UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

MEMORANDUM

DATE: March 29, 2002

SUBJECT: **Dioxin contamination of offices after WTC collapse and transformer fire: Suggested criteria for cleanup levels**

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This memorandum provides a basis for justifying very low cleanup levels for dioxins on interior surfaces. You originally contacted me on March 13, 2002 on this matter because the interior spaces of a building at 100 Church Street in Lower Manhattan are contaminated with chlorinated dioxins and related compounds. This occurred after the WTC collapse and a fire in a nearby transformer that used polychlorinated biphenyls (PCB's). Your interest is the fact that you are the industrial hygiene consultant for the landlord of the building, and the need to determine when re-occupancy is appropriate.

My understanding is that a very limited number of wipe samples have been taken from only 4 smooth, non-porous surfaces that had already been cleaned. The concentrations of dioxins, in 2,3,7,8-TCDD equivalents (TEQ's), ranged from 0.43 to 1.08 nanograms per square meter (ng/m^2). There is no available data to establish the dioxin levels in porous surfaces such as carpeting, draperies, and upholstered furniture that could not have been cleaned to the same degree.

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[1] The opinions are those of the author and do not necessarily represent the official position of the U.S. Environmental Protection Agency.

Calculated dioxin criteria for non-porous interior surfaces based on EPA regulations for PCB's on interior surfaces

Although EPA has not published any regulations or guidelines to my knowledge on specific levels of dioxins on interior surfaces, EPA has published regulations for cleanup levels of PCB's on non-porous interior surfaces. Using these PCB levels for non-porous surfaces, and also using the relative carcinogenic potency of dioxins compared to PCB's, a level for dioxins on surfaces can be calculated.

As shown by the calculations in the appendix to this memorandum, the cleanup level for dioxins on non-porous surfaces would be 0.00015 nanograms TEQ's per square meter (ng/m^2). I offer this estimated cleanup criteria to you as a personal perspective and alternative way of evaluating the situation, and am in no way representing this as any official EPA recommendation.

This is a very low level for non-porous surfaces, probably lower than typical background levels of dioxins. In earlier communications, I had suggested to you that cleanup to background levels would be appropriate, as discussed below.

Cleanup of dioxins to background levels

Earlier I suggested to you that dioxins be cleaned up on all surfaces at the 100 Church Street address to background levels. This recommendation was based on the fact that the proposed EPA risk reassessment for dioxins determined that humans were at risk of adverse health effects from dioxins at levels already at the current background levels in industrialized countries.[1] In other words, EPA determined that just the normal background levels of dioxins in the environment are causing significant health risks to the general population.

I provided to you a copy of one study where wipe samples were taken in two apartments in Lower Manhattan after the WTC collapse.[2] In that study, dioxins were found at levels ranging from 0.0012 to 0.088 ng/m^2. Because this was the only data I had available, and since this data represented dioxin levels after the WTC collapse, these levels may be higher than actual background levels of dioxins on surfaces in Manhattan before the WTC collapse. I suggested that other more relevant studies might be available, or that additional tests for background levels of dioxins could be conducted in remote locations of New York City to establish normal background levels.

The levels of dioxins on the surfaces in the two apartments probably are higher than normal, based on the following reasoning. Although EPA did not include typical background levels of dioxins on smooth interior surfaces as part of the proposed dioxin reassessment, typical soil levels of dioxins were included.[3] EPA found the weighted mean concentration for urban soils is 7.6 nanograms per kilogram (ng/kg) (TEQ's). The study of the two apartments after the WTC collapse, discussed above, found that the bulk dusts in the two apartments had dioxin concentrations (TEQ's) ranging from 33 to 260 ng/kg. This is 4 to 34 times higher dioxin than typical urban soil.

Use of 1988 National Research Council cleanup levels

In your communications, you suggested the use of 25 ng/m^2 as a safe level for dioxins on surfaces for the 100 Church Street address. You quoted the recommendations made in 1988 by the National Research Council (NRC) of the National Academy of Sciences (NAS) for the cleanup of the Binghamton, New York office building which was contaminated after a transformer fire in 1981.[4] This would be inappropriate for several reasons.

First, and most importantly, this 25 ng/m^2 would be much higher than normal background levels for dioxins on smooth interior surfaces. The study of the two apartments after the WTC collapse, discussed above, had much, much lower levels of dioxin than 25 ng/m^2, which were probably higher than typical background levels in Manhattan. The proposed EPA risk reassessment for dioxins determined that humans are already at risk for adverse health effects from dioxins at typical background levels,[5] so it would be inappropriate to use any cleanup levels higher than background.

