

**NEW CARPET EMISSIONS: A RISK CONTROL PERSPECTIVE**  
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*This paper was the basis for an oral presentation at the meeting cited, and it describes the experience the EPA Headquarters professionals' union had with carpet emissions in the EPA workplace. EPA workers were injured by those emissions. The union took steps to protect the workers it represents and the American public which its members ultimately serve.*

In addition to being a union officer, I am senior scientist of the Risk Analysis Branch, Office of Prevention, Pesticides and Toxic Substances, USEPA and the ranking chemist at EPA Headquarters. I do not speak for EPA today, but for the union. Today I disclaim any association with the Agency except as a matter of identification and also disclaim any association with the Agency's policy or point of view on the subject of new carpet emissions and their effects on air quality and human health.

A risk control operation is generally divided into two portions: risk assessment (is there a problem? what is the scope and severity?) and risk management (what should be done?). When Local 2050 became aware of the impact of new carpet emissions on air quality and human health, given the professional setting in which we worked, the union was bound to take a risk-control approach in its advocacy work. It continues on this track, and this paper will follow on it as well, with some diversions into the chronology of the EPA case and its sequella.

**IS THERE A PROBLEM? WHAT IS THE SCOPE?** EPA employees started complaining to the union, their supervisors and upper management about new carpet being installed in their work places (1) soon after installation began in October 1987. Complaints of 65 EPA employees were investigated by a contract industrial hygienist in early 1988 (2). About half of those reporting adverse health effects had a history of allergies. No medical tests of any of these individuals for atopy was conducted as part of the Agency's study of the problem.

A broader picture, beyond the EPA case, of the human data on adverse effects of carpet can be seen in published reports, collections of anecdotes, and in purely anecdotal form (3,4,5).

The effects reported in all these cases including EPA's<sup>1</sup>, include irritation of eyes and the respiratory tract, nausea, skin problems, headache, memory loss and confusion. A much more serious effect is reported by a subset of affected individuals - induction of multiple chemical sensitivity. One EPA employee with MCS, which he attributed to carpet exposure, was also diagnosed with chronic lymphocytic leukemia<sup>2</sup>. We have over forty EPA employees now displaying the symptoms of MCS; these employees are unable to work in their regular offices and are working out of their homes or in specially constructed space in another building.

The EPA case was investigated twice, once by the union and its scientists (11) and once by a broader based scientific team that included union representatives and other EPA and outside scientists.

The latter investigation (12), started in February 1989, being able to draw on a more substantial budget, was conducted through an extensive health survey of all EPA Headquarters employees, followed by extensive air monitoring. Correlations were then sought between the health and air monitoring data. The principal flaw with this study was that the air monitoring was done in March 1989, more than a year after most of the carpet had been installed. As a result, no carpet-related emissions were found, and further, no correlations between air quality and health effects were found. The recommendations from the study were, chiefly, to give employees more control over temperature and

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<sup>1</sup>In January 1988, in the most extreme case, one woman suffered loss of voice, breathing difficulties, burning face, facial rashes, confusion and loss of memory and of the ability to concentrate. She left work in January and did not return until late March. Then, when new carpet was installed in an adjacent office, she suffered an anaphylactic reaction and was rushed to hospital. She now displays the full blown symptoms of multiple chemical sensitivity (MCS) (6). At the time of this incident the woman was a 50-year old, highly rated policy analyst with the agency, a runner, wife and mother with 21 years of education. Subsequent to her injury she was subjected to many examinations, including psychological exams. In the latter, she was found to be very psychologically sound.

<sup>2</sup>The Centers for Disease Control published an epidemiology study in 1988 (7) showing a four fold elevation of death rate from chronic lymphocytic leukemia among carpet production workers in Georgia. Some leading researchers in the field of MCS hypothesize that the immune system is a locus of action of MCS (8 a, b). There are a total of three epidemiology studies relating elevated death rates to work in carpet production facilities (7, 9, 10); none of these studies were acknowledged by EPA in its denial of our TSCA section 21 petition (see below).

humidity, and this should result in greater satisfaction among employees with air quality.

The union and several other scientists involved in the study insisted that a search for correlations between health effects and the locations where new carpet had been installed should be made, given the flaw in timing of the air monitoring work<sup>3</sup>. When this was done, solid statistical correlations were found between the presence of carpet or carpet odors in office spaces and complaints of nausea, headache, sore throat, hoarseness, dizziness, chest problems, fatigue and skin problems(13)<sup>4</sup>.

