

# HT 1: LIMIT HARMFUL EMISSIONS FROM CARPETS

*New York City Health Code; New York City Building Code; New York City Administrative Code*  
Proposal developed by the Materials & VOCs Committee

## Summary

### Issue:

Carpet, carpet backing, carpet cushion and adhesives emit respiratory irritants and cancer-causing compounds, which are harmful to the comfort and well-being of installers and occupants.

### Recommendation:

Establish standards, in accordance with national industry programs, to limit the presence of volatile organic compounds in carpet, carpet backing and carpet adhesives.

## Proposed Legislation, Rule or Study

*Amendments to the New York City Health Code:*

1. Add a new section 131.12 as follows:

§131.12 Volatile organic compounds. (a) Any new carpet, carpet cushion, and carpet adhesive installed in any building shall comply with the standards in this section; provided, however, that this section shall not apply to:

(1) Until July first, two thousand sixteen, carpet, carpet cushion, and carpet adhesive installed in any building classified in occupancy group R-3 under the New York City Building Code; and

(2) Antique carpets, area rugs and similar non-adhered carpets.

(b) It shall be unlawful to buy or sell or offer to buy or sell, or cause any person to buy or sell any carpet, carpet cushion or carpet adhesive that does not comply with the standards in this section.

(c) Carpet cushion and, until July first, two thousand sixteen, carpet shall comply with the following twenty-four hour testing criteria:

<u>Volatile Organic Compound</u>	<u>(Qg/m<sup>2</sup>·hr)</u>
<u>Butylated hydroxytoluene</u>	<u>300</u>
<u>Formaldehyde</u>	<u>50</u>
<u>4-phenylcyclohexene (4PCH)</u>	<u>50</u>
<u>Total Volatile Organic Compounds</u>	<u>1000</u>

(d) Beginning July first, two thousand sixteen, carpet shall comply with the following twenty-four hour and fourteen-day testing criteria:

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Carpet 24-Hour & 14-Day Test Criteria					
Target Contaminant	CAS #	Maximum Emission Factor(EF) (ugm <sup>2</sup> -hr)	Maximum Air Concentration (ug/m <sup>3</sup> )	Maximum Emission Factor (EF) (ugm <sup>2</sup> -hr)	Office Building Target Air Concentration (for reference only) (ug.m <sup>3</sup> )
Acetaldehyde	75-07-0	20	11	16	9
Benzene	71-43-2	55	30	55	30
Caprolactam	105-60-2	120	65	190	100
2-Ethylhexanoic Acid	149-57-5	46	25	46	25
Formaldehyde	50-00-0	50	27	30	16
1-Methyl-2-pyrrolidinone	872-50-4	300	160	300	160
Naphthaline	91-20-3	20	11	8.2	4.5
Nonanal	124-19-6	24	13	24	13
Octanal	124-13-0	24	13	13	7.2
4-phenylcyclohexene	4994-16-5	50	27	17	9.3
Styrene	100-42-5	410	220	410	220
Toluene	108-88-3	280	150	280	150
Vinyl acetate	108-5-4	400	220	190	100
Total Volatile Organic Compounds	-	500 <sup>a</sup>	270	NA	NA

(e) Carpet adhesive shall comply with the following twenty-four hour and fourteen-day testing criteria:

	(Qg/m <sup>2</sup> -hr)	(Qg/m <sup>2</sup> -hr)
Formaldehyde	50	31
2-ethyl-1-hexanol	300	300
Total Volatile Organic Compounds	8000	-

(f) Testing of materials covered by this section shall be in accordance with ASTM D 5116 (guide for small-scale environmental chamber determinations of organic emissions from indoor materials/products).

(g) By July first, two thousand thirteen, and at least every three years thereafter, the department shall review and, if necessary, update or revise the standards in this section.

*Amendments to the New York City Building Code:*

1. Add a new Section 804.6 as follows:

804.6 Volatile organic compounds. Any new carpet, carpet cushion and carpet adhesive installed in any building shall comply with the standards of section 131.12 of the New York City Health Code.

*Amendments to the New York City Administrative Code:*

1. Add a new subchapter to Chapter 4 of Title 20 that is similar in substance and structure to subchapter 12 (Endangered or Threatened Species) but contains the following prohibition language:

§20-xxx Volatile organic compounds. a. It shall be unlawful to buy or sell, offer or attempt to buy or sell, or cause any person to buy or sell any carpet, carpet cushion, and carpet adhesive that does not comply with section 131.12 of the New York City Health Code.

