wet Portland cement. This may be determined quickly, or it may take multiple visits to a physician. The accuracy of the diagnosis depends upon the experience, knowledge, and skill level of the physician making the diagnosis.⁶⁷ A first visit to a physician may be to a general practitioner or dermatologist, or maybe an allergist.

A. Irritant Contact Dermatitis

Irritant contact dermatitis can be acute or chronic. Workers with irritant dermatitis experience burning, pain, itching, blisters, dead skin, scabs, scaling, fissures, redness, swelling, and bumps that may be either dry or with watery discharge. These symptoms usually emerge at exposure sites. Once diagnosed, contact dermatitis is fairly straightforward to treat, especially if repeated and continued exposure can be avoided. But, irritant dermatitis can also cause cell damage, which takes months or even years to fully repair. In addition, secondary bacterial infections are common in the acute stages of contact dermatitis. Scars may form from deep chemical burns or significant secondary infection. Most contact dermatitis will resolve without intervention in four to six weeks, if there is no further exposure. If a worker does not know the reason for the dermatitis though, exposure is likely to continue.

After diagnosis, treatment of irritant contact dermatitis may involve some or all of the following: skin lubrication, antibiotics for infection, astringent soaks, topical or systemic corticosteroids, antihistamines, and UV.⁶⁸

B. Allergic Contact Dermatitis

Continued exposure to cement may cause allergic dermatitis. The first and most important therapy for allergic contact dermatitis is avoiding exposure to wet Portland cement. Recognizing the cause of the allergic reactions is critical to providing effective treatment of the disease. Allergic dermatitis only affects people who have been previously sensitized. Sensitivity to hexavalent chromium, and consequently allergic contact dermatitis, may develop slowly in workers using Portland cement, even after several years of exposure to soluble chromium in cement. In fact, workers can develop allergic contact dermatitis as long as five years after exposure to Portland cement has ended.⁶⁹

⁶⁷ T. L. Diepgen and P. J. Conrads, "The Epidemiology of Occupational Contact Dermatitis," in Kanerva et al., Chapter 1, p. 4.

⁶⁸ Operative Plasterers and Cement Masons International Association, "Physicians Alert: Occupational Contact Dermatitis," 1996.

⁶⁹ FOF, "Health and Safety Practitioner's Guide ..."

Typical symptoms of allergic dermatitis include many of the symptoms of irritant contact dermatitis, such as stinging, burning, pain, itching, blisters, dead skin, scabs, scaling, fissures, redness, swelling, and bumps. These symptoms are usually concentrated where exposure occur, but also may occur on other body parts. Early diagnosis is important, because, once diagnosed, the conditions of many patients will improve with adequate hygiene and avoidance of the allergen. Systemic steroids are the mainstay of therapy in episodes of severe, extensive allergic contact dermatitis.

An important diagnostic tool for determining the existence and character of allergic contact dermatitis is patch testing. Patch testing may suggest or confirm the agent causing the allergic contact dermatitis.

C. Change in Jobs

When an individual develops allergic contact dermatitis from wet Portland cement, the prognosis is often bad.⁷⁰ Key to recovery is early diagnosis, often with a change of job and avoidance of further exposure. Occupational dermatitis can be persistent and devastating to workers, leaving them not only at risk of losing time at work, but also interfering with social activities. After years of apprenticeship and job experience, a victim of allergic dermatitis may be forced to make career changes.

The benefits of job change, however, are proven in Switzerland, where the Swiss Law on Accidents Insurance, in severe cases, issues a declaration of medical inability allowing workers to receive retraining. Construction workers with contact dermatitis, if they change their work completely and early enough, have a better prognosis. Seventy-six percent of Swiss construction workers with occupational dermatitis who changed job healed or improved, versus 16 percent among those who did not leave their job. This led Swiss researchers to conclude that strict allergen avoidance enforced by authorities, and financial support in the case of job change, are important factors in improving the prognosis in occupational dichromate dermatitis.⁷¹ Nonetheless, chronic cement dermatitis can become chronic and continue even with change of work, requiring disability payments.⁷²

⁷⁰ R. Lips, H. Rast, and P. Elsner, "Outcome of job change in patients with occupational chromate dermatitis," Contact Dermatitis, 1996, 34, pp. 268-271.

⁷¹ Ibid., p. 268.

⁷² Hjorth, Lars, "The occurrence and prevention of cement eczema," World Cement September 1995.

V. Health and Safety Activities to Reduce Exposure to Wet Portland Cement

The two major health and safety activities for reducing incidence of the disease are (1) building awareness of workers and employers about the hazard and (2) reducing or eliminating exposure. The research on this NIOSH-supported project focuses on hand protection. Although it is skin on the hands that primarily comes in contact with wet Portland cement, other body parts such as forearms, elbows, face, feet, and knees may also be exposed. The primary antidote to exposure is frequent washing, especially with pH neutralizing soap. This paper focuses on the benefits and low cost of frequent hand washing, compared to the potentially high costs associated with cement burns and contact dermatitis.

A. Hazard Awareness

Awareness of the risk of wet Portland cement is a key step in prevention. All bagged cement should be labeled with information about irritant and allergic contact dermatitis. Material Safety Data Sheets (MSDSs) should fully inform workers of the risks, prevention, and first aid. (See section on MSDSs.) Workers should be aware of the “best practices” for working with Portland cement: instructions on frequent hand-washing, using gloves and the correct way to use them, and thorough body washing and changing out of work clothes before going home as well as laundering clothes separately. Workers should know to seek medical advice immediately if signs and symptoms of dermatitis develop.

B. Hand Protection

The OSHA Sanitation Standard, 1926.51, subpart D, requires facilities for hand washing on construction sites. Therefore, for sites in compliance with Federal regulation, frequent hand washing should be easy.

1. The Importance of Hand Washing Facilities at Construction Sites. Hand washing is the most important prevention against cement-induced dermatitis. After preventing exposure, the first and foremost protection is frequent and vigorous hand washing with, if possible, a pH neutralizing agent or buffering solution. Construction sites are required to have running water, hand soap, and either toweling or warm air blowers, as per OSHA’s 1926.51, Subpart D, which also requires toilets with water on all sites. The regulation states that, “each lavatory shall be provided with hot and cold water, or tepid running water. Hand soap or similar cleansing agents shall be provided. Individual hand towels or sections thereof, of cloth or paper, warm air blowers or clean individual sections of continuous cloth toweling, convenient to the lavatories, shall be provided.” The exception, in Subpart C4, is that the requirements do not apply to mobile crews that have transportation readily available to nearby toilet facilities.

Awareness is crucial because, without awareness of the risks, some workers might use rinse buckets for construction tools. The rinse water is often contaminated with cement residue from tools, and is exactly the opposite of what a worker needs for prevention.

In addition, according to the U.S. Centers for Disease Control, “Hand washing is the single most important means of preventing the spread of infection.”⁷³

2. pH Normalization. pH is a measure of the acidity or alkalinity of a substance. The pH scale ranges from a pH of 0 on the acidic end to a pH of 14 on the alkaline end. The pH of normal skin ranges from 4.5 to 5.5, which is moderately acidic. Wet cement has an extremely alkaline pH value of 12 to 13, which makes it caustic to skin, eyes, and mucous membranes.⁷⁴

Acids and alkalis react with one another to produce water and a salt, resulting in a solution that is more pH neutral.⁷⁵ To neutralize the alkaline cement residue on the hands and body of a cement worker, it is important to use clean running water in combination with vinegar, pH neutral soaps, or buffering solutions.

- a. Vinegar. Vinegar is a home remedy used by some cement workers because its acidic pH neutralizes skin from the alkaline exposure of wet cement. Adding vinegar to cement water can drop the pH from 12 to 8. But it also generates heat.⁷⁶ A vinegar soaked washcloth may be used to wipe hands.
- b. pH Neutral Soaps. pH neutral soaps neutralize the alkalinity of cement.⁷⁷ Only pH neutral soaps that have a pH of 7 or lower should be used for washing hands. Using a pH neutral soap is better than using worksite cleaners for washing hands because such cleaners are often caustic and abrasive and may contain sensitizers, such as lanolin, limonene, or perfume, or irritants like alcohol.⁷⁸ In fact, for cement workers, the best soaps may be acidic, with a pH of 5 or 6, which is closer to the pH of normal skin (4.5).
- c. Buffering Solutions. An alternative to pH neutral soaps is use of a buffering solution. Buffering solutions are used to maintain a constant pH when combined with acids or alkalies because a buffer can neutralize both acids and alkalies. For Portland cement workers, use of a buffering solution restores the acidic pH of skin exposed to wet

⁷³ New Jersey Department of Health and Senior Services, “Fact Sheet ...”

⁷⁴ FOF, “Safety and Health Practitioner’s Guide ...,” p. 13.

⁷⁵ Ibid., p. 14.

⁷⁶ FOF Communications, “Save Your Skin: A 15-Minute Tool Box Session,” Washington DC, undated.

⁷⁷ Ibid.

⁷⁸ FOF, “An Employer’s Guide to Skin Protection.”

cement, thereby permitting barrier repair and preventing skin problems. In addition, a buffering solution may convert hexavalent chromium to trivalent chromium, reducing the risk of developing allergic contact dermatitis.⁷⁹ (See Appendix 3 for descriptions of two types of commercial buffering solutions used by cement workers, Neutralite Safety Solution and Masons Hand Rinse.)

3. Barrier Creams. The use of barrier creams to protect against cement dermatitis is controversial. Most recent safety information recommends avoiding barrier creams because the abrasiveness of cement breaks the seal provided by barrier cream, rendering it ineffective. Also, reapplying barrier cream in the work area can seal cement against the skin, causing greater harm than good.⁸⁰ Some studies have found that irritant cement dermatitis is not influenced by the use of barrier creams.⁸¹

Newer protective lotions and barrier creams may be effective against skin irritants and are being tested against known allergens.⁸² However, to date, testing of these barrier creams is in laboratories and not at actual workplace sites.⁸³ Relying on barrier creams can lead to a false sense of security,⁸⁴ but others argue that, when used the right way, protective lotions and creams can be effective in preventive skin care.⁸⁵

4. Gloves. The effectiveness of gloves in protecting cement workers from contact dermatitis is also controversial. Some studies indicate that the sweating of hands in gloves may actually encourage the onset of dermatitis. Gloves, without proper hand washing, are a risk because unless hands are very clean when gloves are worn, trace amounts of cement have been found to lead to elevated pH inside the workers' gloves. Impervious latex or rubber gloves are recommended by some, in lieu of fabric or leather gloves, because fabric and leather may become saturated with wet cement. Some recommend that gloves and barrier creams be used together.

If gloves are worn, glove liners of thin cotton may increase the comfort level, because they absorb moisture and keep hands clean and dry. But they must not become contaminated by cement. Disposable gloves might make it easier to keep hands clean

⁷⁹ FOF, "Safety and Health Practitioner's Guide ...," p. 14.

⁸⁰ Ibid.

⁸¹ C. Avnstorp, 1991, p. 87 and C. L. Goh and S. L. Gan, "The Effect of Barrier Cream and 'After-Work' Emollient Cream on Occupational Dermatitis From Cutting Oil," Abstract. 9th International Symposium on Contact Dermatitis, Stockholm, Sweden, 1985.

⁸² James L. Nash, "Skin Care: Starting from Scratch," Occupational Hazards, April 2000.

⁸³ Boris D. Lushnaik, NIOSH, as cited in James L. Nash, "Skin Care: Starting from Scratch," Occupational Hazards, April 2000.

⁸⁴ Jeff Stull, Kimberly-Clark's Skin Wellness Institute, as cited in James L. Nash, "Skin Care ..."

⁸⁵ Eleanor Fendler, GoJo Industries, Inc., as cited in James L. Nash, "Skin Care ..."

and they can be less expensive than reusable gloves. The disadvantage of disposable gloves, however, is that workers sometimes wear them too long.⁸⁶

PVC gloves are recommended, if gloves must be used, but it is often difficult to find gloves that both provide complete protection and do not hinder work practices. Leather gloves should not be used, because they contain chromium which can be converted to chromate, and also they may become saturated during work processes. Natural rubber gloves should also be avoided, because of the allergic reactions that some people have to the chemicals in the rubber. When gloves are used it is best if they are elbow length.⁸⁷

If workers do not wash their hands with clean water and pH-neutral soap, using gloves does not offer protection. To be effective, use of gloves must be combined with hand washing. Also, gloves should fit well, be cleaned daily, discarded when worn out or extremely contaminated, and be made of the correct material for use against wet cement.⁸⁸

5. Nitrile Soaked Gloves. German trade associations of the construction industry and representatives of the German state industrial safety authorities have been studying ways to increase the acceptance of nitrile-soaked cotton gloves on building sites.⁸⁹ A discussion group comprised of 21 institutions associated with use of cement in construction, in late 1998 further concluded that for the predominantly machine-processing of products containing cement, “wearing nitrile-soaked cotton gloves stands in the fore as a measure to protect workers.”⁹⁰

6. Applying Sulphites to the Skin. Research results appearing in Contact Dermatitis, in 1982, found that “sulphites such as sodium pyrosulphite and sodium dithionite applied topically to the skin of cement workers, appear to be effective in the prevention of dermatitis.”⁹¹

C. Personal Protective Clothing and Equipment

Personal protective clothing and equipment can limit exposure to wet Portland cement. According to NIOSH and OSHA, employers should require workers exposed to wet Portland cement to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent repeated or prolonged skin

⁸⁶ FOF, “A Safety and Health Practitioner’s Guide ...”

⁸⁷ Commonwealth of Australia, “Cement Dermatitis,” ISBN 0 644 24559 X, 1993, p. 9.

⁸⁸ FOF, “An Employer’s Guide to Skin Protection.”

⁸⁹ Deutsche Bauchemie, “Trade Ruling ‘Low-Chromate cements and Products,’” http://www.deutsche-bauchemie.de/8branche/83_chrom-engl.htm, downloaded April 29, 2002.

⁹⁰ Ibid.

⁹¹ L. M. Wall, “Chromate dermatitis and sodium dithionite, abstract” Contact Dermatitis, 1982.

contact with solids or liquids containing insoluble chromium salts. Employers, according to these two government agencies, should also require their employees to use dust proof and splashproof safety goggles, where solids or liquids containing insoluble chromium salts may contact the eyes.⁹²

Protective equipment and clothing are not enough. When a worker is exposed, contaminated clothing must be removed and the contacted areas rinsed with large quantities of water. Irrigation should be vigorous and then treated as a thermal burn.

D. First Aid

Workers must know that first aid treatment needs to be immediate, because significant tissue damage can occur before the individual feels discomfort. Alkali burns need to be rinsed with large quantities of water and a pH neutral soap. Alkalis cause tissue destruction by dissolving keratin. Deep chemical burns may require hospitalization. A worker whose skin comes into contact with wet cement should wash immediately and seek medical attention. Such quick attention can limit skin damage. Regardless of skin contact, workers should wash frequently, especially at the end of a work day. It is also important for workers to know that they should not rinse their hands in the rinse water for tools, as this water contains residue of wet cement and will damage skin rather than prevent damage.

E. Making Wet Portland Cement Itself Less Hazardous

Adding ferrous sulfate to cement reduces its hexavalent chromium. In 1979, Danish scientists suggested that reducing hexavalent water-soluble chromium to trivalent insoluble chromium by adding ferrous sulphate during production would prevent chromium-induced dermatitis.⁹³ In fact, Denmark passed legislation requiring the use of cement with lower levels of hexavalent chromium in 1983. Finland followed in 1987 and Sweden and Germany adopted administrative decisions in 1989 and 1993, respectively. The accepted level of water-soluble chromium in cement was determined to be less than 2 mg/kg for the four countries.

The Finnish Institute of Occupational Health monitored the incidence of occupational dermatitis through the Finnish Register of Occupational Diseases from 1978 through 1992. The monitoring results indicated that chromium-induced hand dermatitis practically disappeared among construction workers, whereas the incidence of toxic contact dermatitis remained unchanged during the study period.⁹⁴

⁹² F. W. Mackison, R. S. Stricoff, and L. J. Partridge, Jr., eds., NIOSH/OSHA - Occupational Health Guidelines for Chemical Hazards, DHHS (NIOSH) Publication No. 81-123 (3 volumes), Government Printing Office, January 1981, as cited at <http://toxnet.nlm.nih.gov/cgi-bin/sis/search/f?./temp/~AAAQaOKU:1:FULL>, downloaded July 20, 2000.

⁹³ Fregert, Gruvberger, and Sandahl, 1979, as cited in Pekka Roto, "Case Studies ..."

⁹⁴ Roto et al., 1996, as cited in Pekka Roto, "Case Studies ..."

In Denmark, chromate sensitization from cement was detected in only one case among 4,511 patch tests conducted between 1989 and 1994 among patients of a large dermatological clinic, 34 of whom were construction workers. The expected number of chromate-positive construction workers was ten times or more of that amount, or 10 of 34 subjects.⁹⁵ Increasing evidence indicates that the addition of ferrous sulfate to cement may prevent chromate sensitization among construction workers, without causing any negative effects on the health of exposed workers. According to some, the process is economically feasible, and the properties of the cement do not change. It has been calculated that adding ferrous sulfate to cement increases the production costs by US\$1.00 per ton. The reductive effect of ferrous sulfate lasts 6 months; the product must be kept dry before mixing because humidity neutralizes the effect of the ferrous sulfate.⁹⁶ Because the addition of ferrous sulfate to cement does not change its alkalinity, workers should continue to use proper skin protection when working with wet cement. Some U.S. manufacturers argue that adding ferrous sulfate alters properties of the cement.

Substitution of slag for clinker would also help workers and may be more economical than using ferrous sulfate. Over the last decade, clinker, a major constituent of cement, which contains hexavalent chromium, has become scarce and more expensive. Cement manufacturers have found substitutes for clinker, including slag, which is free of hexavalent chromium. Slag from iron blast furnace processing is a relatively cheap by-product of iron ore processing. Substituting slag for clinker results in dilution of hexavalent chromate in cement.⁹⁷ Slag has been used in the U.S. and Canada since the 1980's.⁹⁸

F. Awareness of Risk by Cement Manufacturers

Not all cement manufacturers seem to recognize the risks associated with wet Portland cement. This lack of awareness not only poses potential liability to the manufacturers, but increases risks to workers if they are not adequately informed or trained or provided with adequate prevention. According to an official of the National Ready Mixed Concrete Association, "Too many producers show little interest in cement-burn prevention because they've never encountered the problem."⁹⁹ A survey, specifically for this report, of approximately 30 of the 70 plus cement manufacturing corporations,¹⁰⁰

⁹⁵ Zachariae, Agner, and Menn, 1996, as cited in Pekka Roto, "Case Studies ..."

⁹⁶ Pekka Roto, "Case Studies..."