Second, the NRC has apparently withdrawn their 1988 recommendations. The NAS Press no longer offers the publication which made these recommendations, although earlier titles by the NRC are still offered. As I recollect personally, there was much controversy over the cleanup of the Binghamton office building, and the NRC recommendations did not necessarily hold sway. Further, the recommendations were based on outdated science.

Third, without being able to examine the NRC recommendations themselves, it is very difficult to determine their exact nature, or whether they would be applicable to the building at 100 Church St. The NRC most likely recommended that all porous materials be disposed of, and that non-porous surfaces with the 25 ng/m^2 level be re-painted in high occupancy areas.

Cleanup methods

The EPA has rigorous guidance on cleanup methods and disposal of PCB-contaminated surfaces, materials, etc. in the interior of buildings in both the Code of Federal Regulations as well as guidance documents. These are listed in the references.[6] These could be helpful in the cleanup up of 100 Church Street. I am not aware of any similar set of procedures developed by EPA to address the cleanup of dioxins.

APPENDIX

CALCULATION OF INTERIOR SURFACE LEVELS OF DIOXINS BASED ON EPA's REGULATIONS FOR PCB's ON SURFACES

EPA regulations for surface cleanup levels for PCB's

Although the EPA has not developed surface cleanup levels for dioxins, Title 40 of the Code of Federal Regulations, Part 761, Section 61 provides cleanup levels for PCB's on interior surfaces.[7] The relevant sections are given below. For non-porous surfaces in high occupancy areas, the level is less than or equal to 10 micrograms per 100 centimeters squared ($\leq$ 10 µg/100 cm ^{2}).

40 CFR 761.61 PCB remediation waste

(a) Self-implementing on-site cleanup and disposal of PCB remediation waste...

(4) Cleanup levels. For purposes of cleaning, decontaminating, or removing PCB remediation waste under this section, there are four general waste categories: bulk PCB remediation waste, non-porous surfaces, porous surfaces, and liquids. Cleanup levels are based on the kind of material and the potential exposure to PCBs left after cleanup is completed.

(i) Bulk PCB remediation waste. Bulk PCB remediation waste includes, but is not limited to, the following non-liquid PCB remediation waste: soil, sediments, dredged materials, muds, PCB sewage sludge, and industrial sludge.

(A) High occupancy areas. The cleanup level for bulk PCB remediation waste in high occupancy areas is < or = 1 ppm without further conditions. High occupancy areas where bulk PCB remediation waste remains at concentrations >1 ppm and < or = 10 ppm shall be covered with a cap meeting the requirements of paragraphs (a)(7) and (a)(8) of this section.

(B) Low occupancy areas. (1) The cleanup level for bulk PCB remediation waste in low occupancy areas is < or = 25 ppm unless otherwise specified in this paragraph.

(2) Bulk PCB remediation wastes may remain at a cleanup site at concentrations >25 ppm and < or = 50 ppm if the site is secured by a fence and marked with a sign including the M<INF>L</INF> mark.

(3) Bulk PCB remediation wastes may remain at a cleanup site at concentrations >25 ppm and < or = 100 ppm if the site is covered with a cap meeting the requirements of paragraphs (a)(7) and (a)(8) of this section.

(ii) Non-porous surfaces. <u>In high occupancy areas, the surface PCB cleanup standard is < or = 10 µg/100 cm ^{2} of surface area.</u> In low occupancy areas, the surface cleanup standard is <100 µg/100 cm ^{2} of surface area. Select sampling locations in accordance with subpart P of this part or a sampling plan approved under paragraph (c) of this section.

(iii) Porous surfaces. In both high and low occupancy areas, any person disposing of porous surfaces must do so based on the levels in

paragraph (a)(4)(i) of this section. Porous surfaces may be cleaned up for use in accordance with Sec. 761.79(b)(4) or Sec. 761.30(p).

(iv) Liquids. In both high and low occupancy areas, cleanup levels are the concentrations specified in Sec. 761.79(b)(1) and (b)(2).