## Supporting Information

### Issue - Expanded

Volatile organic compounds (VOCs) are common chemical contaminants that can easily evaporate into the air and are found in homes and offices.<sup>1</sup> Their presence can be noticed as an odor, such as paint and "new car smell."<sup>2</sup> Many building materials and indoor furnishings release VOCs, contributing to "sick building syndrome."<sup>3</sup> Even if a building's ventilation system is properly designed and well maintained, VOCs and other chemical contaminants must be controlled to ensure healthy indoor air.<sup>4</sup>

EPA studies have found that levels of common VOCs are consistently higher indoors than outdoors. VOC levels in homes can be 2 to 5 times higher inside than outside, with some indoor air levels over 1,000 times higher following certain activities such as paint stripping.<sup>5</sup>

Exposure to VOCs can cause short and long-term health problems. Some VOCs are known carcinogens; several studies have found a link between exposure to formaldehyde and increased incidence of nasal cancer, nasopharyngeal cancer, and leukemia.<sup>6</sup> VOCs can also cause eye, nose, and throat irritation; headaches, fatigue, loss of coordination, dizziness, and nausea; and damage to the liver, kidney, and the central nervous system.<sup>7</sup>

VOCs also contribute to ground-level ozone formation (smog). When VOCs are released into the air, the organic compounds react with nitrogen oxides to form ozone.<sup>8</sup> High concentrations of ground-level ozone can cause respiratory problems and exacerbate asthma, emphysema, and bronchitis.<sup>9,10</sup> Ground-level ozone also adversely affects the local ecosystem, damaging or weakening trees and plants, and reducing forest growth and crop yield.<sup>11</sup>

### Environmental & Health Benefits

Limiting VOC levels in carpet, carpet cushions, and carpet adhesives will reduce human exposure to VOCs and the associated health effects. According to the California Air Resources Board, scientific study has only touched the 'tip of the iceberg' in understanding all VOCs in indoor air. Because the link between indoor air pollutants and health impacts is so complex, researchers are also investigating the reaction of VOCs with other compounds present in indoor air and are discovering new areas for future study.<sup>12</sup>

Limiting VOCs will also help lower ground-level ozone concentrations in outdoor urban air, and alleviate the health and environmental risks associated with ground-level ozone.<sup>13</sup>

This proposal was found to have a positive, indirect environmental impact.

This proposal was found to have a low positive health impact per building and to impact a large number of buildings. It was thus given a health score of 2.

### Cost & Savings

This proposal is not expected to have any impact on capital costs.

### Precedents

The standards included in this proposal are consistent with the Green Label Plus program for carpets and the Green Label programs for cushions and adhesives established by the Carpet and Rug Institute (CRI).<sup>14</sup> While the Green Label and Green Label Plus programs are currently voluntary standards for the carpet industry, CRI worked with California's Sustainable Building Task Force and the Department of Health Services, Indoor Air Quality Section, to meet testing protocols used by the Collaborative for High Performance Schools (CHPS) in California.<sup>15</sup>

The 2008 California Green Building Standards Code references the Green Label and Green Label Plus in section 804.4.3 as one of four possible testing and product requirements that all installed interior carpeting must meet.<sup>16</sup> The California

Gold Sustainable Carpet Standard also includes the Green Label Plus program in two of the possible Indoor Air point credits.<sup>17</sup>

In 2005, the City of New York enacted laws creating an environmentally preferable purchasing program, which requires the City to only purchase carpet and carpet adhesives that meet the CRI standards.<sup>18</sup> The Battery Park City Authority's building guidelines also require compliance with the CRI Green Label and Green Label Plus programs.<sup>19</sup>

On June 19, 2009 new rules regarding commercial and consumer products were adopted by the state of Illinois. The adopted rule, Standards and Limitations for Organic Material Emissions for Area Sources, 35 Ill. Adm. Code 223, regulates the VOC content of a wide array of products, including carpet, and carpet pad or cushion adhesives.<sup>20</sup>

### **LEED**

If this recommendation is implemented, buildings in NYC will automatically be in compliance with several points: LEED-CI and LEED-NC credits EQ4.3 Low-Emitting Materials, Carpet and EQ Credit 4.1: VOC limit of 50 g/L, and LEED for Homes credit MR2, Environmentally Preferable Products.

Since these recommended NYC code revisions do not directly reference the CRI standards or the SCAQMD ruling, the recommendation is in line with LEED only as long as those standards remain consistent. This recommendation will also facilitate achieving LEED-NC and LEED-CI credit EQ3.2 Construction IAQ Management Plan, Before Occupancy and LEED EB credit EQ3, Construction IAQ Management Plan and LEED for Homes credit EQ8, Contaminant Control. These points are concerned with reducing overall Indoor Air Quality problems throughout the building or space.