⁹⁷ C. L. Goh and S. L. Gan, Ministry of Labour, Singapore, "Change in cement in manufacturing process, a cause for decline in chromate allergy" Contact Dermatitis, 1996, p. 51.

⁹⁸ *Ibid.*, p. 53.

⁹⁹ Jon Mullarky, "How to Save Your Customer's Skin," The Concrete Producer, October 1997.

found few with knowledge or willingness to discuss the problem. The most common answer about what to do was to “get rubber gloves,” a solution that could exacerbate the problem for some workers.¹⁰¹ None of those interviewed seemed to know anything about ferrous sulfate. Some did send relevant Material Safety Data Sheets (MSDSs) following this telephone survey. A similar survey of key trade associations also found many of those interviewed providing a rubber or latex glove solution.¹⁰² A health and safety professional at the Associated General Contractors of America, when specifically asked about the role of hand washing in preventing burns and dermatitis, had nothing to say about it.

G. Improving the MSDS for Portland Cement Products

Approximately 30 telephone requests, to cement manufacturers for health and safety information related to exposure to wet Portland cement, yielded Material Safety Data Sheets (MSDSs) from 17 of them – six by fax and eleven from company web sites. Most were similar; some identical. Some provided contradictory information.

All eleven that were obtained from company web pages originated from Cornell. About skin risks, these MSDSs said only that Portland cement was a potential health hazard, with skin as a route of entry and that workers should protect their skin with protective clothing, boots, and impervious gloves. Advice for work hygiene practices? “After work is completed, worker should shower with soap and water.”

Other MSDSs included significantly more information than the eleven that are based on the Cornell database. Given this information, there is some question about whether those previous eleven have fully adequate warnings or first aid information for workers. One much more comprehensive MSDS from a Pennsylvania company provided the following much more complete detail of information:

- Emergency Overview: “...exposure of sufficient duration to wet Portland cement can cause serious, potentially irreversible tissue destruction in the form of chemical burns, including third degree burns.”
- Effects Resulting From Skin Contact: “Discomfort or pain cannot be relied upon to alert a person to hazardous skin exposure. Consequently, the only effective means of avoiding skin injury or illness involves minimizing skin contact.. Exposed persons may not feel discomfort until hours after the exposure has ended and significant injury has occurred.... Some individuals may exhibit an allergic response upon exposure to Portland cement, possibly due to trace amounts of chromium. The response may appear in a variety of forms ranging from a mild rash to severe skin

¹⁰⁰ There are 290 listings in the dot.com directory for manufacturers of Portland cement but many are separate facilities of the same establishment.

¹⁰¹ Telephone Survey of Manufacturers, Ruth Ruttenberg & Associates, Inc., 2000.

¹⁰² Telephone Survey of Trade Associations, Ruth Ruttenberg & Associates, Inc., 2000.

ulcers. Persons already sensitized may react to their first contact with the product. Other persons may first experience this effect after years of contact with Portland cement products.”

- First Aid: “Wash skin with cool water and pH-neutral soap or a mild detergent intended for use on skin. Seek medical treatment in all cases of prolonged exposure to wet cement, cement mixtures, liquids from fresh cement products, or prolonged wet skin exposure to dry cement.”
- Exposure Controls/Personal Protection: “Prevention is essential to avoid potentially severe skin injury. Avoid contact with unhardened (wet) Portland cement products. If contact occurs, promptly wash affected area with soap and water. Where prolonged exposure to unhardened Portland cement products might occur, wear impervious clothing and gloves to eliminate skin contact. Where required, wear boots that are impervious to water to eliminate foot and ankle exposure.”

“Do not rely on barrier creams; barrier creams should not be used in place of gloves.”

“Periodically wash areas contacted by dry Portland cement or by wet cement or concrete fluids with a pH neutral soap. Wash again at the end of the work. If irritation occurs, immediately wash the affected area and seek treatment. If clothing becomes saturated with wet concrete, it should be removed and replaced with clean dry clothes.”

- Personal Protection: “Prevention is essential to avoid potentially severe skin injury... If contact occurs, promptly wash affected area with soap and water. Where prolonged exposure to unhardened Portland cement products might occur, wear impervious clothing and gloves to eliminate skin contact. Where required, wear boots that are impervious to water to eliminate foot and ankle exposure...Do not rely on barrier creams... Periodically was areas contacted... with a pH neutral soap. Wash again at the end of the work. If irritation occurs, immediately wash the affected area and seek treatment. If clothing becomes saturated with wet concrete, it should be removed and replaced with clean dry clothing.”

1. More Complete MSDS Information From Other Sources

While the Pennsylvania MSDS cited above seems to be the most thorough, other cement companies supplied MSDSs with significantly more information than the original eleven. A Texas company supplied an MSDS that explains what could be critical information to a worker:

“Discomfort or pain cannot be relied upon to alert a person to a hazardous skin exposure... Exposed persons may not feel discomfort until hours after the exposure has ended and significant injury has occurred.”

Another MSDS warns:

“Direct contact with wet cement may cause extensive skin burns with dermal necrosis within 12 to 48 hours (after one to six-hour exposure) ... possible first, second, or third degree burns may occur.”

Another MSDS urges first aid and medical treatment “in all cases of prolonged exposure to wet cement, cement mixtures, liquids from fresh cement products, or prolonged wet skin exposure to dry cement.” Workers who follow this advice are likely to have less extensive illness and less expense associated with the illness.

Another MSDS warning that can help reduce the severity of dermatitis illnesses is on prevention and immediate response:

“Wear impervious abrasion- and alkali-resistant gloves, boots, long-sleeved shirt, long pants or other protective clothing to prevent skin contact. Promptly remove clothing dusty with dry Portland cement or clothing dampened with moisture mixed with Portland cement, and launder before re-use. If contact occurs, wash areas contacted by material with pH neutral soap and water.”

Such a warning is far more likely to encourage prevention behavior among workers than “wear gloves.”

2. Prevention. Some MSDSs, in contrast to suggesting barrier creams, say “Do not rely on barrier creams.”

3. Potential Severity of the Illness. One important difference in MSDSs is the warning that some give about the potential seriousness of the illness. “Severe skin damage in the form of chemical (caustic) burns” is a warning that provides significantly more awareness to hazards than “may cause irritation or allergic reaction.” If one is not aware of the dangers and risk of severe illness, one is unlikely to take adequate precautions. It is important for workers to have Material Safety Data Sheets. But, it is also important that the Material Safety Data Sheets be accurate and complete. If workers are simply told to use gloves or barrier creams and if they are not told that there can be serious skin damage before they feel pain, the number of cases, and severity of those cases is likely to be greater than it would be with adequate information.

VI. Economic Impact of Contact Dermatitis

One case of irritant or allergic dermatitis can be devastating to the life of a cement worker. It may even threaten the means to earn a living and support a family. As described in the pages that follow, the net financial loss to a worker can also be staggering. As calculated below through a variety of possible illness scenarios, individual costs, once an illness requires medical attention, in a year, is likely to range anywhere from \$110 to \$43,000 – in a combination of medical costs, other out-of-pocket expenses, and foregone wages. (See Table 5.) The cost to government and Workers' Compensation systems are estimated to be anywhere from no cost at all to \$37,000 per case per year. These costs include, where applicable, Workers' Compensation medical payments, Workers' Compensation cash payments, Temporary Assistance to Needy Families (TANF) payments, Unemployment Insurance, Food Stamps, and job retraining.

For a year, if the number of cement-related dermatitis cases is 1,700 to 8,500, then the total burden to affected workers is likely to be \$73 to \$366 million, with a cost to government and Workers' Compensation systems of \$63 million to \$315 million. If a worker became permanently disabled and qualified for Social Security's Supplemental Security Income Program, the cost to the government would be \$14,000 to \$28,000 per year. If the affected worker, as could well be the case, had another 35 years of gainful employment without disability, beyond the human costs, the Social Security system would be paying out between \$490,000 and \$980,000 for just one individual.

Not included in the cost estimates are those associated with severe cement burns. These cases, as described in law suits, when severe can cost tens of thousands of dollars, even more. But data to estimate the number of such burn cases, due to wet Portland cement, are not available.

The economic impact of a disease includes direct and indirect costs, to a broad range of groups – workers, employers, insurers, and the government. While not included here, cement manufacturers may have liability costs. Direct costs include costs of medical care, Workers' Compensation, and disability payments. Indirect costs include costs associated with lost workdays and lost productivity.¹⁰³

Costs to workers associated with contact dermatitis are not only the medical treatment costs, but also loss of time from work, need for retraining to avoid exposure to wet cement, and a range of out-of-pocket costs. (See Table 6.) Some workers may need to leave their trade altogether. Some, with severe symptoms, may suffer chronic unemployment. The remainder of this paper identifies these costs as well as the costs of prevention – and compares the two, finding that, by far, prevention is cheaper.

¹⁰³ NIOSH, "Occupational Dermatoses..."

A. Cost Estimates From a Washington State Study and a BLS Study

Of all occupational illnesses reported to Workers' Compensation, by far the largest number are occupational skin disorders. A study in Washington State in 1998 describes claimant benefits as wage replacement when they lose more than three days of work as well as medical benefits, whether or not there was time lost. A review of the Washington State system, 1989-1993, found 7445 claims for occupational skin disorders, representing 7058 individuals.¹⁰⁴ Medical benefits only were provided for 5020 (88.1 percent) of the 5695 accepted claims. Total medical bills, including pharmacy benefits, were \$1.22 million, with a median claim payment of \$97 and an average claim payment of \$243. Time loss payments were \$1.23 million. The 652 time loss claims accounted for 38,623 days of lost time. The average time loss payment was \$1881 for 59 lost days; the median amount of lost time for these claims was 11 days. Five occupational categories accounted for nearly 40 percent of these claims, one of them being special trade construction contractors. Special trade construction contractors accounted for just over 6 percent of the accepted occupational skin disorder claims that could be classified by occupation (343 of 5657).

An analysis of BLS data from 1984¹⁰⁵ estimated annual medical costs of over \$4.7 million, or \$7.8 million in 2000 dollars. This is \$67 per case, or \$111 in 2000 dollars. Workers' Compensation claim awards of \$10.4 million in 2000 dollars. This is \$2,635 per case in 2000 dollars. The estimated annual indirect cost of lost productivity due to occupational skin diseases in 1984 was estimated to be \$11 million, or \$18 million in 2000 dollars. This is \$1,160 per case in 2000 dollars. Thus, in 1984 the estimated annual direct and indirect costs associated with occupational dermatitis exceeded \$36 million (in 2000 dollars). But considering that the actual annual incidence figures may be 10 to 50 times greater than reported in the BLS data, the total annual cost of occupational skin diseases may range from \$368 million to \$1.7 billion¹⁰⁶ in 2000 dollars. These estimates do not include costs of occupational retraining, costs attributable to the effects on quality of life, third party reimbursements from the government; e.g., Unemployment Insurance, Medicaid, food stamps, TANF payments, or Social Security's Supplemental Security Income program. With only half of all cases resolved in five years, workers will continue to incur medical costs. If there are 1,700 to 8,500 cases of dermatitis due to exposure to wet Portland cement, this would suggest costs associated with just this portion of occupational dermatoses to be:

Annual Medical Costs	\$ 188,700	to	\$ 943,000
Indirect Costs and Lost Productivity	<u>\$ 1,972,000</u>	to	<u>\$ 9,860,000</u>
Estimated Total Cost	\$ 2,160,700	to	\$10,803,000

¹⁰⁴ Joel Kaufman et al., p. 1048.

¹⁰⁵ C. Mathias, "The cost of occupational skin disease," Arch Dermatol, 121:332-334, 1985 as cited in Lushniak, p. 353.

¹⁰⁶ Ibid.

B. Background to a More Comprehensive Way to Estimate Costs Associated With Cement-Related Skin Diseases

There are hundreds of thousands of reported cases of occupational skin diseases each year, with 3.8 percent in construction.¹⁰⁷ As related earlier, an estimated 1,700 to 8,500 are due to cement exposure, maybe twice as many.

Costs associated with cement-related skin diseases clearly vary by the duration and seriousness of a case. To describe the range of skin problems, their seriousness, and their associated costs, six scenarios (synthesized from a number of actual cases and circumstances) are presented in this section, along with estimated medical costs for each of them, as they would be in six states across the country. Other personal costs as well as costs to the government, insurers, and employers are also discussed.

C. Medical Costs Associated With Provision of Medical Services for Treatment and Diagnosis (excluding medication) of Cement-Related Dermatitis Based on Six Scenarios Developed

In order to best estimate the range of medical costs associated with dermatitis, this paper identifies a range of illness and treatments, and estimates the costs of treatment at a range of locations across the country.¹⁰⁸ Six scenarios outline possible sequential events leading to development of irritant or contact dermatitis in workers exposed to wet Portland cement at work. Cement masons, bricklayers, cement floorers, laborers, and highway construction workers are most often exposed to wet cement, and workers from these trades are in the scenarios. The scenarios acknowledge that different workers exposed to wet cement will exhibit differences in the severity and type of dermatitis they develop due to variations in individual susceptibilities, duration of exposure, use of PPE, and the stage at which successful medical diagnosis of their condition and the appropriate medical intervention occurs. The scenarios range from immediate diagnosis with a single doctor visit and reasonably quick resolution of the problem to delayed diagnosis leading, to a severe disease and the need to leave the trade, to cement burns and chromate sensitivity. Clearly not all cases of dermatitis have associated medical costs. Some cases, especially of cement burns, with significant hospitalizations and surgeries would cost far more than the scenarios described below.

¹⁰⁷ Ibid.

¹⁰⁸ Based on the variations in total health insurance premiums for single and family coverage in different states, we chose zip codes in six cities – Foley, AL; Brookline, MA; Los Angeles, CA; Stilwell, OK; Seattle, WA; and Milwaukee, WI – to estimate a broad range of dermatitis-related medical costs.

To determine medical costs associated with cement dermatitis, the Current Procedural Technology (CPT) 2001,¹⁰⁹ Standard Edition, was used to identify codes used in the medical insurance industry for services and procedures associated with diagnosis and treatment of dermatitis. Medical utilization software was used to identify the 75th percentile of cost (most commonly used by insurance companies) for the appropriate medical treatment and service codes in the range of six cities selected. For the exact same services, medical costs in one city can be double or even quadruple the costs in another city. (See Table 7.)

A worker with unresolved dermatitis may be unable to continue work, and may need to depend on Workers' Compensation, unemployment benefits, TANF, or Social Security's Supplemental Security Income program, to fulfill personal and family financial needs. The worker may be on total disability if the dermatitis is severe and the individual is unable to acquire skills to change trades in order to avoid cement exposure. These and other non-medical costs are explored later in this paper.

Health care costs, without medicine, or third party benefits such as unemployment insurance, Workers' Compensation, Medicaid, or welfare range; in these scenarios, from less than \$100 to more than \$4,200 per worker. Non-medical costs are discussed in subpart D below.

- **Scenario I: Quick diagnosis, followed by treatment, and precautions on return to work.**

Mark is a 20 year old cement mason who notices irritation and itching on his hands and forearms after being exposed to wet Portland cement during work. Mark's work involves placing and finishing concrete. During work, Mark does not use gloves and does not wash off any wet cement that gets on his hands and forearms. After a few more days of work, Mark notices that the skin on his hands looks extremely red and scaly, is blistered and inflamed, and there is a watery discharge from the skin. Mark finds it difficult to continue with his work and decides to visit his physician. Fellow workers tell him that his skin condition may be because of contact with wet cement and he reports this to his doctor. He is diagnosed with irritant contact dermatitis during his initial visit to the physician. He is successfully treated for it and the disease resolves in about 4 weeks. During this time, Mark is unable to work because he has to avoid exposure to wet cement. When he returns to work, he takes precautions to avoid exposure, by wearing proper gloves and shoes and

¹⁰⁹ The CPT is published by the American Medical Association. It is a listing of descriptive terms and identifying codes for reporting medical services and procedures performed by physicians. CPT is the most widely accepted nomenclature for the reporting of physician procedures and services under government and private health insurance programs. CPT is also useful for administrative management purposes such as claims processing and for development of guidelines for medical care review.

washing his hands and arms with pH neutral soap and water periodically during the workday. He succeeds in resuming work without any subsequent adverse consequences.

Medical costs for Scenario I. This is one of the simplest scenarios, where the exposed worker develops irritant dermatitis, but it is diagnosed quickly and he is able to resume work by using proper personal protection and following safe work practices. Costs ranged from \$86 to \$452 for a worker who develops irritant contact dermatitis and is correctly diagnosed during his initial visit to the physician. The costs include a single doctor visit, with work-related or medical disability evaluation services. (See Table 7, Scenario I.)

- **Scenario II: Complications associated with irritant contact dermatitis lead to loss of earnings and search for new job**

Rudy, a 35-year old concrete finisher, has been working with Portland cement for 15 years. He is married with one child. Usually the use of gloves was either minimal or absent. There was rarely regular hand washing, due to lack of clean running water on construction sites. He suffered from episodes of hand eczema off and on and was diagnosed with irritant dermatitis. But during the last episode, he developed secondary bacterial infection from the primary dermatitis. He suffered cell damage due to the infection, and it has taken more than a year to heal. In the meantime, he is not working and expects that it will take him four to six months to be retrained and to find a job where he can avoid exposure, because his skills and experience are all with cement work. Rudy applied for and received Workers' Compensation for 12 months for temporary total disability. His economic needs caused him to apply for Medicaid and food stamps as well. He will receive them for 16 months, until he is earning an income again. Federal job training for Rudy costs the government approximately \$1,800.

Medical cost for Scenario II. Once diagnosed, irritant contact dermatitis can be treated successfully, but complications, such as secondary bacterial infection may arise from the primary dermatitis, including cell damage. Medical costs range from \$786 to \$1468 across the six states in such a situation. (See Table 7, Scenario II.)

- **Scenario III: Continuing cement work after development of dermatitis, delayed diagnosis of allergy to chromate, but work resumed with use of proper controls.**

Jason is a 28 year old cement floorer who has been exposed to wet cement for most of his work life. A few years back, he noticed eczema on his hands and knees. The treatment prescribed by his doctor was unsuccessful in healing his lesions and Jason continued to work. His exposure to wet Portland cement continued during this period of time. The eczema lesions spread to his arms and thighs. After subsequent visits to his doctor, he was referred to a skin specialist. The specialist confirmed

that the initial irritant contact dermatitis had metamorphosed into allergic dermatitis after a patch test confirmed that Jason was chromate sensitive. The specialist determined that his eczema was related to his occupation. Jason was put on a regimen of systemic steroids and advised to strictly avoid all exposure to wet cement. Fortunately, Jason's allergic dermatitis has been controlled and he is able to continue work. He now uses gloves and kneepads, does not allow his clothes to get saturated with wet cement, and washes his hands a number of times a day with clean water and a buffering solution.