(v) Change in the land use for a cleanup site. Where there is an actual or proposed change in use of an area cleaned up to the levels of a low occupancy area, and the exposure of people or animal life in or at that area could reasonably be expected to increase, resulting in a change in status from a low occupancy area to a high occupancy area, the owner of the area shall clean up the area in accordance with the high occupancy area cleanup levels in paragraphs (a)(4)(i) through (a)(4)(iv) of this section.

(vi) The EPA Regional Administrator, as part of his or her response to a notification submitted in accordance with Sec. 761.61(a)(3) of this part, may require cleanup of the site, or portions of it, to more stringent cleanup levels than are otherwise required in this section, based on the proximity to areas such as residential dwellings, hospitals, schools, nursing homes, playgrounds, parks, day care centers, endangered species habitats, estuaries, wetlands, national parks, national wildlife refuges, commercial fisheries, and sport fisheries.

PCB risk levels

EPA's 1996 cancer risk estimate for PCB's was a range of 0.086 to 2.4 milligrams per kilogram body weight per day (mg/kg/day), based on experimental uncertainty and variable commercial mixtures of different PCB's.[8] EPA's Integrated Risk Information System has chosen to use the upper-bound risk value of 0.04 mg/kg/day in deriving risk levels for different environmental media (air, water, diet),[9] so this level will be used for the calculations below.

Dioxin risk levels

EPA's 1985 cancer risk estimate is/was 0.006 picograms TCDD equivalents (TEQ) per kilogram per day (pg/kg/day).[10] This level is still the official EPA dioxin risk level.

EPA's draft dioxin risk reassessment would upgrade the potency estimate for dioxin, to a risk level of 0.001 pg/kg/d.[11] EPA explains that this risk level would be lower than the background levels that people are typically exposed to in industrialized countries, so the level cannot be a realistic goal for preventing additional exposures. However, this risk value is an indication that EPA now considers dioxin to be a more potent carcinogen than it did in its 1985 risk assessment.

For the purposes of the calculations, both the 1985 EPA risk level and the proposed risk level is used. The resultant numbers for a criteria on interior surfaces is very low, whether the 1985 number is used or the proposed 2000 EPA risk assessment level is used.

Calculation of dioxin surface level criteria based on EPA levels for PCB's

PCB cleanup level, non-porous surfaces, high occupancy areas

10 ug/100 cm^2 = 10^6 ng/m^2

10 µg x 10^3 ng/ug = 10^4 ng

100 cm^2 x 10^{-4} m^2/cm^2 = 10^{-2} m^2

Carcinogenic risk factors for PCB's and dioxins

PCB's	0.04 mg/kg/day	milligrams per kilogram of body weight per day is the reference dose, or the dose related to an increased cancer risk of one in a million	
		0.04 mg x 10^9 pg/mg = 40,000,000 pg	
	= 40,000,000 pg/kg/day = 4 x 10^7 pg/kg/day		
Dioxins, TEQ's	0.006 pg/kg/day = 6 x 10^{-3} pg/kg/day		EPA 1985 risk assessment
	0.001 pg/kg/day = 1 x 10^{-3} pg/kg/day		proposed EPA 2000 risk reassessment

Risk of dioxins compared to PCB's

6,600,000,000 or 6.6 billion times the PCB risk, EPA 1985 dioxin risk assessment

(4 x 10^7 PCB risk) / (6 x 10^{-3} dioxin risk) = 6.6 x 10^9

40,000,000,000 or 40 billion times the PCB risk, EPA proposed risk reassessment

(4 x 10^7 PCB risk) / (1 x 10^{-3} dioxin risk) = 4 x 10^{10}

Calculated protective dioxin levels for non-porous surfaces, based on PCB levels

0.00015 ng/m^2 dioxin TEQ's on non-porous surfaces - EPA's 1985 risk assessment

(10^6 ng/m^2 PCB level) / (6.6 x 10^9) = 0.15 x 10^{-3} ng/m^2

0.000025 ng/m^2 dioxin TEQ's - EPA 2000 proposed dioxin risk reassessment

(10^6 ng/m^2 PCB level) / (4 x 10^{10}) = 0.25 x 10^{-4} ng/m^2

Abbreviations: cm^2 = square centimeter; m^2 = square meter

µg = microgram = 10^{-6} gram; ng = nanogram = 10^{-9} gram, pg = picogram = 10^{-12} gram

mg/kg/day = milligrams per kilogram of body weight per day = reference dose, or the dose related to an increased cancer risk of one in a million

TEQ = 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) equivalents

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