### **Implementation & Market Availability**

There are no known implementation issues for this proposal as compliant carpet systems are readily available. The CRI standards are well established in the industry and already used by the City of New York, Battery Park City Authority, and many other municipalities and school districts. All major carpet manufacturers carry a full line of compliant materials, and several companies only manufacture compliant products. It is the professional opinion of the Materials & Ventilation Committee that promulgating this standard for NYC will not result in a limited selection.

## ENDNOTES:

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- <sup>1</sup> The Nat'l Inst. for Occupational Safety and Health, Chemicals and Odors, NIOSH Safety and Health Topic: Indoor Environmental Quality, <http://www.cdc.gov/niosh/topics/indoorenv/ChemicalsOdors.html> (last visited July 21, 2009).
- <sup>2</sup> BuildClean, Volatile Organic Compounds (VOCs), <http://www.buildclean.org/?id=279> (last visited July 21, 2009).
- <sup>3</sup> U.S. EPA, Indoor Air Facts No. 4 Sick Building Syndrome, <http://www.epa.gov/iaq/pubs/sbs.html> (last visited July 21, 2009).
- <sup>4</sup> The Nat'l Inst. for Occupational Safety and Health, NIOSH Safety and Health Topic: Indoor Environmental Quality; Chemicals and Odors, <http://www.cdc.gov/niosh/topics/indoorenv/ChemicalsOdors.html> (last visited July 21, 2009).
- <sup>5</sup> U.S. EPA, An Introduction to Indoor Air Quality, <http://www.epa.gov/iaq/voc.html> (last visited Jan. 25, 2010).
- <sup>6</sup> THE NAT'L CANCER INSTIT., FORMALDEHYDE AND CANCER: QUESTIONS AND ANSWERS (2009), <http://www.cancer.gov/cancertopics/factsheet/risk/formaldehyde>
- <sup>7</sup> Ibid.
- <sup>8</sup> U.S. EPA, OZONE: GOOD UP HIGH, BAD NEARBY (2003), <http://www.epa.gov/oar/oaqps/gooduphigh/ozone.pdf>.
- <sup>9</sup> U.S. EPA, AIR QUALITY GUIDE FOR OZONE (2009), <http://www.epa.gov/airnow/ozone/air-quality-guide-0308.pdf>.
- <sup>10</sup> CALIFORNIA EPA, EVALUATION OF HEALTH EFFECTS OF TOXIC AIR POLLUTANTS IN A SOUTHERN CALIFORNIA COMMUNITY: A PILOT STUDY (2002), <ftp://ftp.arb.ca.gov/carbis/research/apr/past/99-302.pdf>.
- <sup>11</sup> U.S. EPA, Ground-level Ozone: Health and Environment, <http://www.epa.gov/air/ozonepollution/health.html> (last visited Jan. 25, 2010).
- <sup>12</sup> CALIFORNIA EPA, REPORT TO THE CALIFORNIA LEGISLATURE, INDOOR AIR POLLUTION IN CALIFORNIA (2005), <http://www.arb.ca.gov/research/indoor/ab1173/rpt0705.pdf>.
- <sup>13</sup> South Coast Air Quality Management District, Painter's Guide to Clean Air, <http://www.aqmd.gov/prdas/brochures/paintguide.html> (last visited July 21, 2009).
- <sup>14</sup> Carpet and Rug Institute, Green Label/Green Label Plus, <http://www.carpet-rug.org/commercial-customers/green-building-and-the-environment/green-label-plus> (last visited March 30, 2009).
- <sup>15</sup> CARPET AND RUG INSTITUTE, GREEN LABEL PLUS FACT SHEET, [http://www.carpet-rug.org/pdf\\_word\\_docs/CRI\\_GLP\\_factsheet.pdf](http://www.carpet-rug.org/pdf_word_docs/CRI_GLP_factsheet.pdf).
- <sup>16</sup> CAL. CODE, Tit. 24 § pt. 11 § 804, 43 (2008), available at <http://www.documents.dgs.ca.gov>.
- <sup>17</sup> CALIFORNIA DEP'T. OF SERVICES, CALIFORNIA GOLD SUSTAINABLE CARPET STANDARD, 11 (2006) <http://www.documents.dgs.ca.gov/green/epp/standards.pdf>; and BILL BALEK, ISSA, NEW VOC LIMITS FOR CLEANING PRODUCTS EFFECTIVE BEGINNING OF 2009, (2009) [http://www.greensafecertified.com/PDFs/VOC\\_Limits\\_2009.pdf](http://www.greensafecertified.com/PDFs/VOC_Limits_2009.pdf).
- <sup>18</sup> THE NAT'L CANCER INSTIT., FORMALDEHYDE AND CANCER: QUESTIONS AND ANSWERS (2009), <http://www.cancer.gov/cancertopics/factsheet/risk/formaldehyde>.
- <sup>19</sup> HUGH L. CAREY, BATTERY PARK CITY AUTHORITY, COMMERCIAL/INSTITUTIONAL ENVIRONMENTAL GUIDELINES 29 (2002), [http://www.batteryparkcity.org/pdf/BPCA\\_CommercialGuidelines.pdf](http://www.batteryparkcity.org/pdf/BPCA_CommercialGuidelines.pdf); HUGH L. CAREY BATTERY PARK CITY AUTHORITY, RESIDENTIAL ENVIRONMENTAL GUIDELINES, 17 (2005) [http://www.batteryparkcity.org/pdf/BPCA\\_GreenGuidelines.pdf](http://www.batteryparkcity.org/pdf/BPCA_GreenGuidelines.pdf); and HUGH L. CAREY BATTERY PARK CITY AUTHORITY, COMMERCIAL/INSTITUTIONAL ENVIRONMENTAL GUIDELINES, 29 (2002), [http://www.batteryparkcity.org/pdf/BPCA\\_CommercialGuidelines.pdf](http://www.batteryparkcity.org/pdf/BPCA_CommercialGuidelines.pdf).
- <sup>20</sup> ILL. ADM. CODE 35 § 223 (2009), available at <http://www.ipcb.state.il.us/documents/dsweb/Get/Document-65421>.