Medical costs for Scenario III. For a cement mason whose initial irritant dermatitis becomes allergic dermatitis, the costs of medical treatment are likely to range from \$702 to \$1355. However, in this scenario, the worker's allergic dermatitis was successfully controlled by use of systemic steroids. The worker was also able to return to his old job and continue to work by avoiding all exposure to wet cement. Medical costs would be much higher for treatment of other possible complications that might result from uncontrolled allergic dermatitis. (See Table 7, Scenario III.)

- **Scenario IV: Cement burns and chromate sensitivity, with recommendation for changing profession.**

Ted is 18 years of age and new on the job. He hopes to become a cement mason. He has been working on laying a concrete driveway and this is his first day doing this type of work. During the work, wet cement gets on to Ted's hands and lower arms. Because Ted is not wearing any boots, his feet and calves are also crusted with cement. In the process of leveling the cement, Ted kneels on the cement but he is not wearing any elbowpads or kneepads. Ted neglects to wash the body parts which have come in contact with wet cement. At the end of the day, he notices that the skin on these areas looks black and is covered with blisters, even small lesions. Ted has received serious cement burns on his hands, elbows, knees, and feet due to contact with wet cement. He is treated in a hospital emergency room but the skin burns and ulcers take several months, perhaps a year, to heal, and his hands are scarred. The doctor says that he may need skin grafting. Ted also discovers that he has chromate sensitivity and that is what may have exacerbated the severity of the cement burns. He is told that he might be able to return to work as a cement mason if he uses the right types of skin protection but that his allergic dermatitis could flare up at any time. A new profession is recommended. But until his skin improves he is unable to support himself. He registers for Medicaid and food stamps, but finds himself in increasing debt and in need of job training.

Medical Costs for Scenario IV. In this scenario, the cement mason receives serious cement burns on his hands, elbows, knees, and feet due to contact with wet cement. He is treated in a hospital emergency room but the skin burns and ulcers take several

months to heal, and his hands are scarred. There is a possibility that he may need skin grafting and he also discovers that he has chromate sensitivity. The cost of medical service in such a potentially complicated scenario may be much higher than other cases involving treatment of simple irritant dermatitis. A worker in the situation similar to that described in this scenario may incur costs ranging from \$1749 in Alabama to \$4461 in Wisconsin. (See Table 7, Scenario IV.) These costs include outpatient services, burn treatment, office consultation, nursing facility services, emergency department visit, testing, disability evaluation services, tissue and skin grafts with anesthesia.

- **Scenario V: Delayed diagnosis, lack of adequate medical coverage, acquiring new skills, but eventual loss of income**

Sam is a 40-year old bricklayer, who also works as a cement mason and laborer at construction sites under contract to his employer. His work almost always exposes him to wet cement. Although Sam uses gloves off and on when working with cement and washes his hands occasionally, he has noticed an itchy, scaly rash on his hands that has become worse over time. Numerous visits to the doctor and the prescribed treatments have yielded no improvement and so he visits a dermatologist at his own expense. A successful diagnosis is eventually made when he is referred to yet another specialist. The diagnosis: Sam suffers from allergic dermatitis and is chromate sensitive. For missing so much work, he is terminated from what had been a job of several years. He loses benefits, including health insurance. The dermatitis is quite severe by this time and he undergoes treatment with steroids for which he pays out-of-his pocket. He is advised to avoid all possible exposure to wet cement. Sam is unable to continue as a bricklayer because the dermatitis returns and get progressively worse every time he returns to bricklaying work. After a considerable amount of time he finds a job as a construction laborer, that does not involve cement work. His hourly rate is lower that it was as a bricklayer, he has no benefits, and he continues to have symptoms.

Medical Costs for Scenario V. A delayed diagnosis is more costly in terms of medical service and overall patient health than a quick initial diagnosis. For the bricklayer in this scenario, costs range from \$537 to \$1102. And, there is considerable expense to him and to public sector training in acquiring new skills and finding non-cement related work. (See Table 7, Scenario V.)

- **Scenario VI: Language barrier and lack of information, no medical insurance, continuing work with symptoms, and delayed diagnosis. Failure to respond to treatment, joblessness, and disability.**

Forty-five year old Jose has been working at a construction site for about four months. The construction contractor he works for requires Jose to work as a laborer, and on several occasions, he has been required to mix Portland cement with water and other components to create the mix, which is used for concrete flooring. Other workers doing work similar to Jose's use gloves and water to wash their limbs and advise him to do the same. Jose does not understand English very well and because the hazards associated with exposure to wet cement are not clear to him, he never uses gloves or water for washing when wet cement gets on his hands and forearms. Jose has had an itchy, scaly rash on his hands and forearms for a few months now, which seems to get better but then reappears when he returns to cement mixing. The last episode was particularly bad and even though Jose does not have health insurance, he visited the doctor. The doctor treated him for dermatitis but was unsuccessful in linking the disease to occupational exposure. Jose continued to work throughout the treatment because his salary supports an extended family of eight. After a number of visits to the general practitioner, he is referred to an allergist. The allergist, who takes a comprehensive work history, is able to associate Jose's allergic dermatitis to his occupational exposure. However, the treatment is not very successful and Jose's dermatitis has gone from bad to worse. He is unable to continue to work because of the worsening dermatitis on his hands and arms. He has to ultimately leave his job to avoid all exposure. Jose is unable to find a job¹¹⁰ outside of his present trade because of lack of skills and continuing illness. He applies for TANF benefits. He goes through a period of medical recovery and unemployment finally gets a job at minimum wage.

Medical Costs for Scenario VI. For an immigrant worker who also faces a language barrier, understanding the hazards associated with exposure to wet cement can be difficult. In this scenario, the worker, after persistent symptoms of dermatitis, pays out-of-pocket, initially visiting a physician a number of times and eventually a specialist who diagnoses his condition. These costs can range from \$623 to \$1242 across the six states. In this scenario, the worker would also incur other out-of-pocket expenses, such as anti-biotics, steroids, and skin salves. The costs associated with lost work, reduces wages, Workers' Compensation and TANF systems are considerably higher than the medical costs alone, because of the loss of wages and eventual disability the worker faces. (See Table 7, Scenario VI.) Had he faced

¹¹⁰ From Lexis cases, it seems some people cannot work because of the recurrence of the dermatitis which can be brought on by something as simple as working in overheated conditions and these people have been awarded permanent disability benefits.

permanent disability, the costs of Social Security's Supplemental Security Income program would range in the hundreds of thousands of dollars.

The Cost of Diagnosis

For serious dermatitis to be most effectively treated, the affected worker must visit a physician in a timely way. Even so, diagnosis may involve several visits to the physician. But, workers with dermatitis may wait a long time to seek medical care. If the correct diagnosis is not made during initial visits, with a link to occupational exposure, workers may go through unsuccessful treatment until the condition is either correctly diagnosed or the general practitioner refers the worker to a specialist, most likely a dermatologist or an allergist. A dermatologist or an allergist may not make the occupational link either. It is unlikely that a worker would go to an occupational health clinic. Focus on occupational exposure may not occur. In cases where a worker sustains severe cement burns, treatment in the emergency room may be necessary. Workers with severe cases of dermatitis may also require hospitalization and use of nursing services. Workers may need restorative surgery including procedures such as skin grafting. The costs of diagnosis depend on how quickly chromate sensitivity is considered in understanding the patient's illness.

Chromate sensitivity may not be easy to identify. It should always be considered when cement workers have dermatitis. Another clue to chromate sensitivity is residual scars in individuals afflicted with ulcers on the hands, arms, and feet.¹¹¹

Cost of Patch Tests for Allergic Contact Dermatitis

A typical allergy work-up costs approximately \$400, but can run into the thousands of dollars. The costs for the patch test kits alone run from \$26 to \$1076:¹¹²

- | | | |
|----|---|--|
| A. | Galxowellcome T.R.U.E. Test: | \$26 (5 allergens) |
| B. | Dormer Laboratories:
(Chemotechnique) ¹¹³ | North American Series \$184.50 (9 allergens)
Epoxy Series \$1076.25 (45 allergens) |
| C. | Omniderm Inc.:
(Trolab Patch Test Allergens) | \$21(1 allergen)
\$18.90 each for 23 allergens
\$17.85 each for 50 or more allergens |

¹¹¹ G. L. Waldbott, Health Effects of Environmental Pollution, 1973, p. 201 as cited at <http://toxnet.nlm.nih.gov/cgi-bin/sis/search/f?./temp/~AAAQaOKU:1:FULL>, downloaded July 20, 2000.

¹¹² August 2000, plus shipping and handling in all cases (about 5 percent of the cost).

¹¹³ Dormer Laboratories has 20 different series for patch tests. The two series listed are the least and most expensive series.

- D. Allerderm Laboratories:¹¹⁴
 (Hermal)
- 8mm chambers:
 25 strips x 10 - \$39/box
 100 strips x 10 - \$130/box
 50 strips x 5 - \$43/box
 150 strips x 1 - \$29/box
- 12 mm chambers:
 200 stripsx1 - \$56/box.

Where some medical costs are covered by Workers' Compensation, it is assumed for the six scenarios in this paper, that three quarters of medical costs would be allowed and paid for by Workers' Compensation Insurance.

D. Other Costs

A worker with contact or allergic dermatitis suffers discomfort and disability. Apart from medical costs associated with the treatment and management of dermatitis, there may be many additional costs to all parties involved – the worker, employer, insurer, government, and cement manufacturers.

1. Costs to the Affected Worker

A worker with contact dermatitis suffers discomfort and disability. Beyond medical costs and other medically-related out-of-pocket expenses, there are lost wages due to time away from work, and lost wages if one must take a new job at lower pay.

a. Out-of-Pocket Medical Costs. Workers' access to job-related health insurance, the cost of that insurance, and the choice of health plans available vary widely. Workers who do not have job-related insurance can face significant, potentially crippling, medical costs when faced with a debilitating condition like dermatitis. Many employers may not offer health insurance, and even when they do so, the cost of the premium portion that the worker must pay may be too high.¹¹⁵ If there is no health insurance, unless the worker qualifies for Workers' Compensation or Medicaid, the worker has to pay all medical expenses out-of-pocket. Even with comprehensive insurance there are almost always copays and deductibles for doctor visits, medication, hospitalization, and treatments. There are expenses associated with prescription drugs, transportation and parking, over the counter ointments, and bandages.

¹¹⁴ Allerderm Laboratories manufactures Finn Chambers which are used for inserting the allergen that is to be tested on the skin.

¹¹⁵ Chris L. Peterson and Jessica P. Vistnes, "State Differences in Job-Related Health Insurance, 1996," MEPS Chartbook No. 4, <http://www.meps.ahcpr.gov/papers/00-0017/chrtbk4.htm>, downloaded February 8, 2001.

A worker who unwittingly carries cement home on his clothes, or launders the contaminated clothing with the clothing of others in his household, runs the risk of family members developing allergic dermatitis, leading to medical costs for family members as well.

For the six scenarios presented in this paper, out-of-pocket costs are estimated in each case, based on length of illness, medicines and salves likely to be required, amount of transportation to and from medical services, etc. They ranged from \$50 to \$2400. See Table 8.)

b. Non-Medical Costs to the Worker

The costs of cement-related skin disease are far greater than the medical costs alone. Sick workers lose work time, for which there is usually no compensation. They may lose their job or even their career. They may personally pay the costs associated with retraining, or the government may pay through a subsidized job training program. A sick worker may have a reduced quality of life for the duration of a short, acute illness – or maybe even for life. And, with severe impacts on an individual worker, come burdens to the worker’s family as well.

i. Loss of Time From Work

A typical worker with irritant contact dermatitis will remain on the job. If exposure continues the irritation is likely to increase and allergic dermatitis may develop. Early symptoms are often ignored, but should receive immediate attention because they can lead to a more serious disease, and one that is harder to cure. In the beginning, a worker may lose wages due to time away from work. In an extreme case, a worker may face unemployment and maybe even permanent disability. Studies in the U.S., find concrete workers who lose work days due to skin disorders, are away from an average of five days (based on Workers’ Compensation claims in Washington State) to a median of 13 days (according to the CPWR Chartbook).

An Australian study¹¹⁶ found that one-third of all patients with pervasive post-occupational dermatitis continued to be moderately to seriously impaired by their symptoms, with not only lost work-time but also long-term unemployment.

For the six scenarios presented in this paper, the costs of lost work time is based on construction wage rates specific to the individual’s craft and state. (See Table 9.) The assumption is loss of full time work with no overtime for the duration of illness. For the six scenarios, these lost wages are from \$0 to over \$54,000 (for a 16 month absence from work).

¹¹⁶ Halbert et al., p. 217.

In two of the six scenarios, sick workers returned to work at lower paying jobs, with annual losses as high as \$15,000. (See Table 8.)

Figured another day, if construction workers have average hourly earnings of \$17.86 and work 40.5 hours per week, then each case with an estimated four to thirteen days away from work costs, in lost wages, \$579 to \$1,800. If there are 1,700 to 8,500 cases per year, then the estimated total cost of lost wages would be between \$980,000 and \$15.3 million per year.

ii. Loss of Job and Career

A typical worker with allergic dermatitis continues to be sensitive to hexavalent chromium and will likely develop more serious symptoms if exposure continues. When symptoms are severe and persistent, a worker may have to leave the trade altogether.

Leaving the trade may be the only way for sensitized workers to avoid exposure to the wet Portland cement that is making them ill. This is especially true when there is a failure to diagnose the disease early and an allergic reaction develops.

iii. Costs for Retraining

Some individuals have to leave their trade altogether – losing their years of experience and training in cement work and needing to train for another trade. The costs of earlier apprenticeship training are lost and costs of new training are incurred. For the purposes of this paper and the six scenarios presented it is assumed that those costs are borne by government job training programs and amount to \$1,800 per enrollee.

In addition, the worker expends time and money for out-of-pocket expenses associated with searching for a new job. These costs are not added to the scenarios presented in the paper.

iv. Lost Quality of Life

Lost quality is the result of reduced employability and the inability to participate in a number of leisure time activities as well. A telephone survey of 235 workers with occupational diseases found that the disease interfered with work activities in 37 percent of respondents, with household work in 29 percent, and with leisure activities in 23 percent.¹¹⁷ No dollar value can appropriately be applied to these losses.

¹¹⁷ D. L. Holness and J. R. Nethercott, "Work outcome in workers with occupational skin disease," American Journal of Industrial Medicine 27:807-815, 1995, in Lushniak, p. 353.

v. Impact on Family

When the primary wage earner loses wages or a job, it affects the financial stability of the entire family. There may be additional consequences of job loss, such as increased debt or the family losing its home. If a worker is disabled and unable to continue to work, the family also faces the psychological impact of disability among a family member. Even the most devoted family can become weary when basic functions such as rearing children, maintaining a home, and earning a living must be performed in addition to caring for a member who is chronically ill.¹¹⁸ In this way, chronic illnesses are disproportionately intrusive on the lives of patients and their families.¹¹⁹ The tolls exacted on careers, marriages, and children can be staggering.¹²⁰ According to one study, over 75 percent of married people who develop a chronic illness, eventually divorced.¹²¹

Furthermore, in marginal families, illnesses, which reduce earnings or increase expenses frequently destroy hopes and dreams for the future.¹²² These marginal families suffer more than others in similar situations, with little money and few connections to the community or extended family.¹²³ No dollar value can measure these losses.

2. Costs to Workers' Compensation Insurers for Lost Wages

Workers' Compensation is a state-mandated program for all employers to provide compensation benefits to employees who become sick or injured on the job. It may be paid by federal or state Workers' Compensation. Workers' Compensation Insurers, beyond medical costs, pay four different categories of wage replacement benefits: permanent total disability, permanent partial, temporary total, and temporary partial.

Comparison of Workers' Compensation Benefits by State. Workers' Compensation benefits vary widely from state to state and, in many states, compensation is meager. Maximum medical benefits range from full coverage in most states to \$100 in New Jersey. For permanent disability, the individual maximum benefit ranges from 60 percent to 80 percent of the person's wage – with maximum weekly benefits ranging from \$65 in Puerto Rico to \$1031 in Iowa. Temporary total disability usually has the same state maximum for weekly benefits. For permanent partial disability, maximum weekly

¹¹⁸ Griffin in Miller and Janosik, p. 254.

¹¹⁹ Juliet Corbin, and Anselm Strauss, Unending Work and Care: Managing Chronic Illness at Home, Jossey-Bass: San Francisco, 1988, p. 36.

¹²⁰ Mona Johnston, Don Martin, Maggie Martin, and Jim Gumaer, "Long-Term Parental Illness and Children: Perils and Promises," The School Counselor, January 1992, Vol. 39, p. 225.

¹²¹ Ibid.

¹²² Griffin in Miller and Janosik, p. 248.

¹²³ Ibid., p. 250.

benefits \$65 in Puerto Rico to \$948 in Iowa. (For the six states reviewed in the scenarios presented, see Table 10 for maximum weekly benefits.) Among the six scenarios total Workers' Compensation cash payments range from \$15,000 to \$27,000.

There are variations across states in the waiting period to become eligible for Workers' Compensation benefits. For the six states used in the scenarios of this paper, there is no benefit payment for the first three to seven days until the time off exceeds a certain number of days. Depending on the state, this time period varies from 5 to 21 days. Depending on the severity of the dermatitis, disability for workers afflicted with cement related dermatitis may be classified as temporary partial, temporary total or permanent partial, or permanent total.

3. Costs to the Employer

Workers are not the only ones to suffer when faced with cement-related skin conditions. Employers with health plans will have associated costs. They may also face the negative effects of lower productivity. In some states the employer may be responsible for rehabilitation costs faced by a sick worker.

a. Lower Productivity. Construction employers lose income when productivity falls and the work schedule is interrupted. Lost workdays due to contact dermatitis are closely related to productivity.¹²⁴ One study found lost productivity costs almost as high as medical costs.

A worker with contact or allergic dermatitis is less productive than a healthy worker. Workers whose hands simply hurt cannot perform as efficiently or effectively as when they are healthy. There may be lost workdays, which could put an employer behind schedule or require the hiring of someone less familiar with a job already started or less skilled in the craft.

b. Rehabilitation Costs. Depending on the statutes of the individual state in which the worker is injured, when a workplace injury prevents a worker from earning wages equal to wages earned prior to the injury, the worker may be entitled to rehabilitation services. For instance, [Section 440.49\(1\)\(a\)](#), Florida Statutes states that when an employee has suffered an injury covered by this chapter that precludes the employee from earning wages equal to wages earned prior to the injury, the employer or carrier shall provide such injured employee with appropriate training and education at its own expense, for his/her suitable gainful employment and vocational rehabilitation.¹²⁵

¹²⁴ Goh and Gan, p. 28.