Early in the problem, it was natural that an airborne source of the problem was suspected at EPA. EPA had conducted air monitoring (May–November, 1988) in several locations in the Waterside Mall complex, the focal point of complaints, and found that 4-phenylcyclohexene<sup>5</sup> was the principal carpet related chemical present. At the time monitoring began, a report by Crabb and Van Ert (15) surfaced from EPA files. These workers reported that "numerous" cases of new carpet-related complaints had been handled by various authorities in Arizona, and that 4-PC was the single common chemical found in their investigation of four such cases.

Subsequent work (16,17) has shown that 4-PC is the most persistent of carpet emission gases, and that styrene and 4-vinylcyclohexene are

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<sup>3</sup>Monitoring done in the period May–November 1988, while the crisis was "hot", was not used in this study. Sites were too few, and there was no statistical design, correlative to the health survey, to the location of those few sites. The union insisted that these be published as part of the overall Study, however, and they were, in the Supplement to Volume II of reference 12.

<sup>4</sup>When EPA released the results of this element of the study to the public and the media, in spite of the finding of statistically significant correlations between carpet and health complaints, and the fact that carpet-related complaints were the genesis of the entire four volume study, the word "carpet" did not even appear in the summary of findings in the press release.

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4-PC is a by-product in the manufacture of styrene-butadiene latex, the agent which binds carpet face fibers to the primary carpet backing material. It arises from the Diels–Alder reaction between one molecule each of styrene and butadiene. The amount produced in any batch and carried through to final shipment to a carpet factory is highly variable. Average levels now are reported to be in the range of 100 ppm in the latex (14).

also present in some samples. Kinetics of the emissions have been studied (16,17,18), and show the half-life of 4-PC in carpet to be ca. 8 days (18, p. E-5), at least for periods of up to about a month or two. Styrene and 4-VC emissions decrease much more rapidly (16,17). The significance of the relative volatilities of the principal emissions is that complaints about adverse effects sometimes continue for weeks or months<sup>6</sup>, rather than hours or days, further implicating 4-PC as a causative agent.

Through 1988-89, EPA developed a joint approach to risk assessment of carpet emissions with the Consumer Product Safety Commission. A major failing of their approach, however, was the refusal to use or to consider any of the health or air monitoring data gathered at EPA in 1988 and 1989. CPSC eventually sent letters to allergists across the country soliciting calls of complaint from patients who believed they may be suffering adverse effects from carpeting, allotting the princely sum of \$5000 for the entire project. CPSC that said it could find no causative relationship between carpeting and reports of adverse effects in this study (4).

The union, upon noting the half-hearted approach being followed by EPA and CPSC<sup>7</sup> in getting to the bottom of the issue, and after receiving scores of calls and letters about similar problems from citizens, developed its own recommendations on how it should be done. The recommendations were ultimately presented to EPA in the form of a citizens' petition under the Toxic Substances Control Act, asking EPA to take regulatory action to protect the public as well as our bargaining unit members<sup>8</sup>.

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<sup>6</sup>In certain cases, individuals are unable to inhabit their homes until the new carpeting is removed. In other cases, individuals failing to recognize carpeting as the contaminant source have suffered repeated respiratory problems until their carpeting was identified as the contaminant source" (15, p.p.1&2)

<sup>7</sup>CPSC has drawn fire (19) for its handling of the "carpet problem" from consumers., Congress and many states' Attorneys General. CPSC refused to docket (i.e. consider worthy of evaluation) a petition filed by 26 states' Attorneys General asking for warning labels on carpets.

<sup>8</sup>The petition's prime bases were the data on the complaints centered in newly carpeted EPA spaces, on levels of 4phenylcyclohexene in these spaces, and the implication of that chemical in similar problems in Arizona

EPA denied the petition<sup>9</sup>, and instead created the "Carpet Policy Dialogue" involving about twenty five parties, including Local 2050, other federal agencies, and various elements of the carpet and chemical industries (20). Programs of chemical analysis of carpet-, adhesive- and carpet padding emissions were an outgrowth of the dialogue, along with an information brochure for consumers<sup>10</sup>

Dr. Rosalind Anderson has found a relationship between carpet emissions and adverse effects in mice, using a standard test method, ASTM E 981. Professor Yves Alarie<sup>11</sup>, developer of the ASTM method has confirmed Dr. Anderson's results in 5 of 6 carpet samples tested by both laboratories (21a), in which mice exposed for several one hour periods to emissions of certain new or old carpet suffer adverse pulmonary and neurological effects and death (21a). EPA obtained similar results in tests conducted side-by-side at Anderson Laboratories in January 1993, but failed to get the same results after modifying the test in its Research Triangle Park laboratories (21b). Work continues on this animal test<sup>12</sup>.

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<sup>9</sup>As a result, hundreds if not thousands of additional citizens, many of whom present to you with signs and symptoms of allergy and other immune disorders, or asthma, are now in a state of permanently impaired health.