# HT 2: LIMIT HARMFUL EMISSIONS FROM PAINTS & GLUES

*New York City Building Code*

Proposal developed by the Materials & VOCs Committee

## Summary

### Issue:

Volatile organic compounds (VOCs) are emitted from building materials, glues, adhesives, paints and lacquers. These compounds are respiratory irritants that adversely affect the health of workers and occupants.

### Recommendation:

Reduce indoor air contaminants by limiting VOCs in adhesives, sealants, paints and coatings.

## Proposed Legislation, Rule or Study

*Amendments to the New York City Building Code:*

1. Add a new section 801.1.3 as follows:

801.1.3 Volatile organic compounds. These provisions shall limit the volatile organic compounds of interior finishes, adhesives and sealants.

2. Add a new section 803.10 as follows:

803.10 Volatile organic compounds. No interior wall or ceiling finish shall contain any volatile organic compound in any concentration exceeding that permitted under Rule 1113 of the South Coast Air Quality Management District.

3. Add a new section 804.6 as follows:

804.6 Volatile organic compounds. No interior floor finish shall contain any volatile organic compound in any concentration exceeding that permitted under Rule 1113 of the South Coast Air Quality Management District.

4. Add a new section BC 806 as follows:

### SECTION BC 806 - ADHESIVES & SEALANTS

806.1 Volatile organic compounds. No interior adhesive or sealant shall contain any volatile organic compound in any concentration exceeding that permitted under Rule 1168 of the South Coast Air Quality Management District

## Supporting Information

### Issue - Expanded

Volatile organic compounds (VOCs) are common chemical contaminants that can easily evaporate into the air and are found in homes and offices.<sup>1</sup> Their presence can be noticed as an odor, such as paint and "new car smell."<sup>2</sup> Many building materials and indoor furnishings release VOCs, contributing to "sick building syndrome."<sup>3</sup> Even if a building's ventilation system is properly designed and well maintained, VOCs and other chemical contaminants must be controlled to ensure healthy indoor air.<sup>4</sup>

EPA studies have found that levels of common VOCs are consistently higher indoors than outdoors. VOC levels in homes can be 2 to 5 times higher inside than outside, with some indoor air levels over 1,000 times higher following certain activities such as paint stripping.<sup>5</sup> Paint emits numerous chemicals that the California EPA has deemed as toxic air compounds (TACs),<sup>6</sup> and emissions can continue for extended periods of time. One study found that less than 50% of the VOCs in latex paint are emitted in the first year.<sup>7</sup>

Exposure to VOCs can cause short and long-term health problems. Some VOCs are known carcinogens; several studies have found a link between exposure to formaldehyde and increased incidence of nasal cancer, nasopharyngeal cancer, and leukemia.<sup>8</sup> VOCs can also cause eye, nose, and throat irritation; headaches, loss of coordination, and nausea; and

damage to liver, kidney, and the central nervous system.<sup>9</sup>

VOCs also contribute to ground-level ozone formation (smog).<sup>10</sup> When VOCs are released into the air, the organic compounds react with nitrogen oxides to form ozone.<sup>11</sup> High concentrations of ground-level ozone can cause respiratory problems and exacerbate asthma, emphysema, and bronchitis.<sup>12</sup> Ground-level ozone also adversely affects the local ecosystem, damaging or weakening trees and plants, and reducing forest growth and crop yield.<sup>13</sup>