¹²⁵ For purposes of this section, "suitable gainful employment" means employment or self-employment which is reasonably attainable in light of the individual's age, education, previous occupation, and injury and which offers an opportunity to restore the individual as soon as practicable and as nearly as possible to his average weekly earnings at the time of injury.

4. Costs to the Construction Industry and Potential Liability for Cement Manufacturers

Cement manufacturers may incur significant costs if they are found liable due to damage to those who work with their products.

The Vice President of Engineering for the National Ready Mixed Concrete Association, writing in The Concrete Producer, warned producers:¹²⁶

“In many recent cases, courts have found concrete producers liable for failing to provide an adequate warning of cement-burn hazards.”

He goes on to say that adequate product warnings are required under various federal laws and regulations, including the Consumer Product Safety Act, the Federal Hazardous Substance Act, and the Hazard Communication Standard of the Occupational Safety and Health Act.

A far back as 45 years ago, in cases¹²⁷ of product liability, where the injured party has sued the cement manufacturer for personal injury, the person developed severe cement burns while performing construction work using cement at his own house. The courts have found the supplier subject to liability in these cases, because “the supplier has reason to know that the product he furnishes is likely to be dangerous for the use for which it is supplied; has no reason to believe the user will realize its dangerous condition; and fails to exercise reasonable care to inform the user of the facts which make the product likely to be dangerous.”¹²⁸

While some courts have found no duty on the part of the supplier or employer to inform workers or consumers of the risk of working with Portland Cement, some courts have found the opposite. In 1973, the Supreme Court of Wisconsin found a skilled tile setter, after 15 years in the trade, developed allergic dermatitis and was due an award of permanent partial disability.¹²⁹ In 1983, the Court of Appeal for Louisiana found that in the case of the plaintiff sustaining severe concrete burns, “Louisiana Industries’ failure to warn of the dangerous propensity of wet concrete to burn skin was conduct which renders it liable in the case.”¹³⁰

¹²⁶ Mullarky, “How to Save Your Customer’s Skin.”

¹²⁷ 435 So. 2d 575; 1983 La. App. June 29, 1983.
52 A.D.2d 202; 383 N.Y.S.2d 729; 1976 N.Y. App. Div. May 21, 1976.
353 S.W.2d 108; 1961 Mo. App. November 6, 1961.
46 Cal. 2d 190; 293 P.2d 26; 1956 Cal. February 10, 1956.

¹²⁸ 52 A.D.2d 202; 383 N.Y.S.2d 729; 1976 N.Y. App. Div. May 21, 1976.

¹²⁹ 57 Wis. 2d 190; 203 N.W.2d 687; 1973 Wisc. LEXIS 1538.

¹³⁰ 435 So. 2d 575; 1983 La. App. June 29, 1983.

5. Costs to Government

When a worker is unable to work for a long duration of time due to dermatitis, or is unable to successfully train to get a job with no cement exposure, there may be unemployment costs and the costs of other government-supported subsidy programs like food stamps, Medicaid, welfare, and disability.

a. Unemployment Insurance

Unemployment insurance provides workers, whose jobs have been terminated through no fault of their own, monetary payments for a given period of time or until they find a new job. Unemployment compensation provides an unemployed worker time to find a new job, equivalent to the one lost without financial distress.¹³¹ Benefits are based on earnings from the last job and usually last up to 26 weeks.

Benefits vary greatly from state to state. (See Table 11 for a few examples.) While not representing the full range of benefits, for the one scenario where a sick worker receives 26 weeks of unemployment benefits, the costs range from \$1,000 to \$14,000.

Each state administers a separate unemployment insurance program. Which employees are eligible for compensation, the amount they receive, and the period of time benefits are paid are determined by a mix of federal and state law. Some states provide additional unemployment benefits to workers who are disabled. Financing for the California disability compensation program, for example, comes from a tax on employees.

b. Food Stamps

Under the Personal Responsibility and Work Opportunity Reconciliation Act of 1996, the Food Stamp Program was substantially scaled back and includes changes in eligibility and income criteria for families. In subsequent legislation, Congress restored some benefits to select populations and gave states options to restore benefits and provide work and training opportunities to able-bodied adults without dependents and other populations excluded from the federal program.¹³²

For those qualifying for food stamps, benefits run as high as \$130 per month for a single individual, \$341 for a family of three, and \$781 for a family of eight.¹³³ For a family of three, maximum income allowed is \$1,548 to \$1,946, or a maximum of \$23,352 per year. If one is legally disabled, there is no pre-qualification process. Otherwise, ones assets, including, in some states, the value of ones automobile, are considered as well as earned and unearned income.

¹³¹ Legal Information Institute, "Unemployment Compensation Law: An Overview," http://www.law.cornell.edu/topics/unemployment_compensation.html, downloaded May 16, 2001.

¹³² Welfare Information Network, <http://www.welfareinfo.org/food.htm>, downloaded April 30, 2001.

¹³³ "The Food Stamp Program," <http://www.foodusa.org/>, downloaded July 13, 2001.

In the six scenarios presented in this paper, where sick workers are eligible for food stamps, it is assumed that they receive the maximum allowable amount.

c. Medicaid

Medicaid is a health insurance program for low-income and needy people, established by the federal government and funded jointly by Federal and State governments.¹³⁴ Each state administers the program differently. Medicaid covers approximately 36 million individuals including children, the aged, blind, and/or disabled, and people who are eligible to receive federally assisted income maintenance payments. In many states, Medicaid covers medical services and costs. In some states, Medicaid charges consumers small amounts for certain services.¹³⁵ Each state has its own requirements under Medicaid for coverage, and for the amount, duration, and scope of medical and remedial care provided to the needy. While not representing the full range among the states, for the six states in the scenarios of this report, one is eligible for Medicaid with maximum gross monthly income of \$1,196 to \$1,539.¹³⁶

In Alabama, families with an unemployed parent are covered for the mandatory 6-month period and an optional extension of 6 months. Alabama uses the same definition of disability used under the SSI program unless a more restrictive definition of disability is specified in the plan. In Massachusetts, families with an unemployed parent are covered for the mandatory 6-month period and an optional extension of 6 months. For the scenarios in this paper where a sick worker qualifies for Medicaid, it is assumed that three quarters of the medical costs are judged to be allowable under the program.

d. Welfare Benefits

The Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) of 1996 ended the federal entitlement of individuals to cash assistance under Title IV-A (AFDC), giving states complete flexibility to determine eligibility and benefits levels. Under the new law, Title IV-A funds are replaced with block grants for temporary assistance for needy families (TANF). The federal law limits the provision of TANF to families with a minor child or pregnant woman and imposes a time limit on the receipt of benefits, in addition to other requirements to qualify for benefits.¹³⁷

Federal law prohibits states from using federal TANF funds to provide assistance to a family with an adult who has received assistance for 60 months. This is a permanent or

¹³⁴ Health Care Finance Administration, <http://www.hcfa.gov/medicaid/medicaid.htm>, downloaded April 30, 2001.

¹³⁵ NOLO Law for All, "Medicare and Medicaid Explained," <http://www.nolo.com/encyclopedia/articles/ret/OA8.html>, downloaded April 30, 2001.

¹³⁶ See HCFA website at: <http://www.hcfa.gov/medicaid/stateplan/Map.asp>.

¹³⁷ Welfare Information Network, 2001.

lifetime bar on the use of federal TANF funds to provide assistance to a family except that federal TANF funds can be used to provide assistance beyond 60 months for up to 20 percent of the average monthly caseload in the state TANF program. States are free to use state funds to provide assistance to families in excess of the 20 percent limit. In addition, at any time prior to their reaching the 60-month time limit, a state can provide assistance to a family with all state funds and thereby stop the federal time limit clock, which is tied to the use of federal TANF funds. Thus, although states must comply with the 60-month TANF time limit on the use of federal TANF funds, the flexibility available in the use of state funds allows each state to structure time limit policies including exemptions and extensions in a variety of ways, or not to impose a state time limit at all.¹³⁸

Benefits vary greatly from state to state. While not representing the full range of benefits, for the six states studied in the scenarios in this paper, monthly gross income cut offs for a family of three ranged from a low of \$1193 in Oklahoma to a high of \$1308 in Wisconsin. Cash payments from TANF for the sixth scenario ranged from \$1,500 to over \$14,000 for a year. (See Table 12.) In addition, the TANF program is involved not only with Medicaid and food stamps, but also with housing subsidies and day care opportunities. The latter two could be needed by seriously ill construction workers, but are not included in any of the six scenarios.

e. Disability Benefits

The Social Security Administration pays disability benefits under two programs: the Social Security Disability Insurance (SSDI) program, that is part of the Old Age, Survivors and Disability Insurance (OASDI)¹³⁹ program, and the Supplemental Security Income (SSI) program.¹⁴⁰ SSA defines "disability"¹⁴¹ in the same way for all adults

¹³⁸ <http://www.spdp.org/tanf/timelimit.htm>, downloaded June 6, 2001.

¹³⁹ The Old-Age, Survivors, and Disability Insurance (OASDI) program provides protection against the loss of earnings due to retirement, death, or disability. The OASDI program consists of two separate parts which pay monthly benefits to workers and their families, Old-Age and Survivors Insurance (OASI) and Disability Insurance (DI). Under OASI, monthly benefits are paid to retired workers and their families and to survivors of deceased workers.

¹⁴⁰ Social Security Administration, Office of Policy, "Programs: Disability," <http://www.ssa.gov/policy/programs/>, downloaded March 1, 2001.

¹⁴¹ Disability is defined as the inability to engage in substantial gainful activity by reason of any medically determinable physical or mental impairment that can be expected to result in death or to last for a continuous period of not less than 12 months. This means: "for a nonblind disabled worker, a blind worker under age 55, a disabled adult child, or a disabled widow, widower or surviving divorced spouse, the inability to engage in substantial gainful activity. A person must not only be unable to do his or her previous work but cannot, considering age, education, and work experience, engage in any other kind of substantial gainful work which exists in the national economy. Before 1991, a stricter disability definition applied to disabled widow(er)s. A widow(er) needed to have a disability severe enough to prevent him or her from engaging in "any gainful activity."

receiving Social Security benefits (OASDI and SSI). The medical requirements for disability payments are the same under both programs and a person's disability is determined by the same process. While eligibility for Social Security disability is based on prior work under Social Security, SSI disability payments are made on the basis of financial need.¹⁴²

To qualify for disability benefits from Social Security, an applicant must fulfill two requirements.¹⁴³ First, a physical or mental impairment must be severe enough to keep an individual from "substantial" (generally monthly earnings of \$500 or more) work for at least a year, or be so serious as to possibly result in death. Some consider this a strict definition of disability, and it is. No provisions exist for temporary or partial disabilities under Social Security.

Social Security rules are different from those of private plans or other government agencies. Qualifying for disability from one source does not necessarily mean eligibility for disability benefits from Social Security. A statement from a doctor indicating a disability does not automatically qualify an individual for benefits either.¹⁴⁴ The requirements consider not only whether the individual is unable to do work previously performed, but also if he or she is able to do any other type of work. An individual's age, education, past experience, and transferable skills are all considered in determining eligibility to Social Security disability benefits. Second, in addition to the medical requirement of the law, a work requirement must be met. An individual must have worked long enough and recently enough to be eligible for benefits based on the age at which they became disabled. Younger workers generally need less work to qualify. For example, a 55-year-old worker would need credit for just more than eight years of work and at least five years of the work would have to have been during the 10-year period immediately before the disability began.

If the disability payment is Workers' Compensation or another public disability payment, the workers and their families' Social Security benefits may be reduced so that the combined amount of the Social Security benefit plus Workers' Compensation payment and/or public disability payment does not exceed 80 percent of average current earnings. (The unreduced benefit amount is counted for income tax purposes.)¹⁴⁵

¹⁴² The Supplemental Security Income (SSI) program is a nationwide Federal assistance program administered by the Social Security Administration (SSA) that guarantees a minimum level of income for needy aged, blind, or disabled individuals.

¹⁴³ Doreen Benson, "Disability coverage helps safeguard workers of all ages," *The Detroit News: Strategies*, Monday, July 27, 1998, <http://www.detroitnews.com/STRAT/9807/27/benson/benson.htm>, downloaded March 9, 2001.

¹⁴⁴ *Ibid.*

¹⁴⁵ Social Security Administration, "How Worker's Compensation And Other Disability Payments May Affect Your Benefits," SSA Publication No. 05-10018, June 1997, <http://www.ssa.gov/pubs/10018.html>.

If SSI had been included in one of the six scenarios in this paper, annual benefits, based on current Social Security calculations, would have ranged from \$14,000 to \$28,000.

VII. Costs Associated with Health and Safety Activities

The costs associated with health and safety activities for this intervention are (1) the low pH soaps, pH normalizing solutions, or other cleaning products that are used with clean water and toweling and (2) the time needed away from productive work to wash ones hands. In some cases, barrier creams or gloves may be used along with hand washing. Clean water and toweling are required by OSHA at construction sites, so there is no additional cost added for this intervention.

A. Costs Associated with Hand Washing

OSHA requires, in its sanitation standard, that there be running water at each work site. So there should be no additional cost associated with this intervention. Nonetheless, there will be immediate costs for providing hand washing, when employers are out of compliance and this could be an issue or resistance. Those who sent portable toilets often sent them with clean water and toweling.

1. The Products

There are several possible products which lower pH, costing as one cent per worker per day. Some are cited below:

- a. **Low pH Soaps.** According to an official at EZ-QUI Industries in Bedford, New Hampshire low pH soaps should be used for cleaning equipment and tools and pH neutral soaps should be used for hand washing. Low pH soaps, with pH of 1.5 to 3.0, are used by concrete workers to clean their equipment/tools/and dumping trucks. The cost of these soaps, which are usually liquid or powder, is \$285-\$450 for a 55 gallon drum in 2000. The cost per gallon works out to much less as these low pH soaps are diluted with water before use.¹⁴⁶

Concrete workers use pH neutral soaps, with a pH of 7 to 7.5, to clean their hands. These soaps are either liquid or powders, usually bought in bulk. Some of the soaps have lanolin for moisturizing because washing hands with plain water can dry the skin. Lanolin soaps are more expensive. These pH neutral soaps cost about \$4 - \$9 per gallon. A 55 gallon drum costs approximately \$280-\$300 and provides soap for 55,000 washes. If only 1,000 pumps per gallon, and 2 pumps per hand wash, that is 27,500 hand washings per 55 gallon drum, or only a penny a hand wash. At three hand washes per person per pay, a fifty-five gallon drum of low pH soap would supply 25 workers enough soap for a full year, seven days a week.

Some soaps are used without water, but using water to rinse the hands and arms, before application of the soap is a much more effective practice.

¹⁴⁶ Telephone interview with Scott Pollock, EZ-QUI Industries, June 6, 2000, 603-668-2829.

b. pH Normalizing Solutions

Two examples of pH neutralizing solutions are Neutralite and Mason's Hand Rinse. (See Appendix 3 for more information about Neutralite and Mason's Hand Rinse.)

i. Neutralite Solution. A one quart bottle of Neutralite solution costs \$8.00, and produces 1051 pumps per quart of the liquid. Based on this information, the cost per decontamination would be as follows:

\$8.00 (one quart of Neutralite) divided by 1051 sprays per quart = \$0.0076 per spray.

3 sprays per hand x 2 hands = 6 sprays per decontamination.

6 sprays x 0.0076 per spray = \$0.0456 per decontamination (approx. 4.5 cents).

6 decontaminations per day x 4.5 cents per decontamination = 27 cents per day per worker.

If multiple cases of the Neutralite solution are purchased (20 or more), then the cost of one bottle goes down to \$7.23. The manufacturer can also supply bucket or truck mounted NSS holders for \$6.00 each with additional mailing charges.

ii. Mason's Hand Rinse. According to the manufacturer, one 8-ounce bottle of Mason's Hand Rinse can provide 40 applications. Each application consists of 4 sprays of the rinse to each hand. Four applications of the rinse per worker per 8-hour day are recommended. Thus, one bottle supplies enough rinse for one full time worker for 10 working days.

Each case of the rinse contains 100 bottles. The cost per bottle varies depending upon how many cases are ordered. If 1-4 cases are ordered, the cost per bottle is \$5.80; for 5-9 cases, \$3.90; and, for 10 or more cases, \$2.50 per bottle.

Mason's Hand Rinse may cost the employer as little as \$0.25 per worker per day. If a construction worker works 250 days a year, the cost of Mason's Hand Rinse would be \$62.50. A dermatitis resolved with just one doctor's visit costs at least \$86, and does not include lost work time, medicines, transportation, costs to the doctor, etc.

2. Time Needed for Careful Hand Washing

If hand washing occurs three times a day and coincides with bathroom breaks, then only the extended time for thorough handwashing is a cost to the employer – perhaps one minute, three times per day. Three minutes a day, if wages average \$18.76 per hour, would cost 93 cents per day or \$4.65 for a five day per week – in contrast to over \$750 per week for lost work time from a dermatitis case.

B. Costs for Cleaning Equipment

Concrete workers use low pH soaps, with pH of about 1.5 to 3.0, to clean their equipment, tools, and dumping trucks. These costs may match or exceed hand washing – suggesting that care for the equipment is already understood and accepted. The cost of these soaps, which are usually liquid or powder, is \$285-\$450 for a 55 gallon drum. The cost per gallon works out to much less as these low pH soaps have to be diluted with water before use.¹⁴⁷

C. Gloves¹⁴⁸

While gloves are not the only answer in preventing contact dermatitis, they may be part of a solution when coupled with adequate handwashing facilities. Cost of gloves recommended for use in the cement industry include:

- A. Chem Master (CHM): \$2.50 per pair
- B. Neoprene (6780R – 12 inch): \$4.00 per pair
- C. Nitri-Solve (12 inch nitrile): \$2.50 per pair
- D. Black Knight (12 inch PVC): \$2.50 per pair

(For descriptions of these gloves, see Appendix 4.)

If a worker needs a new pair every month, the cost per worker per year would range from \$30 to \$48. These gloves may also protect from other irritants and allergies as well as protect from abrasive surfaces and materials.

D. Cost of an Intervention for Overall Costs

With a cost for low pH soap as little as 3 cents a day and time not working 93 cents, the cost of burn and disease prevention is less than \$1 a day; less than 12 cents per hour. Even with the most expensive buffering agent, the cost of \$65 per year is still only 26 cents per day, for a total cost of \$1.19; still less than fifteen cents a day for an eight hour day.

In reality the three one minute periods each day for hand washing, might not affect productivity at all, especially if it significantly reduced the pain and discomfort of dermatitis among construction workers who continue working.

¹⁴⁷ Interview with Scott Pollock, EZ-QUI Industries, June 6, 2000.

¹⁴⁸ As faxed by Bob Gingras, Best Glove, June 12, 2000 and at <http://www.bestglove.com/>, downloaded June 12, 2000.