<sup>10</sup>The carpet industry also instituted the "Green Tag Program", purportedly a quality control initiative (in which one sample per year of a carpet "type" is tested), based on the chemical testing program. Complaints about the brochure and the Green Tag Program, first raised by Local 2050, have intensified, resulting in a Federal Trade Commission investigation of the Program and Congressional pressure to change misleading statements in the first edition of the information brochure and to drop the Green Tag Program (19).

<sup>11</sup>University of Pittsburgh

<sup>12</sup>Anderson also reports killing mice with two one-hour exposures to 4-PC alone, at levels of 200 parts per billion (22). Humans exposed to 10-20 ppb levels, a not uncommon level in newly carpeted space, receive this cumulative dose in one or two 24 hour periods. Small children at home are especially susceptible to such exposures, and there are anecdotal reports of seizures in young children exposed to new carpet emissions. Anderson reports that animals dying of 4-PC exposure alone show principally neurological effects, while animals dying from carpet exposures display severe lung toxicity as well as neurological damage.

**WHAT SHOULD BE DONE?** Warnings? Yes, without doubt. Attorneys general of 26 states have asked, as the union did before them, that warnings be mandated at the point of sale of carpets.

More research? Yes, without doubt. Clues to the cause(s) and manifestations of MCS may lie in the results of Anderson, Alarie, et al. Further studies of individuals injured by carpet and other substances to the point of MCS induction are on-going and should be accelerated. More work on characterizing the atmospheres in which mice are injured and killed in the ASTM E 981 test must be done to point the way to needed changes in carpet constituents or processes.

Changes in carpet manufacturing processes? Probably, depending on results of further work on ASTM E 981. Replacement of the binding agent now used (styrene-butadiene latex contaminated with 4-PC) could be a key measure.

Restitution? Yes, as a matter of justice. A re-invented government should consider using its good offices to broker a settlement among the parties involved. Restitution for victims of carpet toxicity could be structured in a way not to utterly bankrupt or destroy the carpet industry. There are models for this sort of activity. Government, through its manifold failures in this public health problem, bears almost as heavy a responsibility for making whole those who have been injured as the industrial elements who manufactured and sold the defective products.

I will conclude by giving you a flavor of human cost of this problem. Following are excerpts from a recent letter to Representatives Mike Synar, Chairman of the Energy, Environment and Natural Resources Subcommittee of the House Committee on Government Operations, and Bernard Sanders, a Subcommittee Member, from a victim of new carpet emissions who lives in Wilson, North Carolina.

"Not only did my then six-year-old daughter and I become ill after new carpeting was installed by 'Company x1 (name deleted) in 1989, but the fumes also contaminated our home. After fourteen years as a paralegal, I became too sick to work, and we had to suddenly abandon and eventually lost to foreclosure our home of almost eleven years. Answers to my many questions about toxins in carpet and its health affects were virtually impossible to come by, although the man who sold us the carpet called and told me that our carpet "got in a bad batch of chemicals, is highly toxic, and we are coming out in the morning (Sunday) to rip it up." The carpet was removed three days later. And that was that. Things got so bad that we ended up on welfare, food stamps and became homeless -more than once. This is after earning

\$30,000 a year as a freelance paralegal.

"It took almost two years, but we are now living on Social Security Disability and my monthly income (\$1,095) is too high to qualify for Medicaid or any other aid. We do not ever have enough money for food or medicine or safe housing. My daughter (almost eleven) cannot go, -, skating or to the movies or swimming or to camp or do any of those things all her friends can do. Nor can she participate in any extracurricular activities because we simply do not have the money (yet she is academically gifted).

"Each time I have to spend a nickel, I worry that we will not have enough food to get through the month. I have sold so much of my personal belongings and will have to sell my piano just to pay the interest I owe to a pawn shop because I hocked my family's jewelry for grocery money. This is beyond absurd. You try and explain this reality to my child.

"We have both been diagnosed with everything from deep airway asthma to tachycardia, heart palpitations and chronic sinus problems. My Social Security Disability Decision states that my inability to work stems from exposure to toxic fumes in carpet. We were both quite healthy prior to this exposure and had never had any allergies.

"Our government refuses to warn the public or regulate the carpet industry because government has chosen to protect industry at all costs. Even at the cost of our precious children's health.

"Explain that to my daughter. Tell her she should not be depressed that we lost everything, because profits and cover-ups are the American way. Tell her in no uncertain terms that her life is dispensable because Big Business interests are more important than her health and peace of mind.

"I am aware of the latest EPA test results which prove the findings of Anderson Labs. But, I have been informed that these results will not be released because it will fuel the flood of lawsuits. In the meantime, industry will remain in its mode of 'deny, deny, deny' while my child struggles in her attempt to be a regular kid.