### **Environmental & Health Benefits**

Limiting VOC levels in adhesives, paints, coatings and sealants will reduce human exposure and avoid potential health risks associated with indoor air exposure. According to the California Air Resources Board, scientific study has only touched the ‘tip of the iceberg’ in understanding all VOCs in indoor air. Because the link between indoor air pollutants and health impacts is so complex, researchers are also investigating the reaction of VOCs with other compounds present in indoor air and are discovering new areas for future study.<sup>14</sup>

Limiting VOCs will also help lower ground-level ozone concentrations in outdoor urban air, and alleviate the health and environmental risks associated with ground-level ozone.<sup>15</sup>

This proposal was found to have a positive, indirect environmental impact.

This proposal was found to have a low positive health impact per building and to impact a large number of buildings. It was thus given a health score of 2.

### **Cost & Savings**

This proposal is not expected to have any impact on capital costs.

### **Precedents**

These limits are more stringent and comprehensive (in terms of the number of materials addressed) than the limits established in current New York State Department of Environmental Conservation (DEC) Regulations.<sup>16</sup>

These VOC limits are consistent with the South Coast Air Quality Management District’s (SCAQMD) Rules 1113 and 1168, which have been incorporated into the 2008 California Green Building Standards Code<sup>17</sup> and adopted by numerous municipalities throughout the country.<sup>18</sup> Regionally, the Bay Area Air Quality Management District also established VOC limits for adhesive and sealant products.<sup>19</sup>

Additionally, the Green Seal® has set guidelines for VOC levels in paints that manufacturers must follow to obtain a certification.<sup>20</sup> A variety of industry associations have also implemented guidelines addressing VOC levels for their respective products, including the Carpet and Rug Institute<sup>21</sup> and Resilient Flooring Institute.<sup>22</sup>

In 2005, the City of New York enacted laws creating an environmentally preferable purchasing program, which establishes VOC limits for coatings purchased by the city.<sup>23</sup> Within New York City, the Battery Park City Authority has requirements for sealants, adhesives, paints and coatings in all new construction to abide by the South Coast Air Quality Management District’s Rule 1168.<sup>24 25</sup>

A number of states, including California, New Jersey, Texas and Arizona, have enacted laws limiting VOC content in paints and coatings. EPA laws in effect since September 13, 1999 establish limits of VOC’s contained in the Architectural and Industry Maintenance (AIM) industry. All of the states in the northeast region have enacted regulations on the content of VOC’s in consumer products including cleaning products and products used in architectural and interior applications (NY, PA, NJ, MD, DE, DC, ME, CT, MA, NH, RI, VT, VA).

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) is developing Proposed Standard 189.1 - Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings. Section 8.4.2 of the standard calls for the use of low emitting building materials including adhesives, sealants, paints and coatings that are in compliance with SCAQMD Rules 1113 and 1168, and Green Seal Standards GS-36 (aerosol adhesives) and GS-11 (paints, coatings and primers). The Standard is expected to be finalized in early 2010.<sup>26</sup>

### **LEED**

These recommendations correspond with many requirements of

- LEED-CI credit EQ4.1 Low-Emitting Materials: Adhesives & Sealants;
- LEED-CI credit EQ4.2 Low-Emitting Materials: Paints & Coatings;
- LEED-NC credit EQ4.1 Low-Emitting Materials: Adhesives & Sealants;
- LEED-NC credit EQ4.2 Low-Emitting Materials: Paints & Coatings; and
- LEED for Homes credit MR2, Environmentally Preferable Products.

It should be noted that the reference standards vary significantly depending upon the type of application for the product. For example; topcoat paints, primers and sealers all have differing requirements. Adherence to these

recommendations will likely assist in achieving LEED credits, though each material must be researched independently under the selected rating system.

This recommendation will also facilitate achieving LEED-NC and LEED-CI credit EQ3.2 Construction IAQ Management Plan, Before Occupancy and LEED EB credit EQ3, Construction IAQ Management Plan and LEED for Homes credit EQ8, Contaminant Control. These points are concerned with reducing overall Indoor Air Quality problems throughout the building or space.

Adhesives for carpet and laminate adhesive are addressed separately by LEED, and do not apply to these recommendations.

#### Implementation & Market Availability

There are no known implementation issues for this proposal. Low VOC and VOC-free products are readily available.