VIII. Conclusions

An investment of \$1 a day for 560,000 workers who use cement daily and as many as 1.8 million who use cement perhaps every other day, would be less than \$1.5 million a year in contrast to \$135 million to \$679 million to workers, insurers, and the government when workers contract cement-related dermatitis. The cost-benefit equation is clear. In addition employers gain more productive workers, perhaps lower insurance rates, and cement manufacturers reduce their legal liability. Workers are healthier and acute cement burns are also prevented. Hand washing prevents other diseases as well. The choice is clear: health and cost savings through simple hand washing.

Table 1

**NAICS With 100 Percent of Employees Involved in Concrete Work
1997**

NAICS	Description	Paid Employees
235410	Masonry and stone contractors	164,236
235430	Tile, marble, terrazzo, and mosaic contractors	39,775
235710	Concrete contractors	262,256
	TOTAL	466,267

Source: U.S. Department of Commerce, Bureau of the Census, 1997 Economic Census, "Bridge Between NAICS and SIC, Core Business Statistics Series," 1997, pp. 10-11.

Table 2

**NAICS Assumed to Have 50 Percent of Employees
Involved in Concrete Work
1997**

NAICS	Description	Paid Employees
233210	Single-family housing construction	570,990
233220	Multifamily housing construction	58,896
233310	Manufacturing and Industrial building construction	143,066
233320	Commercial and Institutional building construction	528,173
234110	Highway and street construction	277,979
234120	Bridge and tunnel construction	47,764
234910	Water, sewer, and pipeline construction	162,566
234920	Power and communication transmission line construction	74,050
234930	Industrial nonbuilding structure construction	98,555
234990	All other heavy construction	219,486
235520	Floor laying and other floor contractors	60,533
235910	Structural steel erection contractors	72,301
235990	All other special trade contractors	198,141
	TOTAL	2,512,500
	50 % of TOTAL	1,256,250

Source: U.S. Department of Commerce, Bureau of the Census, *1997 Economic Census*, "Bridge Between NAICS and SIC, Core Business Statistics Series," 1997, pp. 10-11 and discussion with those familiar with construction work.

Table 3**NAICS Assumed to Have No Workers Involved in Concrete Work
1997**

NAICS	Description	Paid Employees
233110	Land subdivision and land development	41,827
235110	Plumbing, heating, and air-conditioning contractors	788,930
235210	Painting and wall covering contractors	195,331
235310	Electrical contractors	641,985
235420	Drywall, plastering, acoustical, and insulation contractors	266,710
235510	Carpentry contractors	230,409
235610	Roofing, siding, and sheet metal contractors	253,315
235810	Water well drilling contractors	21,214
235920	Glass and glazing contractors	35,823
235930	Excavation contractors	116,237
235940	Wrecking and demolition contractors	18,820
235950	Building equipment and other machinery installation contractors	75,501
	TOTAL	2,686,102

Source: U.S. Department of Commerce, Bureau of the Census, 1997 Economic Census, "Bridge Between NAICS and SIC, Core Business Statistics Series," 1997, pp. 10-11 and discussion with those familiar with construction work.

Table 4**Economic Data on Construction Categories by NAICS
1997**

Number of Companies	Number of Establishments	Number of Employees	Payroll	Value of Construction	Net Value of Construction	Cost of Material, Components, Supplies, and Fuels
All Construction	656,448	5,664,853	\$174,184,608	\$845,543,552	\$612,209,024	\$241,400,736
Masonry, Stone Setting (174100)	22,614	164,236	\$4,068,498	\$12,231,875	\$11,438,477	\$3,910,609
Concrete Work Special Trade Contractors (177110)*	1,124	10,172	\$221,178	\$716,768	\$638,255	\$235,824
Concrete Work Special Trade Contractors (177120)*	30,417	262,256	\$6,858,140	\$25,848,848	\$23,603,728	\$9,762,065
Total for the three cement using NAICS categories	54,155	436,664	\$11,147,816	\$38,797,491	\$35,680,460	\$13,908,498
Percent that the three cement using NAICS categories comprise of all construction	8.2%	7.7%	6.4%	4.6%	5.8%	5.8%

* Concrete Work Special Trade Contractors (177110), are included within Concrete Contractors (235710). Concrete Work Special Trade Contractors (177120), are included within Drywall, Plastering, Acoustical, and Insulation Contractors (235420). Note that these Census numbers are not totally consistent with Census numbers presented in Table 1.

Source: U.S Department of Commerce, Bureau of the Census, 1997 Economic Census, "Industry Summary: Construction," January 2000.

Table 5

**Summary of Estimated Range of Costs of Dermatitis
Due to Cement Exposure
Based on Six Disease Scenarios**

For a Single Disease	Low	High
Costs to the Individual Workers	\$1,300	\$44,000
Costs to Government and Workers' Compensation	0	\$37,000
Net Loss to Worker	\$110	\$43,000
National Cost Per Year	If 1,700 Cases	If 8,500 Cases
Net Loss to Individual Workers	\$73,100,000	\$365,500,000
Cost to Government and Workers' Compensation	\$62,900,000	\$314,500,000

Notes: (1) For more detail see Table 7. Net loss to worker is worker costs minus the portion of government and Workers' Compensation costs that are third party transfer payments. (2) Government and Workers' Compensation costs do not include costs to Medicaid.

Source: Data presented and developed in this study.

Table 6

Types of Costs Associated With Burns and Dermatitis Due to Exposure to Wet Portland Cement

Medical Costs; Whether to Worker or Insurer
Allergy testing
Emergency room visit
Medication
Nursing services
Physician visits (general physician and specialist)
Skin grafting
Surgery
Work-related or disability evaluation
Productivity Costs:
Cost to hire and train replacement workers
Loss of productivity for employer
Costs to Worker:
Impact on family
Loss of job
Loss of wages
Partial/total disability
Possible loss of home
Retraining and learning new skills
Reduced quality of life
Other Costs:
Day care support
Food stamps
Housing subsidy
Job training
Medicaid
Social Security's Supplemental Security Income program
Temporary Assistance to Needy Families (TANF) cash support
Unemployment Insurance
Workers' Compensation

Table 7

Medical Costs for Six Scenarios

SCENARIO I				
City and State	Zip Code	Code for Medical Treatment	Type of Medical Treatment/Service	Cost of Medical Service (in dollars)
Foley, AL	36535	99203	Outpatient Services	\$86
		99455	Work related or medical disability evaluation services	NA
TOTAL COST				\$86
Stilwell, OK	74960	99203	Outpatient Services	101
		99455	Work related or medical disability evaluation services	(50th Percentile) 65
TOTAL COST				\$166
Seattle, WA	98144	99203	Outpatient Services	131
		99455	Work related or medical disability evaluation services	100
TOTAL COST				\$231
Milwaukee, WI	53222	99203	Outpatient Services	125
		99455	Work related or medical disability evaluation services	117
TOTAL COST				\$242
Brookline, MA	02446	99203	Outpatient Services	110
		99455	Work related or medical disability evaluation services	250
TOTAL COST				\$360
Los Angeles, CA	90034	99203	Outpatient Services	140
		99455	Work related or medical disability evaluation services	(50th Percentile) 312
TOTAL COST				\$452

Table 7

Medical Costs for Six Scenarios

SCENARIO II				
City and State	Zip Code	Code for Medical Treatment	Type of Medical Treatment/Service	Cost of Medical Service (in dollars)
Foley, AL	36535	99203	Outpatient Services (3 times)	(\$86x3)=\$258
		99244	Office consultation	193
		99302	Nursing facility services	104
		99354	Prolonged physician service with direct patient contact	161
		99455	Work related or medical disability evaluation services	NA
		11000	Debridement of extensive eczematous or infected skin; up to 10% of body surface	70
			TOTAL COST	\$786
Stilwell, OK	74960	99203	Outpatient Services (3 times)	(\$101x3)=303
		99244	Office consultation	216
		99302	Nursing facility services	96
		99354	Prolonged physician service with direct patient contact	129
		99455	Work related or medical disability evaluation services	(50th Percentile) 65
		11000	Debridement of extensive eczematous or infected skin; up to 10% of body surface	65
			TOTAL COST	\$874
Seattle, WA	98144	99203	Outpatient Services (3 times)	(\$131x3)=393
		99244	Office consultation	265
		99302	Nursing facility services	117
		99354	Prolonged physician service with direct patient contact	156
		99455	Work related or medical disability evaluation services	100
		11000	Debridement of extensive eczematous or infected skin; up to 10% of body surface	89
			TOTAL COST	\$1120
Milwaukee, WI	53222	99203	Outpatient Services (3 times)	(\$125x3)=375
		99244	Office consultation	267
		99302	Nursing facility services	129
		99354	Prolonged physician service with direct patient contact	229
		99455	Work related or medical disability evaluation services	\$117

Table 7

Medical Costs for Six Scenarios

SCENARIO II				
City and State	Zip Code	Code for Medical Treatment	Type of Medical Treatment/Service	Cost of Medical Service (in dollars)
		11000	Debridement of extensive eczematous or infected skin; up to 10% of body surface	108
			TOTAL COST	\$1225
Brookline, MA	02446	99203	Outpatient Services (3 times)	(\$110x3)=330
		99244	Office consultation	225
		99302	Nursing facility services	128
		99354	Prolonged physician service with direct patient contact	150
		99455	Work related or medical disability evaluation services	250
		11000	Debridement of extensive eczematous or infected skin; up to 10% of body surface	60
			TOTAL COST	\$1143
Los Angeles, CA	90034	99203	Outpatient Services (3 times)	(\$140x3)=420
		99244	Office consultation	289
		99302	Nursing facility services	150
		99354	Prolonged physician service with direct patient contact	187
		99455	Work related or medical disability evaluation services	(50th Percentile) 312
		11000	Debridement of extensive eczematous or infected skin; up to 10% of body surface	110
			TOTAL COST	\$1468

Table 7

Medical Costs for Six Scenarios

SCENARIO III				
City and State	Zip Code	Code for Medical Treatment	Type of Medical Treatment/Service	Cost of Medical Service (in dollars)
Foley, AL	36535	99203	Outpatient Services (4 times)	(\$86x4)=\$344
		99244	Office consultation	193
		99354	Prolonged physician service with direct patient contact	161
		99455	Work related or medical disability evaluation services	NA
		95004	Percutaneous test	4
		94044	Patch or application test	NA
			TOTAL COST	\$702
Stilwell, OK	74960	99203	Outpatient Services (4 times)	(\$101x4)=404
		99244	Office consultation	216
		99354	Prolonged physician service with direct patient contact	129
		99455	Work related or medical disability evaluation services	(50th Percentile) 65
		95004	Percutaneous test	5
		94044	Patch or application test	NA
			TOTAL COST	\$819
Seattle, WA	98144	99203	Outpatient Services (4 times)	(\$131x4)=524
		99244	Office consultation	265
		99354	Prolonged physician service with direct patient contact	156
		99455	Work related or medical disability evaluation services	100
		95004	Percutaneous test	6
		94044	Patch or application test	NA
			TOTAL COST	\$1051
Milwaukee, WI	53222	99203	Outpatient Services (4 times)	(\$125x4)=500
		99244	Office consultation	267
		99354	Prolonged physician service with direct patient contact	229
		99455	Work related or medical disability evaluation services	117
		95004	Percutaneous test	7
		94044	Patch or application test	NA
			TOTAL COST	\$1120
Brookline, MA	02446	99203	Outpatient Services (4 times)	(\$110x4)=440
		99244	Office consultation	225
		99354	Prolonged physician service with direct patient contact	\$150

Table 7

Medical Costs for Six Scenarios

SCENARIO III				
City and State	Zip Code	Code for Medical Treatment	Type of Medical Treatment/Service	Cost of Medical Service (in dollars)
		99455	Work related or medical disability evaluation services	250
		95004	Percutaneous test	6
		94044	Patch or application test	NA
		TOTAL COST		\$1071
Los Angeles, CA	90034	99203	Outpatient Services (4 times)	(\$140x4)=560
		99244	Office consultation	289
		99354	Prolonged physician service with direct patient contact	187
		99455	Work related or medical disability evaluation services	(50th Percentile) 312
		95004	Percutaneous test	7
		94044	Patch or application test	NA
		TOTAL COST		\$1355

Table 7

Medical Costs for Six Scenarios

SCENARIO IV				
City and State	Zip Code	Code for Medical Treatment	Type of Medical Treatment/Service	Cost of Medical Service (in dollars)
Foley, AL	36535	16025	Burns, local treatment	\$78
		99203	Outpatient Services	86
		99242	Office consultation	114
		99302	Nursing facility services	104
		99284	Emergency department visit	240
		95004	Percutaneous test	4
		95044	Patch or application test	NA
		99455	Work related or medical disability evaluation services	NA
			If skin grafting is performed:	
		01951	Anesthesia for burn excisions or debridement	35
		20926	Tissue grafts	NA
		15120	Free skin graft	(50th Percentile) 1088
			TOTAL COST	\$1749
Stilwell, OK	74960	16025	Burns, local treatment	104
		99203	Outpatient Services	101
		99242	Office consultation	132
		99302	Nursing facility services	96
		99284	Emergency department visit	236
		95004	Percutaneous test	5
		95044	Patch or application test	NA
		99455	Work related or medical disability evaluation services	(50th Percentile) 65
			If skin grafting is performed:	
		01951	Anesthesia for burn excisions or debridement	33
		20926	Tissue grafts	NA
		15120	Free skin graft	(60th Percentile) 1570
			TOTAL COST	\$2342
Seattle, WA	98144	16025	Burns, local treatment	163
		99203	Outpatient Services	131
		99242	Office consultation	145
		99302	Nursing facility services	117
		99284	Emergency department visit	218
		95004	Percutaneous test	6
		95044	Patch or application test	NA
		99455	Work related or medical disability evaluation services	100

Table 7

Medical Costs for Six Scenarios

SCENARIO IV				
City and State	Zip Code	Code for Medical Treatment	Type of Medical Treatment/Service	Cost of Medical Service (in dollars)
			If skin grafting is performed:	
		01951	Anesthesia for burn excisions or debridement	\$45
		20926	Tissue grafts	1200
		15120	Free skin graft	1515
			TOTAL COST	\$3640
Milwaukee, WI	53222	16025	Burns, local treatment	235
		99203	Outpatient Services	125
		99242	Office consultation	162
		99302	Nursing facility services	129
		99284	Emergency department visit	239
		95004	Percutaneous test	7
		95044	Patch or application test	NA
		99455	Work related or medical disability evaluation services	117
			If skin grafting is performed:	
		01951	Anesthesia for burn excisions or debridement	54
		20926	Tissue grafts	1307
		15120	Free skin graft	2086
			TOTAL COST	\$4461
Brookline, MA	02446	16025	Burns, local treatment	140
		99203	Outpatient Services	110
		99242	Office consultation	134
		99302	Nursing facility services	128
		99284	Emergency department visit	223
		95004	Percutaneous test	6
		95044	Patch or application test	NA
		99455	Work related or medical disability evaluation services	250
			If skin grafting is performed:	
		01951	Anesthesia for burn excisions or debridement	30
		20926	Tissue grafts	1000
		15120	Free skin graft	1800
			TOTAL COST	\$3821
Los Angeles, CA	90034	16025	Burns, local treatment	150
		99203	Outpatient Services	140
		99242	Office consultation	176
		99302	Nursing facility services	150

Table 7**Medical Costs for Six Scenarios**

SCENARIO IV				
City and State	Zip Code	Code for Medical Treatment	Type of Medical Treatment/Service	Cost of Medical Service (in dollars)
		99284	Emergency department visit	\$263
		95004	Percutaneous test	7
		95044	Patch or application test	NA
		99455	Work related or medical disability evaluation services	(50th Percentile) 312
			If skin grafting is performed:	
		01951	Anesthesia for burn excisions or debridement	55
		20926	Tissue grafts	800
		15120	Free skin graft	2200
			TOTAL COST	\$4253

Table 7

Medical Costs for Six Scenarios

SCENARIO V				
City and State	Zip Code	Code for Medical Treatment	Type of Medical Treatment/Service	Cost of Medical Service (in dollars)
Foley, AL	36535	99203	Outpatient Services (3 times)	(\$86x3)=\$258
		99242	Office consultation	114
		99354	Prolonged physician service with direct patient contact	161
		95004	Percutaneous test	4
		95044	Patch or application test	NA
		99455	Work related or medical disability evaluation services	NA
			TOTAL COST	\$537
Stilwell, OK	74960	99203	Outpatient Services (3 times)	(\$101x3)=303
		99242	Office consultation	132
		99354	Prolonged physician service with direct patient contact	129
		95004	Percutaneous test	5
		95044	Patch or application test	NA
		99455	Work related or medical disability evaluation services	(50th Percentile) 65
			TOTAL COST	\$634
Seattle, WA	98144	99203	Outpatient Services (3 times)	(\$131x3)=393
		99242	Office consultation	145
		99354	Prolonged physician service with direct patient contact	156
		95004	Percutaneous test	6
		95044	Patch or application test	NA
		99455	Work related or medical disability evaluation services	100
			TOTAL COST	\$800
Milwaukee, WI	53222	99203	Outpatient Services (3 times)	(\$125x3)=375
		99242	Office consultation	162
		99354	Prolonged physician service with direct patient contact	229
		95004	Percutaneous test	7
		95044	Patch or application test	NA
		99455	Work related or medical disability evaluation services	117
			TOTAL COST	\$890
Brookline, MA	02446	99203	Outpatient Services (3 times)	(\$110x3)=330
		99242	Office consultation	134

Table 7

Medical Costs for Six Scenarios

SCENARIO V				
City and State	Zip Code	Code for Medical Treatment	Type of Medical Treatment/Service	Cost of Medical Service (in dollars)
		99354	Prolonged physician service with direct patient contact	\$150
		95004	Percutaneous test	6
		95044	Patch or application test	NA
		99455	Work related or medical disability evaluation services	250
		TOTAL COST		\$870
Los Angeles, CA	90034	99203	Outpatient Services (3 times)	(\$140x3)=420
		99242	Office consultation	176
		99354	Prolonged physician service with direct patient contact	187
		95004	Percutaneous test	7
		95044	Patch or application test	NA
		99455	Work related or medical disability evaluation services	(50th Percentile) 312
		TOTAL COST		\$1102