"And what about the other thousands of children? Who is out there protecting them? After four years, I continue to receive phone calls from parents who have nowhere to turn. One day their children are perfectly healthy. Then they purchase a homeimproving product and suddenly their children get sick and stay sick.

"I beg you: For once, put public interest beyond that of profit

and release these latest findings. So what if the carpet industry has to pay? They absolutely should have to pay for the consequences of their greed and their lack of regard for our children!

"For my daughter's sake and for the sake of all children who have become chronically ill from toxic carpet exposure, please make sure this issue is resolved and allow the truth to be told.

"Our lives are virtually in your hands."

I have over a hundred such case reports in my files, Dr. Anderson has over 600 (21a). The number in CPSC's files is uncertain, but probably over 1000 (21c).

### **REFERENCES**

1. Supplement to Volume I: Indoor Air Quality and Work Environment Study: EPA Headquarters Buildings. November 1989. U.S. Environmental Protection Agency, Washington, D.C. 20460.
2. Ennen M. Summary of industrial hygiene investigation. Memorandum: J.C. Chamberlin to J.W. Hirzy. August 17, 1988.
3. Breysse P. Industrial hygiene investigation. State office building, Seattle. School of Public Health and Community Medicine, University of Washington, Seattle WA. 1983.
4. Schacter L. Carpet related health complaints. U.S. Consumer Product Safety Commission Memorandum. 1990.
5. Hirzy JW. Entries to telephone logs. June 1988 - August 1993.
6. Lively-Diebold R. Testimony on H.R. 1530 before the House Committee on Science, Space and Technology, Subcommittee on Natural Resources, Agriculture Research, and Environment. July 20, 1989.
7. O'Brien TR and Decouflel P. Cancer mortality among northern Georgia carpet and textile workers. Am. J. Indust. Med. 14 15-24 (1988).
- 8.a. Ziem GE. Multiple chemical sensitivity: treatment and followup with avoidance and control of chemical exposures. Toxicol. and Indust. Health. 8 73-86 (1992).
  - b. Heuser G, et al. Diagnostic markers of multiple chemical sensitivity. In Multiple Chemical Sensitivities, National Research Council, National Academy Press, 1992.

9. Cartwright RA, Miller JG and Scarisbrick DA. Leukaemia in a carpet factory: an epidemiological investigation. *Brit. J. Occup. Med.* 37 42-43 (1987).
10. Vobecky J, Deveroede G, Lacaille J and Watier A. An occupational group with a high risk of large bowel cancer. *Gastroenterology* 75 221-223 (1978).
11. Hirzy JW and Morison R. Carpet/4-phenylcyclohexene toxicity: The EPA headquarters case. In The Analysis, Communication and Perception of Risk Eds. B.J. Garrick and W.C. Gekler, Plenum Press, New York, 1991.
12. Indoor Air Quality and Work Environment Study: EPA Headquarters Buildings. Published in four volumes, November 1989 - June 1991. U.S. Environmental Protection Agency, Washington, D.C. 20460.
13. Volume IV: Indoor Air Quality and Work Environment Study: EPA Headquarters Buildings. Section: Results of Linear and Logistic Regressions June 1991.
14. Penberthy W. Summary report of the process engineering subgroup of the carpet policy dialogue. U.S. Environmental Protection Agency August 1991.
15. Crabb CL, Van Ert DE and Carter DE. Odorous emissions from new carpeting: development of field monitoring and analytical technique. Master of Science Thesis, University of Arizona. 1984.
16. Hetes RG, Womack DS, Pierson TK and Naugle DF. Evaluation of exposures to volatile organics off-gassing from new carpets. Research Triangle Institute. February 1992.
17. Hodgson AT, Wooley JD, and Daisey JM. Volatile organic emissions from carpets. U.S. Consumer Product Safety Commission. April 1992.
18. Supplement to Volume II: Indoor Air Quality and Work Environment Study: EPA Headquarters Buildings. May 1990
19. Synar M and Sanders B. Remarks at hearing on carpet toxicity testing before House Committee on Government operation, Subcommittee on Environment, Energy and Natural Resources. June 11, 1993.
20. Federal Register Vol. 55, No. 79 pp.17404-17409. April 24, 1990.

21. Testimony at hearing on carpet toxicity testing before House Committee on Government Operation, Subcommittee on Environment, Energy and Natural Resources. June 11, 1993.

a. Anderson R and Alarie Y.

b. Kimm V.

c. Peterson E.

22. Anderson R. Testimony at hearing on carpet toxicity before Senate Committee on Governmental Affairs, Ad Hoc Subcommittee on Consumer and Environmental Affairs. October 1, 1992.