#### Notes

Researchers have investigated VOCs in buildings for many years. There are many thousands of different types of compounds that are considered VOCs. Given this fact, research on the human health effects of VOCs is limited. Below is a summary of the current information related to VOCs, exposure, and health effects.

Human Exposure Standards:

The following information is taken from the Health Canada technical guide on indoor air quality in office buildings:

The threshold limit values (TLVs) for individual chemical substances that have been adopted by the American Conference of Governmental Industrial Hygienists (ACGIH) are not appropriate for office environments, for several reasons. For example, ACGIH TLVs apply to industrial workers who may be exposed to a few known contaminants at high concentrations over a 40-hour work week. Industrial workers are usually provided with adequate protective equipment (e.g., source ventilation, protective clothing or face masks, breathing equipment). In addition, the industrial workforce is generally made up of young, healthy, adult males.

Office workers, on the other hand, are exposed, without protective equipment, to a broad spectrum of contaminants at low concentrations over periods often longer than 40 hours per week. The synergistic effect of these compounds on occupant comfort is not known. As well, the population composition of the office workforce covers a much broader spectrum than that of the industrial workforce. It would therefore seem that individual limits much lower than ACGIH TLVs are more appropriate.<sup>27</sup>

ASHRAE Standard 62-2007 observes that one approach has been to assume that some fraction of TLV is applicable and would not lead to adverse health effects or complaints in general populations; however, ASHRAE cautions that this approach should not be used without first assessing its suitability for the contaminant of concern. ASHRAE indicates that concentrations of concern range from less than one part per billion (ppb) for some very toxic compounds or for compounds having very low odor thresholds up to concentrations several orders of magnitude higher. "Not all compounds can be identified, and toxicological data are incomplete for many compounds." Although there are at present no U.S. standards for Total VOC, the U.S. Green Building Council Leadership in Energy and Environmental Design target is 500 micrograms per cubic meter. The European Community has prepared a target guideline value for TVOC of 300 micrograms per cubic meter, where no individual VOC should exceed 10% of the TVOC concentration.<sup>28</sup> ASHRAE 62-2007 states that precise guidance on TOC concentrations cannot be given, and that setting target concentrations for TVOCs is not recommended.

Health Effects:

Of the VOCs typically found indoors, only a few, such as formaldehyde and acrolein, are irritants at levels typically measured. A few of the VOCs commonly found in indoor environments are known carcinogens (e.g., benzene), although evidence for carcinogenicity is extrapolated from high-level exposures in industrial environments.<sup>29</sup> Others (e.g., carbon tetrachloride, chloroform) have produced cancer in laboratory animals, but no direct evidence exists for human effects.<sup>30</sup> Most VOCs are lipid soluble, readily cross the blood-brain barrier, and are easily absorbed through the lungs. Most are neurotoxic and, in levels in excess of occupationally acceptable limits, may cause central nervous system depression, vertigo, visual disorders, and occasionally tremors, fatigue, anorexia, and weakness. Potential genotoxic effects are still under investigation. Effects of low-level exposures to VOC mixtures over long periods of time are still being researched.

The following information is taken from the Health Canada technical guide on indoor air quality in office buildings:

Research in North America and Europe has demonstrated that VOCs at concentrations much lower than the ACGIH TLVs can cause discomfort. In an exposure range of 0.3-3 mg/m<sup>3</sup>, odors, irritation, and discomfort may appear in response to the presence of TVOC together with thermal comfort factors and stressors. Above about 3 mg/m<sup>3</sup>, one may expect complaints; above 25 mg/m<sup>3</sup>, temporary discomfort and respiratory irritation have been demonstrated for a common mix of chemicals in an office building.

Hypersensitive individuals can have severe reactions to a variety of VOCs at very low concentrations. They can react to organic compounds that are released by building materials, carpets, and various consumer products, including plastics, soaps and dyes. These reactions can occur following exposure to a single sensitizing dose or sequence of doses, after which time a much lower dose can provoke symptoms. Chronic exposure to low doses can also cause reactions. Symptoms are usually non-specific and may be insufficient to permit identification of the appropriate compounds. Because the available knowledge of toxicological and sensory effects of VOCs and their mixtures is incomplete, reduction of overall exposure to VOCs is desirable.<sup>31</sup>

## **ENDNOTES:**

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<sup>1</sup> National Institute for Occupational Safety and Health, Safety and Health Topic: Indoor Environmental Quality. Chemicals and Odors, <http://www.cdc.gov/niosh/topics/indoorenv/ChemicalsOdors.html> (last visited Jan. 13, 2010).

<sup>2</sup> BuildClean. Volatile Organic Compounds (VOCs), <http://www.buildclean.org/?id=279> (last visited Jan. 13, 2010).