Table 7

Medical Costs for Six Scenarios

SCENARIO VI				
City and State	Zip Code	Code for Medical Treatment	Type of Medical Treatment/Service	Cost of Medical Service (in dollars)
Foley, AL	36535	99203	Outpatient Services (4 times)	(\$86x4)=\$344
		99242	Office consultation	114
		99354	Prolonged physician service with direct patient contact	161
		95004	Percutaneous test	4
		95044	Patch or application test	NA
		99455	Work related or medical disability evaluation services	NA
			TOTAL COST	\$623
Stilwell, OK	74960	99203	Outpatient Services (4 times)	(\$101x4)=404
		99242	Office consultation	132
		99354	Prolonged physician service with direct patient contact	129
		95004	Percutaneous test	5
		95044	Patch or application test	NA
		99455	Work related or medical disability evaluation services	(50th Percentile) 65
			TOTAL COST	\$735
Seattle, WA	98144	99203	Outpatient Services (4 times)	(\$131x4)=524
		99242	Office consultation	145
		99354	Prolonged physician service with direct patient contact	156
		95004	Percutaneous test	6
		95044	Patch or application test	NA
		99455	Work related or medical disability evaluation services	100
			TOTAL COST	\$931
Milwaukee, WI	53222	99203	Outpatient Services (4 times)	(\$125x4)=500
		99242	Office consultation	162
		99354	Prolonged physician service with direct patient contact	229
		95004	Percutaneous test	7
		95044	Patch or application test	NA
		99455	Work related or medical disability evaluation services	117
			TOTAL COST	\$1015
Brookline, MA	02446	99203	Outpatient Services (4 times)	(\$110x4)=440
		99242	Office consultation	134

Table 7**Medical Costs for Six Scenarios**

SCENARIO VI				
City and State	Zip Code	Code for Medical Treatment	Type of Medical Treatment/Service	Cost of Medical Service (in dollars)
		99354	Prolonged physician service with direct patient contact	\$150
		95004	Percutaneous test	6
		95044	Patch or application test	NA
		99455	Work related or medical disability evaluation services	250
		TOTAL COST		\$980
Los Angeles, CA	90034	99203	Outpatient Services (4 times)	(\$140x4)=560
		99242	Office consultation	176
		99354	Prolonged physician service with direct patient contact	187
		95004	Percutaneous test	7
		95044	Patch or application test	NA
		99455	Work related or medical disability evaluation services	(50th Percentile) 312
		TOTAL COST		\$1242

Table 8**Total Quantifiable Costs Associated With Six Scenarios**

SCENARIO I¹					
State	Medical	Other Out-of-Pocket	4 Weeks Pay at 4 hours/week²	Total Cost to Worker	Net Loss to Worker³
Alabama	\$86	\$50	\$1,776	\$1,912	\$1,912
California	\$452	\$50	\$2,956	\$3,458	\$3,458
Massachusetts	\$360	\$50	\$3,376	\$3,786	\$3,786
Oklahoma	\$166	\$50	\$1,924	\$2,140	\$2,140
Washington	\$231	\$50	\$3,160	\$3,441	\$3,441
Wisconsin	\$242	\$50	\$2,748	\$3,040	\$3,040

¹ Key: bold: costs to worker

underline: cost to government/Workers' Compensation

double underline: third party payments by government/Workers' Compensation

² BLS, 1999, average hourly wage for 2,000 hours for cement masons and concrete finishers, in 2000 dollars.

³ Net loss to worker is total cost to worker minus transfer payments

Table 8

Total Quantifiable Costs Associated With Six Scenarios

SCENARIO II¹													
State	Medical	If ¼ out-of-pocket	If ¾ Medicaid	Other Out-of-pocket	Workers' Comp %	1 Year Temporary Total Disability WC Max	1 Year Food Stamps for Family of 3	Job Training	Lost Wages for 16 Months	Total Cost to Worker	Total 3rd Party Reimb	Govt/WC Cost	Net Loss to Worker²
Alabama	\$786	\$197	<u>\$589</u>	\$600	66.7%	<u>\$14,785</u>	<u>\$6,896</u>	<u>\$1,800</u>	\$29,600	\$30,397	\$21,681	\$24,070	(\$8,716)
California	\$1,468	\$367	<u>\$1,101</u>	\$600	66.7%	<u>\$23,648</u>	<u>\$6,896</u>	<u>\$1,800</u>	\$47,328	\$48,295	\$30,544	\$33,445	(\$17,751)
Massachusetts	\$1,143	\$286	<u>\$857</u>	\$600	60-66.7%	<u>\$27,039</u>	<u>\$6,896</u>	<u>\$1,800</u>	\$54,427	\$55,113	\$33,935	\$36,592	(\$21,178)
Oklahoma	\$874	\$219	<u>\$655</u>	\$600	70%	<u>\$16,282</u>	<u>\$6,896</u>	<u>\$1,800</u>	\$31,013	\$31,832	\$23,178	\$25,633	(\$8,654)
Washington	\$1,120	\$280	<u>\$840</u>	\$600	60-75%	<u>\$26,649</u>	<u>\$6,896</u>	<u>\$1,800</u>	\$52,640	\$53,520	\$33,545	\$36,185	(\$19,975)
Wisconsin	\$1,225	\$306	<u>\$919</u>	\$600	66.7%	<u>\$22,125</u>	<u>\$6,896</u>	<u>\$1,800</u>	\$44,293	\$45,199	\$29,021	\$31,740	(\$16,178)

¹ Key: bold: costs to worker
underline: cost to government/Workers' Compensation
double underline: third party payments by government/Workers' Compensation

² Net loss to worker is total cost to worker minus transfer payments

Table 8

Total Quantifiable Costs Associated With Six Scenarios

SCENARIO III¹				
State	Medical	Other Out-of-Pocket²	Total Cost to Worker	Net Loss to Worker³
Alabama	\$702	\$600	\$1,302	\$1,302
California	\$1,355	\$600	\$1,955	\$1,955
Massachusetts	\$1,071	\$600	\$1,671	\$1,671
Oklahoma	\$819	\$600	\$1,419	\$1,419
Washington	\$1,051	\$600	\$1,651	\$1,651
Wisconsin	\$1,120	\$600	\$1,720	\$1,720

- ¹ Key: bold: costs to worker
underline: cost to government/Workers' Compensation
double underline: third party payments by government/Workers' Compensation
- ² Includes steroids
- ³ Net loss to worker is total cost to worker minus transfer payments

Table 8

Total Quantifiable Costs Associated With Six Scenarios

SCENARIO IV¹											
State	Medical	If ¼ out-of-pocket	If ¾ Medicaid	Other Out-of-pocket	Food Stamps for 1	Job Training	1 Year Lost Wages²	Total Cost to Worker	Total 3rd Party Reimb	Govt/WC Cost	Net Loss to Worker³
Alabama	\$1,749	\$437	<u>\$1,312</u>	\$2,400	<u>\$1,560</u>	<u>\$1,800</u>	\$22,200	\$25,037	\$1,560	\$4,672	(\$23,477)
California	\$4,253	\$1,063	<u>\$3,190</u>	\$2,400	<u>\$1,560</u>	<u>\$1,800</u>	\$35,500	\$38,963	\$1,560	\$6,550	(\$37,403)
Massachusetts	\$3,821	\$955	<u>\$2,866</u>	\$2,400	<u>\$1,560</u>	<u>\$1,800</u>	\$40,820	\$44,175	\$1,560	\$6,226	(\$42,615)
Oklahoma	\$2,342	\$586	<u>\$1,756</u>	\$2,400	<u>\$1,560</u>	<u>\$1,800</u>	\$23,260	\$26,246	\$1,560	\$5,116	(\$24,686)
Washington	\$3,640	\$910	<u>\$2,730</u>	\$2,400	<u>\$1,560</u>	<u>\$1,800</u>	\$39,480	\$42,790	\$1,560	\$6,090	(\$41,230)
Wisconsin	\$4,461	\$1,115	<u>\$3,346</u>	\$2,400	<u>\$1,560</u>	<u>\$1,800</u>	\$33,220	\$36,735	\$1,560	\$6,706	(\$35,175)

¹ Key: bold: costs to worker
 underline: cost to government/Workers' Compensation
 double underline: third party payments by government/Workers' Compensation

² BLS, 1999, average hourly wage for 2,000 hours for cement masons and concrete finishers in 2000 dollars.

³ Net loss to worker is total cost to worker minus transfer payments

Table 8

Total Quantifiable Costs Associated With Six Scenarios

SCENARIO V ¹								
State	Medical	Out-of-Pocket ²	UI ³	Two Weeks Lost Wages ⁴	1 Year Lost Wages in Lower Paid Job ⁵	Total Cost to Worker	Total 3 rd Party Reimb	Net Loss to Worker ⁶
Alabama	\$537	\$600	<u>\$3,068</u>	\$1,310	\$15,640	\$18,087	\$3,068	(\$15,019)
California	\$1,102	\$600	<u>\$3,510</u>	\$1,790	\$14,500	\$17,992	\$3,510	(\$14,482)
Massachusetts	\$870	\$600	<u><u>\$14,352</u></u> ⁵	\$2,072	\$10,920	\$14,462	\$14,352	(\$110)
Oklahoma	\$634	\$600	<u>\$4,030</u>	\$1,145	\$8,260	\$10,639	\$4,030	(\$6,609)
Washington	\$800	\$600	<u>\$1,060</u> ⁷	\$2,049	\$15,440	\$18,889	\$1,060	(\$17,829)
Wisconsin	\$890	\$600	<u>\$4,680</u>	\$1,658	\$10,000	\$13,148	\$4,680	(\$8,468)

- ¹ Key: bold: costs to worker
 underline: cost to government/Workers' Compensation
 double underline: third party payments by government/Workers' Compensation
- ² Includes steroids.
- ³ Unemployment Insurance: weekly x 26 weeks.
- ⁴ BLS, 1999, average hourly wage for bricklayers in 2000 dollars.
- ⁵ Includes \$75/month dependent allowance per person.
- ⁶ Net loss to worker is total cost to worker minus transfer payments
- ⁷ The formula for Washington state is quite complex. See Table 11.

Table 8

Total Quantifiable Costs Associated With Six Scenarios

SCENARIO VI ¹														
State	Medical	If ¼ Out-of-Pocket	If ¾ WC	Out-of-Pocket ²	SSDI	Food Stamp s for Family of 8	TANF 26 weeks	Minimum Wage \$5,115 for 26 weeks	Lost Wages 26 Weeks	Lost Wages Due to Reduce Earnings 26 Weeks	Total Cost to Worker	Total 3 rd Party Reimb	Govt/W C Cost	Net Loss to Worker ⁴
Alabama	\$623	\$156	<u>\$467</u>	\$2,400	\$13,620	<u>\$9,372</u>	<u>\$834</u>	\$5,150	\$8,550	\$3,400	\$14,506	\$10,206	\$10,673	(\$4,300)
California	\$1,242	\$310	<u>\$932</u>	\$2,400	\$23,628	<u>\$9,372</u>	<u>\$3,309</u>	\$5,150	\$15,130	\$9,980	\$27,820	\$12,684	\$13,616	(\$15,136)
Massachusetts	\$980	\$245	<u>\$735</u>	\$2,400	\$27,768	<u>\$9,372</u>	<u>\$3,474</u> ³	\$5,150	\$20,440	\$15,290	\$38,375	\$13,346	\$14,081	(\$25,029)
Oklahoma	\$735	\$184	<u>\$551</u>	\$2,400	\$16,188	<u>\$9,372</u>	<u>\$1,752</u> ³	\$5,150	\$10,180	\$5,030	\$17,794	\$11,124	\$11,675	(\$6,670)
Washington	\$931	\$233	<u>\$698</u>	\$2,400	\$25,776	<u>\$9,372</u>	<u>\$1,500</u>	\$5,150	\$17,890	\$12,740	\$33,263	\$10,872	\$11,570	(\$22,391)
Wisconsin	\$1,015	\$254	<u>\$761</u>	\$2,400	\$24,084	<u>\$9,372</u>	<u>\$7,200</u>	\$5,150	\$15,720	\$10,570	\$28,944	\$16,572	\$17,333	(\$12,372)

¹ Key: bold: costs to worker
underline: cost to government/Workers' Compensation
double underline: third party payments by government/Workers' Compensation

² Includes medicines, transportation to doctor, over the counter products.

³ This payment is for a family of three.

⁴ Net loss to worker is total cost to worker minus transfer payments

Table 9

**Average Hourly Earnings, by State, for Cement Masons, Bricklayers,
and Construction Labor
2000**

State	Cement Mason	Bricklayer	Construction Labor
Alabama	\$11.10	\$16.37	\$ 8.55
California	\$18.35	\$22.38	\$15.13
Massachusetts	\$21.10	\$25.90	\$20.44
Oklahoma	\$12.02	\$14.31	\$10.18
Washington	\$19.74	\$25.61	\$17.89
Wisconsin	\$17.17	\$20.72	\$15.72

Note: Data are from 1999, adjusted to 2000 dollars

Source: Bureau of Labor Statistics

Table 10

**Workers' Compensation
Maximum Weekly Benefit and Percent of Weekly Wage**

State	% of Weekly Wage	Permanent Total Disability	Temporary Total Disability	Permanent Partial Disability
Alabama	66.7%	\$531	\$531	\$220
California	66.7%	\$490	\$490	\$230
Oklahoma	60-66.7%	\$473	\$473	\$237
Massachusetts	70%	\$831	\$831	\$623
Washington	60-75%	\$822	\$822	\$822
Wisconsin	66.7%	\$582	\$582	\$184

Table 11

Unemployment Compensation Benefits in Six States

State	Duration of Benefit (in weeks)	Weekly Benefit Amount	
		Minimum	Maximum
Alabama ¹	26	\$45	\$190
Oklahoma ²	26 times the weekly benefit amount <i>OR</i> 25% of the average annual wage <i>OR</i> 50% of the wages (whichever is less)	\$16	\$293
Washington ³	13-30	The weekly benefit amount is calculated as 4% of the average of the total wages reported in the two highest quarters of the base year. The total amount a claimant can potentially receive on a claim is called the maximum benefits payable. It is calculated as either 1/3 of the total base year wages or 30 times the WBA, whichever is the smaller amount. ⁴	
Wisconsin ⁵	26 times the weekly benefit rate <i>OR</i> 40% of the total covered base period wages (whichever is less)	\$46	\$313
Massachusetts ⁶	30	Approx. 50 percent of average weekly wage	\$477*
California ⁷	12-26	\$40	\$230

* There is also a \$25 a week [dependency allowance](#) for each dependent child. The amount of the dependency allowance cannot be more than 50 percent of the benefit rate, no matter how many the dependent children are in number.

Sources:

- ¹ <http://www.dir.state.al.us/ucclaims.htm>, downloaded June 6, 2001.
- ² <http://www.oesc.state.ok.us/ui/default.htm>, downloaded June 6, 2001.
- ³ <http://www.wa.gov/esd/ui/webpbr.htm>, downloaded June 6, 2001.
- ⁴ <http://www.wa.gov/esd/ui/ui101/mon.htm>, downloaded June 6, 2001.
- ⁵ <http://www.dwd.state.wi.us/uiben/apply.htm#qualify>, downloaded June 6, 2001.
- ⁶ <http://www.detma.org/claimant/uiworks/calculations.htm>, downloaded June 6, 2001.
- ⁷ <http://www.weddc.cahwnet.gov/uifaq.htm#payments>, downloaded June 6, 2001

Table 12

Approximate TANF Payments for Six Selected States

State	Approximate Payment
Alabama	\$139 per month
California	\$538-565 per month
Massachusetts	\$579 per month for a family of 3
Oklahoma	\$292 per month for a family of 3
Washington	\$1,500 per year as diversion cash
Wisconsin	\$150 per person per month

Source: State web-pages

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Bibliography

353 S.W.2d 108; 1961 Mo. App. November 6, 1961.

435 So. 2d 575; 1983 La. App. June 29, 1983.

46 Cal. 2d 190; 293 P.2d 26; 1956 Cal. February 10, 1956.

52 A.D.2d 202; 383 N.Y.S.2d 729; 1976 N.Y. App. Div. May 21, 1976.

57 Wis. 2d 190; 203 N.W.2d 687; 1973 Wisc. LEXIS 1538.

Adams, Baggs, Limaye, Parsons, and Absi, "Hand Washing References and Abstracts," <http://www.hi-tm.com/Documents/handwashing.html>, downloaded July 19, 2000.

Advanced Cement Technologies, <http://www.metakaolin.com>, downloaded January 13, 2000.

Alamo Cement Company, Material Safety Data Sheet for Portland Cement, fax received June 22, 2000.

American Concrete Institute, "The New ACI 318-99 Building Code," <http://www.aci-int.net/seminars/3182000.htm>, downloaded June 5, 2000.

American Contact Dermatitis Society, <http://www.contactderm.org>, downloaded July 19, 2000.

American Medical Association, Current Procedural Technology (CPT) 2001.

American Society for Testing and Materials (ASTM), "Hexavalent Chromium in Portland Cement, Citation Information," <http://www.astm.org/JOURNALS/CEMENT/PAGES/6.htm>, downloaded December 18, 2001.

Arrotti, Gerard, "Fit the Gloves to the Hazard," Occupational Health and Safety.

Artesia Ready Mix Concrete-Material Safety Data Sheet, <http://msds.pdc.cornell.edu/msds/siri/ms>, downloaded July 6, 2000.

Avnstorp, Christian, "Risk Factors for Cement Eczema," Contact Dermatitis, 1991:25:81-88.

Baranowska-Dutkiewicz B., "Absorption of hexavalent chromium by skin in man," Arch Toxicol, Vol. 47, No. 1, March 1981.

Barceloux, D. G. "Chromium," Journal of Toxicology and Clinical Toxicology, Vol. 37, No. 2, 1999.

Becker, William J. and Stephenson, William C., eds., "Field Sanitation: OSHA Standard 1928.110," University of Florida Cooperative Extension Service, Fact Sheet AE-132, November 1992.

Benson, Doreen, "Disability Coverage Helps Safeguard Workers of All Ages," The Detroit News: Strategies, Monday, July 27, 1998, <http://www.detnews.com/STRAT/9807/27/benson/benson.htm>, downloaded March 9, 2001.

Best Manufacturing Company, "Chemical Resistant," <http://www.bestglove.com>, downloaded June 22, 2000.

Bickman, Julie B., "Eight Steps to Better Glove Selection," Occupational Health and Safety.

Blue Circle Cement, "Health and Safety Information – Portland Cements," <http://www.bluecircle.co.uk/>, Summer 2001.

Burndt, U., Wigger-Alberl, W., Gabard, B., and Elsner, P., "Efficacy of a Barrier and Its Vehicle as Protective Measures Against Occupational Irritant Contact Dermatitis," National Library of Medicine, <http://www.ncbi.nlm.nih.gov>, downloaded April 27, 2000.

Burnett, Carol A., "Occupational Dermatitis Causing Days Away From Work in U.S. Private Industry, 1993," American Journal of Industrial Medicine, July 1998.

California Portland Cement, Material Safety Data for Portland Cement, <http://msds.pdc.cornell.edu/msds/siri/ms>, downloaded July 6, 2000.