<sup>3</sup> U.S. EPA, Indoor Air Quality. Indoor Air Facts No. 4: Sick Building Syndrome, <http://www.epa.gov/iaq/pubs/sbs.html> (last visited Jan 13, 2010).

- <sup>4</sup> National Institute for Occupational Safety and Health, Safety and Health Topic: Indoor Environmental Quality, <http://www.cdc.gov/niosh/topics/indoorenv/> (last visited Jan. 26, 2010).
- <sup>5</sup> U.S. EPA, An Introduction to Indoor Air Quality, <http://www.epa.gov/iaq/voc.html> (last visited Jan. 26, 2010).
- <sup>6</sup> CAL. HEALTH AND SAFETY CODE § 39655 (2005) (An air pollutant is defined as an airborne substance which may cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health.).
- <sup>7</sup> STATE OF CALIFORNIA EPA, REPORT TO THE CALIFORNIA LEGISLATURE: INDOOR AIR POLLUTION IN CALIFORNIA (2005) available at <http://www.arb.ca.gov/research/indoor/ab1173/rpt0705.pdf>.
- <sup>8</sup> National Cancer Institute, Formaldehyde and Cancer: Questions and Answers, <http://www.cancer.gov/cancertopics/factsheet/risk/formaldehyde> (last visited Jan. 13, 2010).
- <sup>9</sup> U.S. EPA, An Introduction to Indoor Air Quality, <http://www.epa.gov/iaq/voc.html>. (last visited Jan. 13, 2010).
- <sup>10</sup> Ibid.
- <sup>11</sup> U.S. EPA, OZONE: GOOD UP HIGH, BAD NEARBY (2003), available at <http://www.epa.gov/air/ozonepollution/pdfs/ozonegb.pdf>.
- <sup>12</sup> U.S. EPA, AIR QUALITY GUIDE FOR OZONE, <http://www.epa.gov/airnow/ozone/air-quality-guide-0308.pdf> (last visited Jan. 13, 2010).
- <sup>13</sup> U.S. EPA, Ground-level Ozone: Health and Environment, <http://www.epa.gov/air/ozonepollution/health.html> (last visited Jan. 13, 2010).
- <sup>14</sup> STATE OF CALIFORNIA EPA, REPORT TO THE CALIFORNIA LEGISLATURE: INDOOR AIR POLLUTION IN CALIFORNIA (2005).
- <sup>15</sup> South Coast Air Quality Management District, Painter's Guide to Clean Air, <http://www.aqmd.gov/prdas/brochures/paintguide.html> (last visited Jan. 13, 2010).
- <sup>16</sup> 3 NYCRR § 228, 235 (2009), available at <http://www.dec.ny.gov/regs/2492.html>.
- <sup>17</sup> CAL. CODE, Tit. 24 § pt. 11 § 804, 42-43 (2008), available at <http://www.documents.dgs.ca.gov>.
- <sup>18</sup> Susan Brimo-Cox, VOC Regulations: Regional VOC regulations, PAINTPRO, January/February 2007, available at [http://www.paintpro.net/Articles/PP901/PP901-Business\\_Strategies.cfm](http://www.paintpro.net/Articles/PP901/PP901-Business_Strategies.cfm).
- <sup>19</sup> BAY AREA AIR QUALITY MANAGEMENT DISTRICT, 8 § 51 (2002), available at <http://www.baaqmd.gov/dst/regulations/rg0851.pdf>.
- <sup>20</sup> GREEN SEAL, GS-11: ENVIRONMENTAL REQUIREMENTS FOR PAINTS (3D. ED. 2010) available at [http://www.greenseal.org/certification/standards/GS-11\\_Paints\\_and\\_Coatings.pdf](http://www.greenseal.org/certification/standards/GS-11_Paints_and_Coatings.pdf).
- <sup>21</sup> Carpet and Rug Institute, Green Label/ Green Label Plus, <http://www.carpet-rug.org/commercial-customers/green-building-and-the-environment/green-label-plus/index.cfm> (last visited Jan. 13, 2010).
- <sup>22</sup> SCIENTIFIC CERTIFICATION SYSTEMS, INDOOR AIR QUALITY PERFORMANCE: RESILIENT FLOORING INSTITUTE FLOOR SCORE, (2007), available at [http://rfci.com/SCS-EC10.2\\_2007.pdf](http://rfci.com/SCS-EC10.2_2007.pdf).
- <sup>23</sup> City of New York Local Laws 118 & 120 of 2005 (2005). Available at [http://www.nyc.gov/html/nycwasteless/html/at\\_agencies/laws\\_directives.shtml](http://www.nyc.gov/html/nycwasteless/html/at_agencies/laws_directives.shtml)
- <sup>24</sup> HUGH L. CAREY, BATTERY PARK CITY AUTHORITY, COMMERCIAL/INSTITUTIONAL ENVIRONMENTAL GUIDELINES 29 (2002), [http://www.batteryparkcity.org/pdf/BPCA\\_CommercialGuidelines.pdf](http://www.batteryparkcity.org/pdf/BPCA_CommercialGuidelines.pdf).
- <sup>25</sup> HUGH L. CAREY, BATTERY PARK CITY AUTHORITY, RESIDENTIAL ENVIRONMENTAL GUIDELINES 17 (2005) [http://www.batteryparkcity.org/pdf/BPCA\\_GreenGuidelines.pdf](http://www.batteryparkcity.org/pdf/BPCA_GreenGuidelines.pdf).
- <sup>26</sup> ASHRAE, Proposed Standard 189.1 Begins Third Public Review with Increased Energy Savings (Mar. 4, 2009), <http://www.ashrae.org/pressroom/detail/17123>.
- <sup>27</sup> HEALTH CANADA, CAN. MIN. OF NAT. HEALTH AND WELFARE, INDOOR AIR QUALITY IN OFFICE BUILDINGS: A TECHNICAL GUIDE, (1995), available at [http://www.hc-sc.gc.ca/ewh-semt/alt\\_formats/hecs-sesc/pdf/pubs/air/office\\_building-immeubles\\_bureaux/93ehd-dhm166-eng.pdf](http://www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/air/office_building-immeubles_bureaux/93ehd-dhm166-eng.pdf).
- <sup>28</sup> Ibid.
- <sup>29</sup> Robert Rinsky, et al., Benzene and Leukemia: An Epidemiologic Risk Assessment, 316:17 N. ENGL. J. MED., 1044-1050 (1987), available at <http://content.nejm.org/cgi/content/abstract/316/17/1044>.
- <sup>30</sup> JV RODRICKS, ASSESSING CARCINOGENIC RISKS ASSOCIATED WITH INDOOR AIR POLLUTANTS (1996).
- <sup>31</sup> HEALTH CANADA, CAN. MIN. OF NAT. HEALTH AND WELFARE, INDOOR AIR QUALITY IN OFFICE BUILDINGS (1995).