Calveras Cement Company, Material Safety Data Sheet for Portland Cement, fax received July 5, 2000.

The Center to Protect Workers' Rights, "A Safety and Health Practitioner's Guide to Skin Protection," 1999.

The Center to Protect Workers' Rights, "Physician's Alert," Electronic Library of Construction Occupational Safety and Health, <http://www.cdc.gov/niosh/elcosh/docs/d0200/d000281/d000281.html>, downloaded April 11, 2001.

Chicago Construction Network, <http://www.chicagoconstruction.com/search/c-htms/cemtn.htm>, downloaded January 13, 2000.

Childs, Nathan D., "Cement Factories See Drop in Chromate Dermatitis," <http://www.medscape.com/IMNG/SkinAllergyNews/1997v.28n10/san2810.17.02.html>, downloaded January 13, 2000.

Clary Meuser Research Network, "Allergic Contact Dermatitis: High Risk Jobs," <http://www.hazmap.com/workers.htm>, downloaded January 13, 2000.

Coenraads, P. J. and Nater J. P., "Sickness and absence from work due to skin diseases in the construction industry," Derm Beruf Umwelt, Vol. 32, No. 1, 1984.

Colombia Northwest Inc., Material Safety Data Sheet for Portland Cement, <http://msds.pdc.cornell.edu/msds/siri/ms>, downloaded July 6, 2000.

Commonwealth of Australia, "Cement Dermatitis," ISBN 0 644 24559 X, 1993.

Concrete Construction, "Buffering Solution Stops the Burn," March 1998.

Concrete Producer, "How to Save Your Customer's Skin," copyrighted by The Aberdeen Group, September 18, 1998.

Conde-Salazar, L., Guimaraens, D., Villegas, C., Romero, A., and Gonzalez, M. A., "Occupational allergic contact dermatitis in construction workers," Contact Dermatitis, Vol. 33, No. 4, October 1995.

"Contact Dermatitis in Subjects Infected With HIV Type 1," Journal of the American Academy of Dermatology, May 1999, Part 1, Volume 40, Number 5, <http://www.eblue.org/scripts/om.dll/ser>, downloaded July 19, 2000.

"Contact Dermatitis," Web MD Health, <http://my.mebmd.com/contst/aset/adam/diseaseposonivy>, downloaded August 3, 2000. (Web link not working August 2001.)

Corbin, Juliet and Strauss, Anselm, Unending Work and Care: Managing Chronic Illness at Home, Jossey-Bass: San Francisco, 1988.

"The Cost of Occupational Skin Disease," Archives of Dermatological Research, Vol. 121, March 1985.

Covey, C. D., "Field Sanitation and Drinking Water-Federal," University of Florida Cooperative Extension Service, Fact Sheet FRE-91, July 1992.

Covington and Burling, "Tort Issues Related to Contact With Wet Concrete," Prepared for the Board of the National Ready Mix Concrete Association, January 1997.

CRS Rinker Materials, Material Safety Data Sheet for Portland Cement, fax received July 3, 2000.

Curtis, Wynne, "(Environ-Safety) Porta Potties Hygiene," E-mail received April 13, 2000.

De Raeve, Vandecasteele, Demedts, and Nemery, "Dermal and Respiratory Sensitization to Chrome in a Cement Floorer," American Journal of Industrial Medicine, 1998: 34:169-176.

Dessoff, Alan L., "Get a Grip on Hand PPE," Safety+Health, July 1995.

Deutsche Bauchemie, "Trade Ruling 'Low-Chromate cements and Products,'" http://www.deutsche-bauchemie.de/8branche/83_chrom-engl.htm, downloaded April 29, 2002.

Einarsson, O., Kylin, B., Lindstedt, G., and Wahlberg, J. E., "Chromium, cobalt and nickel in used cutting fluids," Contact Dermatitis, Vol. 1, No. 3, June 1975.

Electronic Textbook of Dermatitis, "Contact Dermatitis - Sensitizer Type," <http://www.telemedicine.org/stamford.htm>, downloaded February 15, 2001.

Ellis, V. and Freeman, S., "Dermatitis due to chromate in cement, Part I: Chromate content of cement in Australia," Australasian Journal of Dermatology, Vol. 27, No. 2, 1986.

El-Sayaad, Ibrahim and Al-Sayeed, Kholoud, "Contact Dermatitis and Patch Testing Clinic," <http://www.geocities.com/HotSprings/Spa/8355/patch.html>, downloaded April 29, 2002.

eMedicine World Medical Library, "Contact Dermatitis," <http://www.emedicine.com/PED/topic2569.htm>, downloaded July 19, 2000.

Eng-Tips Forums, <http://www.eng-tips.com/gviewthread.cfm/lev2/26/lev3/72/pid/591/qid/700>, downloaded May 24, 2001.

Essroc Materials, Material Safety Data Sheet for Portland Cement, fax received July 6, 2000.

European Commission, Directorate-General Health and Consumer Protection, Scientific Committee on Toxicity, Ecotoxicity and the Environment (CSTEE), "Risks to Health from Chromium VI in Cement," Brussels, C2/AST/scteeop/Chromium VI 27062002/D(02), June 2002.

European Society of Contact Dermatitis, "The Patch Test," http://www.dermis.net/org/escd/patch_testing.htm, downloaded April 22, 2002.

FOF Communications, "Safety and Health Practitioner's Guide to Skin Protection – For Work With Wet Cement in Construction," 1999.

"The Food Stamp Program," <http://www.foodusa.org>, downloaded July 13, 2001.

Foussereau, J., Benezra, C., Maibach, H. I., and Hjorth, N., "Bricklayers," Occupational Contact Dermatitis: Clinical and Chemical Aspects, Philadelphia, Pennsylvania, W. B. Saunders Company, 1982, (abstract), <http://toxnet.nlm.nih.gov/cgi-bin/sis/search/f?/temp/~AAARfaG1K:15>, downloaded June 5, 2001.

Force Field Technologies, Inc., "Neutralite: Safety Solution," <http://www2.itexas.net/forcefield/page2.htm>, downloaded August 18, 2002.

Freeman, Susanne "Dermatitis due to chromate in cement: part II - Incidence of cement dermatitis in Australia," Australasian Journal of Dermatology, Vol. 27, No. 3, 1986.

Fregert, Gruvberger and Sandahl, eds, "Reduction of Chromate in Cement By Iron Sulfate," Contact Dermatitis 1979:5:39-42.

Gad, S. C., "Acute and Chronic Systemic Chromium Toxicity," Science and Total Environment, October 1989, Volume 86, No. 1-2.

German Cement Works Association, "Responsibility for employees," Activity Report of the VDZ, 1999-2001, http://www.vdz-online.de/daten/tb_00_01/en/script/start.htm, downloaded April 29, 2002.

Glen Falls Cement, Material Safety Data Sheet for Portland Cement, fax received July 6, 2000.

Glo Germ Company, <http://www.glogerm.com>, downloaded June 6, 2000.

Goh C. L. and Gan S. L., Ministry of Labour, Singapore, "Change in Cement in Manufacturing Process, a Cause for Decline in Chromate Allergy" Contact Dermatitis, 1996.

Goh, C. L. and Gan, S. L., "The Effect of Barrier Cream and 'After-Work' Emollient Cream on Occupational Dermatitis From Cutting Oil," (Abstract), 9th International Symposium on Contact Dermatitis, Stockholm, Sweden, 1985.

Goh C. L., "Sickness Absence Due to Occupational Dermatoses in a Prefabrication Construction Industry," Contact Dermatitis, 15, 1986.

Goh, C. L., Wong, P. H., Kwok, S. F., and Gan, S. L., "Chromate allergy: total chromium and hexavalent chromate in the air," Derm Beruf Umwelt, Vol. 34, No. 5, September-October 1986, pp. 132-134.

Goh, Gan, and Ngui, "Occupational Dermatitis in a Prefabrication Construction Factory," Contact Dermatitis, Vol. 15, No. 4, October 1986.

Goon, A. T. and Goh, C. L., "Epidemiology of occupational skin disease in Singapore 1989-1998," Contact Dermatitis, Vol. 43, No. 3, September 2000, pp. 133-136.

Guo, Y. L., Wang, B. J., Yeh, K. C., Wang, J. C., Kao, H. H., Wang, M. T., Shih, H. C., and Chen, C. J., "Dermatoses in cement workers in southern Taiwan," Contact Dermatitis, Vol. 40, No. 1, Jan 1999.

Handley, J. and Burrows, D., "Dermatitis from hexavalent chromate in the accelerator of an epoxy sealant (PR1422) used in the aircraft industry," Contact Dermatitis, Vol. 30, No. 4, Apr 1994.

Hjorth, Lars, "The occurrence and prevention of cement eczema," World Cement September 1995.

Halbert, A. R., Gebaur, K. A., and Wall, L. M., eds., "Prognosis of Occupational Chromate Dermatitis," Contact Dermatitis, 1992:27.

Health and Safety Executive, "Cement," <http://www.hse.gov.uk/pubns/cis26.htm>, downloaded January 13, 2000.

Heller, F. F., "The Prognosis in Industrial Dermatitis," British Medical Journal, January 25, 1958.

Holnam Inc., Material Safety Data Sheet for Portland Cement, <http://msds.pdc.cornell.edu/msds/siri/ms>, downloaded July 6, 2000.

Holness, Linn D. and Nethercott, James R., "Work Outcome in Workers With Occupational Skin Disease," American Journal of Industrial Medicine 27, 1995.

Imperial Inc., Material Safety Data Sheet for Portland Cement, <http://www.imperialinc.com/msd004110.shtml>, downloaded August 3, 2000.

International Metalworkers Federation, Occupational Skin Diseases, Switzerland, 1986.

Irvine, C., Pugh, C. E., Hansen, E. J., and Rycroft, R. J., "Cement dermatitis in underground workers during construction of the Channel Tunnel," Occup Med (Lond), Vol. 44, No. 1, February 1994.

Johnston, Mona, Martin, Don, Martin, Maggie, and Gumaer, Jim, "Long-Term Parental Illness and Children: Perils and Promises," The School Counselor, January 1992, Vol. 39.

Kanerva, L., Finnish Institute of Occupational Health, "A Review of Skin Sensitization Caused by Chromium," The Chromium File, International Chromium Development Association, October 1996, <http://www.chromium-asoc.com/crfile2oct96.htm>, downloaded July 5, 2000.

Kanerva, L., Elsner, P., Wahlberg, J. E., and Maibach, H. I., "Classification of Occupations," Handbook of Occupational Dermatology 2000, Chapters 1-3.

Kaufman, Joel, Cohen, Martin, Sama, Susan, Shields, Joanne, and Kalat, John, "Occupational Skin Diseases in Washington State, 1989 Through 1993: Using Workers' Compensation Data to Identify Cutaneous Hazards," American Journal of Public Health, July 1998, Vol. 88, No. 7.

Kiec- "Occupational allergic contact dermatitis in Lodz: 1990-1994," Occup Med (Lond), Vol. 46, No. 3, June 1996.

Klemm, W. A., "Hexavalent Chromium in Portland Cement," <http://www.astm.org/JOURNALS/CEMENT/PAGES/6.htm>, downloaded December 18, 2001.

Kristiansen, J., Christensen, J. M., and Byrialsen, K., "A DANREF certified reference material for chromate in cement," Analyst, Vol. 122, No. 10, October 1997.

Lafarge Florida Inc., "Working Safely with Concrete," fax received June 22, 2000.

Larson, M. and Wolford, R., "Survey of Apprentice Cement Masons," FOF Communications, Report to NIOSH/CPWR Consortium, 1997.

Legal Information Institute, "Unemployment Compensation Law: An Overview," http://www.law.cornell.edu/topics/unemployment_compensation.html, downloaded May 16, 2001.

Lehigh Portland Cement Company, Material Safety Data Sheet for Portland Cement, fax received June 22, 2000.

Leow, Y. H. and Goh, C. L., "Contact allergy in Singapore," Asian Pac J Allergy Immunol, Vol. 17, No. 3, September 1999.

Lips, R., Rast, H., and Elsner, P., "Outcome of Job Change in Patients with Occupational Chromate Dermatitis," Contact Dermatitis, 1996, 34.

Lushniak, Boris, "The Public Health Impact of Irritant Contact Dermatitis," Contact Dermatitis, Volume 17, Number 3, August 1997.

Meade, Vicki, "What You Should Know About Barrier Creams," Occupational Health and Safety, June 1995, pp. 51-54.

Meding, Birgita and Swanbec, Gunnar, "Consequences of Having Hand Eczema," Contact Dermatitis, 1990: 23:6-14.

Miller, Claudia S., Invited Testimony Before the Subcommittee on National Security, Veterans Affairs and International Affairs, United States House of Representatives, February 2, 2000.

Miller, Claudia S., "Toxicant-Induced Loss of Tolerance-An Emerging Theory of Disease," Environmental Health Perspectives, Vol. 105, Supplement 2, March 1997.

MMWR Weekly, “Cercarial Dermatitis Outbreak at a State Park,” <http://www.cdc.gov/epo/mmwr/preview/mmwrhtml/00015689.htm>, downloaded March 17, 2000.

MMWR Weekly, “Dermatitis Among Workers Cleaning the Sacramento River,” <http://www.cdc.gov/epo/mmwr/preview/mmwrhtml/00015689.htm>, downloaded March 17, 2000.

MMWR Weekly, “Dermatitis Associated with Cashew Nut Consumption,” <http://www.cdc.gov/epo/mmwr/preview/mmwrhtml/0001269.htm>, downloaded March 17, 2000.

MMWR Weekly, “Epidemiologic Notes and Reports on Outbreak of Severe Dermatitis Among Orange Pickers,” <http://www.cdc.gov/epo/mmwr/preview/mmwrhtml/00000768.htm>, downloaded March 17, 2000.

Mountain Cement, Material Safety Data Sheet for Portland Cement, <http://msds.pdc.cornell.edu/msds/siri/ms>, downloaded July 6, 2000.

Mullarky, Jon, “How to Save Your Customer’s Skin,” The Concrete Producer, October 1997.

“Multiple Chemical Sensitivities Syndrome: A Review,” American Journal of Contact Dermatitis, 1996 Vol. 7, No. 4.

Nash, James L., “Skin Care: Starting from Scratch,” Occupational Hazards, April 2000.

National Academy of Social Insurance, Workers’ Compensation: Benefits, Coverage, and Cost, 1997-1998,” Washington, DC, May 2000.

National Institute for Occupational Safety and Health, “An Employer’s Guide to Skin Protection: For Work With Wet Cement in Construction,” 1999.

National Institute for Occupational Safety and Health, National Occupational Research Agenda (NORA), “Allergic and Irritant Dermatitis,” <http://www.cdc.gov/niosh/nrderm.html>, downloaded February 15, 2001.

National Institute for Occupational Safety and Health, “Occupational Dermatoses – A Program for Physicians,” <http://www.cdc.gov/niosh/ocderm1.html>, downloaded April 26, 2001.

National Library of Medicine, Toxicology Data Network, “Chromium: Human Health Effects,” <http://toxnet.nlm.nih.gov/cgi-bin/sis/search/f?./temp/~AAAAQaOKU:1:FULL>, downloaded July 20, 2000.

National Occupational Health & Safety Commission, Commonwealth of Australia, "Dermatitis due to chromate in cement: part I – Chromate content of cement in Australia," abstract, <http://www.nohsc.gov.au/OHSInformation/Databases/OHSLITPGM/OHSLIT/d/000364.htm>, downloaded August 18, 2002.

National Occupational Health & Safety Commission, Commonwealth of Australia, "Dermatitis due to chromate in cement: part II – Incidence of cement dermatitis in Australia," abstract, <http://www.nohsc.gov.au/OHSInformation/Databases/OHSLITPGM/OHSLIT/d/000365.htm>, downloaded August 18, 2002.

National Occupational Health & Safety Commission, Commonwealth of Australia, "Occupational dermatitis: an epidemiological study in the rubber and cement industries," abstract, Australia," <http://www.nohsc.gov.au/OHSInformation/Databases/OHSLITPGM/OHSLIT/d/000366.htm>, downloaded August 18, 2002.

National Occupational Health & Safety Commission, Commonwealth of Australia, "Chromate dermatitis and sodium dithionite," abstract, <http://www.nohsc.gov.au/OHSInformation/Databases/OHSLITPGM/OHSLIT/c/000363.htm>, downloaded August 18, 2002.

National Ready Mixed Concrete Association and American Society of Concrete Contractors, "Checklist for Concrete Pre-Construction Conference," received August 2000.

National Ready Mixed Concrete Association, "Tort Issues Related to Contact with Wet Concrete," Prepared for The Board of The National Ready Mixed Concrete Association, January 1997.

Nethercott, J., Paustenbach, D., Adams, R., Fowler, J., Marks, J., Morton, C., Taylor, J., Horowitz, S., and Finley, B., "A study of chromium induced allergic contact dermatitis with 54 volunteers: implications for environmental risk assessment," Occup Environ Med., Vol. 51, No. 6, June 1994.

New Jersey Department of Health and Senior Services, "Hazardous Substance Fact Sheet for Chromium," January 2000.

NOLO Law for All, "Medicare and Medicaid Explained," <http://www.nolo.com/encyclopedia/articles/ret/OA8.html>, downloaded April 30, 2001.

Occupational Health Foundation, "How to Save Your Skin: Preventing Skin Problems in the Construction Industry - Symposium Findings and Recommendations," December 1996.

Onoda Cement LTD, Material Safety Data Sheet for Ready Mix Concrete, <http://msds.pdc.cornell.edu/msds/siri/ms>, downloaded July 6, 2000.

Operative Plasterers and Cement Masons International Association, "Physicians Alert:

Occupational Contact Dermatitis,” 1996.

Operative Plasterers and Cement Masons International Association “Save Your Skin: Tips on Preventing Skin Problems,” 1996.

Peterson, Chris L. and Vistnes, Jessica P., “State Differences in Job-Related Health Insurance, 1996,” MEPS Chartbook No. 4, <http://www.meps.ahcpr.gov/papers/00-0017/chrtbk4.htm>, downloaded February 8, 2001.

Podall, Jim, “Examine the Hazards When Choosing Hand and Arm Protection,” Occupational Health and Safety, July 1997.

Pollock, Scott, EZ_QUI Industries, interviewed June 6, 2000.

Portland Cement Association, “Cement Industry: Industry Overview,” http://www.portcement.org/cem/cementindustry_industryover.asp, downloaded May 24, 2001.

Portland Cement Association, Concrete Basics, “Working Safely with Concrete,” http://www.portcement.org/cb/concretebasis_working.asp, downloaded August 18, 2002.

Protèque International, “Contact Dermatitis: A Major Occupation Health Problem,” <http://www.proteque.com/documents/report.html>, downloaded July 19, 2000.

Riverside Cement, Material Safety Data Sheet for Portland Cement, <http://msds.pdc.cornell.edu/msds/siri/ms>, downloaded July 6, 2000.

Roanoke Cement Co., Material Safety Data Sheet for Portland Cement, <http://msds.pdc.cornell.edu/msds/siri/ms>, downloaded July 6, 2000.

Roto, P., “Case Studies: Prevention of Occupational Dermatoses Among Workers Exposed to Cement Dust,” Encyclopedia of Occupational Safety and Health, Chapter 93-Construction, <http://www.cdc.gov/niosh/elcosh/docs/d0200/d000293/d000293.html>, downloaded April 10, 2001.

Roto, P., Sainio, H., Reunala, T., and Laippala, P., “Addition of Ferrous Sulfate to Cement and Risk of Chromium Dermatitis Among Construction Workers,” Contact Dermatitis, 1996: 14.

Rudzki, E. and Kozłowska, A., “Causes of chromate dermatitis in Poland” Contact Dermatitis April 1980, Vol. 6, No. 3.

Silpro Corporation, <http://www.silpro.com>, downloaded June 22, 2000.

Smith, S. L., “Thin Skinned: The Risks of Dermal Exposure,” Occupational Hazards, September 1993.

Social Security Administration, "How Worker's Compensation and Other Disability Payments May Affect Your Benefits," SSA Publication No. 05-10018, June 1997, <http://www.ssa.gov/pubs/10018.html>.

Social Security Administration, Office of Policy, "Programs: Disability," <http://www.ssa.gov/policy/programs>, downloaded March 1, 2001.

Steris Corporation, Material Safety Data Sheet for Portland Cement, fax received April 24, 2000.

Swedish Council for Work Life Research, "Occupational Contact Allergy to Metals," Newsletter, March 1999.

University of Wales College of Medicine, Department of Dermatology, "Chromate: Contact Dermatitis Information," <http://www.archive.uwcm.ac.uk/uwcm/dm/contact/chromate.html>, downloaded April 29, 2002.

U.S. Department of Commerce, Bureau of the Census, "1997 NAICS Definitions," <http://www.census.gov/epcd/naic/NDEF235.HTM>, downloaded June 7, 2000.

U.S. Department of Commerce, Bureau of the Census, 1997 Economic Census, "Bridge Between NAICS and SIC, Core Business Statistics Series," 1997.

U.S. Department of Commerce, Bureau of the Census, 1997 Economic Census, "Cement Manufacturing," October 1999.

U.S. Department of Commerce, Bureau of the Census, 1997 Economic Census, "Concrete Block and Brick Manufacturing," November 1999.

U.S. Department of Commerce, Bureau of the Census, 1997 Economic Census, "Concrete Pipe Manufacturing," November 1999.

U.S. Department of Commerce, Bureau of the Census, 1997 Economic Census, "Construction Subject Series," April 2000.

U.S. Department of Commerce, Bureau of the Census, 1997 Economic Census, "Industry Summary: Construction," January 2000.

U.S. Department of Commerce, Bureau of the Census, 1997 Economic Census, "Other Concrete Product Manufacturing," November 1999.

U.S. Department of Commerce, Bureau of the Census, 1997 Economic Census, "Ready-Mix Concrete Manufacturing," November 1999.

U.S. Department of Health and Human Services, Health Care Finance Administration, "Medicaid," <http://www.hcfa.gov/medicaid/medicaid.htm>, downloaded April 30, 2001.

U.S. Department of Health and Human Services, National Library of Medicine, <http://www.ncbi.nlm.nih.gov>, downloaded March 15, 2000.

U.S. Department of Health and Human Services, NIOSH, A NIOSH Look at Data From the Bureau of Labor Statistics: Worker Health by Industry and Occupation, DHHS (NIOSH) Publication No. 2001-120.

U.S. Department of Health and Human Services, NIOSH, “Toxicologic Review of Selected Chemicals, Portland Cement,” CAS:65997-15-1, <http://www.cdc.gov/niosh/pel88/65997-15.html>, downloaded April 29, 2002.

U.S. Department of Health and Human Services, NIOSH/NORO, “Allergic and Irritant Dermatitis/Background and Definitions,” <http://www.cdc.gov/niosh/skn-dis.html>, downloaded March 17, 2000.

U.S. Department of Labor, Bureau of Labor Statistics, “1999 National Occupational Employment and Wage Estimates, Construction and Extraction Occupations,” http://stats.bls.gov/oes/1999/oes_47Co.htm, downloaded July 16, 2001.

U.S. Department of Labor, Bureau of Labor Statistics, <http://146.142.4.24/servlet/SurveyOutputServlet?jrnsessionid=995315925086308153>, downloaded July 16, 2001.

U.S. Department of Labor, Bureau of Labor Statistics, “Cement Masons, Concrete Finishers, and Terrazzo Workers,” Occupational Outlook Handbook, <http://www.bls.gov/coc/ocos204.htm>, downloaded June 7, 2000 and August 14, 2000.

U.S. Department of Labor, Bureau of Labor Statistics, “Construction,” Occupational Outlook Handbook, <http://www.bls.gov/oco/eg/egs003.htm>, downloaded August 28, 2000.

U.S. Department of Labor, Bureau of Labor Statistics, <http://146.142.4.24/cgi-bin/surveymost>, downloaded July 23, 2001.

U.S. Department of Labor, Occupational Safety and Health Administration, “Criteria for Personal Protective Equipment: 1926.95,” <http://www.osha-slc.gov/OsStddata/19260095.html>, downloaded July 11, 2000.

U.S. Department of Labor, Occupational Safety and Health Administration, “Hand Protection-1910.138,” <http://www.osh-slc.gov/OshStddata/19100138.html>, downloaded June 6, 2000.

U.S. Department of Labor, Occupational Safety and Health Administration, “OSHA Regulations: Sanitation-1926.51,” http://www.osh-slc.gov/OshStd_data/1926_0051.html, downloaded July 12, 2000.

U.S. Department of Labor, Occupational Safety and Health Administration, “OSHA Standards Interpretation and Compliance Letters: CFR 1926.51(f),” <http://www.osha-slc.gov/OshDoc/Interpdata/I19940210B.html>, downloaded June 14, 2000.

U.S. Department of Labor, Occupational Safety and Health Administration, “Semi Annual Regulatory Agenda,” Federal Register, 63, November 22, 1999.

“Utility of a Standard Allergen Series Alone in the Evaluation of Allergic Contact Dermatitis: A Retrospective Study of 731 Patients,” Journal of the American Academy of Dermatology, June 1997, part 1, Volume 36, Number 6, <http://www.eblue.org/scripts/om.dll/ser>, downloaded July 19, 2000.

Varigos, G. A. and Dunt, D. R., “Occupational Dermatitis: An Epidemiological Study in the Rubber and Cement Industries,” Contact Dermatitis, 1981:7.

Vineland Pediatrics, “Therapy for Allergic Disease,” <http://www.vped.com/allergy.html>, downloaded July 19, 2000.

Wall, L. M., “Chromate Dermatitis and Sodium Dithionite,” Contact Dermatitis, 1982:8, pp. 291-293.

Wigger-Alberti, W. and Elsner, P., “Do Barrier Creams and Gloves Prevent or Provoke Contact Dermatitis,” American Journal of Contact Dermatitis, http://www.wbsaunders.com/AmJContactDerm/ab9_2/264877.htm, downloaded June 19, 2000.

Welfare Information Network, <http://www.welfareinfo.org/food.htm> downloaded April 30, 2001.

Wong, S. S., Chan, M. T., Gan, S. L., Ng, S. K., and Goh, C. L., “Occupational Chromate Allergy in Singapore: a study of 87 patients and a review from 1983 to 1995,” American Journal of Contact Dermatitis, 1998, Vol. 9, No. 1.

Appendix 1

Methodology

This paper supports the overall work of a three year NIOSH-supported study by The Center to Protect Workers' Rights. In testing an intervention to reduce occupational dermatitis and cement burns in construction workers who are exposed to wet Portland cement, CPWR is also developing the costs of the intervention and the comparative costs of non-prevention; i.e., disease and burns.

The challenges of this paper, methodologically, are:

1. To estimate the number of construction workers exposed to wet Portland cement
2. To estimate the number of exposed construction workers who experience cement burns and contact dermatitis
3. To estimate the number of exposed construction workers who develop allergic dermatitis
4. To estimate the medical costs associated with cement-related skin problems
5. To estimate non-medical costs, such as lost wages, disability insurance, unemployment insurance, and Workers' Compensation
6. To estimate lost productivity to employers
7. To estimate the amount of time it takes to wash ones hands at a work site
8. To estimate the costs of pH neutralizing soaps and solutions.

For numbers 1 through 3 above, the authors of this report relied on data from the Bureau of Labor Statistics, the Census, and other published literature. Estimation of medical and non-medical costs and of costs for hand washing on the job, involved several steps:

- Six scenarios are created to outline possible sequential events leading to development of irritant or contact dermatitis in workers exposed to wet cement at work. Those in construction trades such as cement masons, bricklayers, cement floorers, laborers, and highway construction workers are most often exposed to wet cement, and workers from these trades are in the scenarios. The scenarios acknowledge that different workers exposed to wet cement will exhibit differences in the severity and type of dermatitis they develop due to variations in individual susceptibilities, duration of exposure, use of PPE, and the stage at which successful medical diagnosis of their condition and the appropriate medical intervention occurs.
- Acknowledging a range of costs for the same treatment, based on geographic location of treatment, each scenario has six associated costs. These costs are based on zip codes across the country which range in level of expense. The six locations are in Foley, Alabama; Los Angeles, California; Brookline, Massachusetts; Stilwell, Oklahoma; Seattle, Washington; and Milwaukee, Wisconsin.

- To determine medical costs associated with cement dermatitis, the Current Procedural Technology (CPT) 2001,¹⁴⁹ Standard Edition, was used to identify codes used in the medical insurance industry for services and procedures associated with diagnosis and treatment of dermatitis. Medical utilization software was used to determine the 75th percentile of cost (most commonly used by insurance companies) for the appropriate medical treatment and service codes in the six zip codes previously identified.
- Costs to worker and family can be significant; e.g., lost wages, out-of-pocket medical expenses, inability to do other activities. Lost wages may be for lost work time; they may be for lower wages if a person must leave their trade.
- Compensation costs for workers afflicted with burns or dermatitis were estimated. A worker with unresolved dermatitis may be unable to continue work, and become eligible for Workers' Compensation, unemployment benefits, Medicaid, food stamps, SSI disability, or a job retraining program. If the worker has severe dermatitis and he is unable to acquire skills to change his trade in order to avoid exposure to cement, he may have to go on total disability. He may need the help of a public sector job retraining program. These costs were estimated for each scenario in each geographic location.
- Data on lost time away from work and average hourly earnings were used to estimate lost wages. Lost productivity is based on time away from a job, when the affected worker is expected to return to the job site.
- Estimating the costs associated with the time needed to wash ones hands through a work day includes lost work time to walk to thoroughly wash ones hands three times a day, and assumes that a worker will wash during bathroom breaks.
- The costs of pH neutralizing products is from conversations with suppliers and their literature and web site information.
- Finally, because costs may be borne by the affected workers, employers, insurers, and the public sector, the burden on each major group is estimated.

¹⁴⁹ The CPT is published by the American Medical Association. It is a listing of descriptive terms and identifying codes for reporting medical services and procedures performed by physicians. CPT is the most widely accepted nomenclature for the reporting of physician procedures and services under government and private health insurance programs. CPT is also useful for administrative management purposes such as claims processing and for development of guidelines for medical care review.

Appendix 2

Job Descriptions Those Who Work with Wet Portland Cement

A. Cement Masons

Cement masons place and finish concrete. They may also color concrete surfaces, expose aggregate in walls and sidewalks, or fabricate concrete beams, columns, and panels. In preparing a site for placing concrete, cement masons first set the forms for holding the concrete to the desired pitch and depth and properly align them. Masons then guide a straightedge back and forth across the top of the forms to “screed,” or level, the freshly placed concrete. Immediately after leveling the concrete, masons smooth the concrete surface with a “bull float,” a long-handled tool about 8 by 48 inches that covers the coarser materials in the concrete.

Sometimes masons perform all steps of laying concrete, including the finishing.

B. Concrete Finishers

Concrete finishers continue after cement masons have leveled and floated the concrete. They press an edger between the forms and the concrete and guide it along the edge and the surface to create a smooth finish. On concrete surfaces that will remain exposed after forms are stripped, cement masons fill any large indentations with a Portland cement paste and smooth the surface with a rubbing carborundum stone. Finally, they coat the exposed area with a rich Portland cement mixture using either a special tool or a coarse cloth to rub the concrete to a uniform finish.

C. Terrazzo Workers

Terrazzo workers create attractive walkways, floors, patios, and panels by exposing marble chips and other fine aggregates on the surface of finished concrete. Much of the preliminary work of terrazzo workers is similar to that of cement masons. Most terrazzo requires three layers of materials. First cement masons or terrazzo workers build a solid, level concrete foundation that is 3 to 4 inches deep. After the forms are removed from the foundation, workers add a 1-inch layer of sandy concrete. Before this layer sets, terrazzo workers partially embed metal divider strips into the concrete wherever there is to be a joint or change of color in the terrazzo. For the final layer, terrazzo workers blend and place into each of the panels a fine marble chip mixture. They then hand trowel each panel until it is level with the tops of the ferrule strips. While the mixture is still wet, workers toss additional marble chips of various colors into each panel and roll a lightweight roller over the entire surface. Finally, they grind, buff, and polish the terrazzo.

D. Bricklayers and Stone Masons

Bricklayers and stonemasons work in closely related trades. Their work varies, from laying a simple masonry walkway to installing an ornate exterior of a high-rise building. Bricklayers build walls, floors, partitions, fireplaces, chimneys, and other structures with brick, precast masonry panels, concrete block, and other masonry materials. When building a structure, bricklayers begin by constructing a pyramid of bricks—called a lead—at each corner of a wall, around which the rest of the bricks are laid. After the corner leads are complete, less experienced bricklayers fill in the wall between the corners, using a line from corner to corner to guide each course, or layer, of brick. Bricklayers spread a bed of mortar (a cement, sand, and water mixture) with a trowel (a flat, bladed metal tool with a handle), place the brick on the mortar bed, and then press and tap the brick into place. Depending on blueprint specifications, bricklayers either cut bricks with a hammer and chisel or saw them to fit around windows, doors, and other openings. Then, mortar joints are finished with jointing tools for a sealed, neat, uniform appearance.

Stonemasons build stone walls, as well as set stone exteriors and floors. Stonemasons usually work on nonresidential structures, such as houses of worship, hotels, and office buildings. When building a stone wall, masons set the first course of stones into a shallow bed of mortar. They then align the stones with wedges, plumb lines, and levels, and adjust them into position with a hard rubber mallet. Masons continue to build the wall by alternating layers of mortar and courses of stone. As the work progresses, masons remove the wedges, fill the joints between stones, and use a pointed metal tool called a tuck pointer, to smooth the mortar to an attractive finish. To hold large stones in place, stonemasons attach brackets to the stone and weld or bolt these brackets to anchors in the wall. Finally, masons wash the stone with a cleansing solution to remove stains and dry mortar.

E. Laborers

Construction craft laborers are skilled workers who provide much of the physically demanding labor at construction projects, tunnel and shaft excavations, hazardous waste removal projects, and demolition sites. They clean and prepare sites, dig trenches, mix and place concrete, and set braces to support the sides of excavations. Construction craft laborers may also assist other craft workers. Construction craft laborers operate a variety of equipment including concrete mixers.

Many of these workers belong to the Operative Plasterers' and Cement Masons' International Association, The International Union of Bricklayers and Allied Craftsmen, the United Brotherhood of Carpenters and Joiners, or the Laborers' International Union of North America.

F. Workers in Construction Generally

Many construction workers – whether residential, commercial, heavy highway, or other – work with wet Portland cement at some time. Clearly there are more workers exposed to wet Portland cement than those who specialize in the trade; probably one million or more at some time during their career in construction.

Appendix 3

Examples of Buffering Solutions

Neutralite Safety Solution

Force Field Technologies, Inc., of Granbury, Texas, produces a pH buffering solution which can be used by concrete industry workers such as cement laborers, plasterers, brick layers, and precast concrete workers as a decontaminant. It presents dryness and irritant and allergic contact dermatitis. According to the manufacturer, Neutralite Safety Solution can reduce hexavalent chromium to undetectable limits. After rinsing off excess concrete, Neutralite should be “drench” sprayed on skin and allowed to dry. Application should be made as soon as possible after contact. Neutralite is non-irritating at 1-1/2 percent solution (2 oz. Neutralite crystals to 1 gallon of water) and has a pH of 4.6 for a one percent solution.

Mason’s Hand Rinse

Mason’s Hand Rinse is an anti-alkali formula produced by Field Labs of Santa Cruz, California. This formula safely neutralizes alkaline residue that remains on the skin after working with Portland cement products such as concrete, stucco, plaster, grout, and mortar. Instructions are for at least four sprays of Mason’s Hand Rinse after washing and drying hands, rubbing thoroughly, and then letting hands air-dry. The rinse should not be washed off.

Appendix 4

Gloves Used For Cement Work

The following are just a few examples of gloves appropriate for cement work:

A. Chem Master (CHM)

According to its manufacturer, the Chem Master features a neoprene-over-natural rubber construction that provides good resistance to a broad range of chemicals as well as excellent abrasion, tear, and puncture resistance. Worker comfort is enhanced by the gloves 100 percent cotton flock lining.

B. Neoprene

The world's first wet-grip neoprene glove is recyclable. It is multidipped in premium-grade neoprene for quality and durability and provides protection against acids, caustics, oils, greases, and many solvents. It provides all-around protection against physical hazards such as abrasion and cut. Heavyweight styles have a five-piece flannel liner. Industrial-weight styles have a lighter coating for increased flexibility. Rough-finished styles are available for applications where a good wet grip is required. Also available with a reinforced thumb crotch for extra protection and wear. An insulated style is also available.

C. Nitri-Solve

According to the manufacturer, NitriSolve gloves are made from their special nitrile (NBR) compound and provide protection against abrasion, puncture, cut and snag and resistance to a broad range of solvents, animal fats and other chemicals. NitriSolve's case-hardened finish enhances both chemical and abrasion resistance and makes it easy to pull on and off. A non-slip grip makes wet work easier and safer. NitriSolve is available in flock-lined and unlined styles in varying thickness and lengths for a wide range of applications.

D. Black Knight

The Black Knight is fully coated and lined with PVC, which, according to its manufacturer, makes it one of the most durable work gloves available. The cotton lined PVC construction of the Black Knight glove provides protection from chemicals, oil, and grease as well as abrasion resistance. The Black Knight glove is available in jersey or interlock liners as well as smooth or rough finishes.