# HT 3: RESTRICT CANCER-CAUSING FORMALDEHYDE IN BUILDING MATERIALS

*New York City Health Code; New York City Building Code; New York City Administrative Code*  
 Proposal developed by the Materials & VOCs Committee

## Summary

**Issue:**

Formaldehyde is a carcinogen and irritant found in composite wood materials, which are widely used in construction.

**Recommendation:**

Limit the content of formaldehyde in non-structural composite wood products.

## Proposed Legislation, Rule or Study

*Amendments to the New York City Health Code:*

1. Add a new section 131.14 as follows:

§131.14 Formaldehyde. (a) This section shall apply to any hardwood plywood, particleboard or medium density fiberboard, or pre-manufactured product containing such materials, installed in a building; provided, however, that this section shall not apply to any building classified in occupancy group R-3 under the New York City Building Code until July first, two thousand sixteen and shall not apply to manufactured homes.

(b) Any material or product covered by this section shall comply with the following standards as of the dates set forth therein and as tested by a third-party certification organization using the protocols of ASTM E 1333-96:

Formaldehyde Limits		
Maximum formaldehyde emissions in parts per million allowable for installation in buildings:		
	As of July 1, 2010	As of July 1, 2013
Hardwood Plywood Veneer Core	0.05	--
Hardwood Plywood Composite Core	0.08	0.05
Particleboard	0.18	0.09
Medium Density Fiberboard	0.21	0.11
Thin Medium Density Fiberboard (max. thickness 8 mm.)	0.21	0.13

[.] (c) By July first, two thousand sixteen, and at least every 3 years thereafter, the department shall review and, if necessary, update or revise the standards in this section.

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*Amendments to the New York City Building Code:*

1. Add a new Section 2303.8 as follows:

2303.8 Formaldehyde limits. Any hardwood plywood, particleboard or medium density fiberboard, or pre-manufactured product containing such materials installed in a building shall comply with the standards of section 131.14 of the New York City Health Code.

*Amendments to the New York City Administrative Code*

1. Add a new subchapter to Chapter 4 of Title 20 that is similar in substance and structure to Subchapter 12 (Endangered or Threatened Species) but contains the following prohibition language:

Composite wood products. (a) It shall be unlawful to buy or sell, offer or attempt to buy or sell, or cause any person to buy or sell any hardwood plywood, particleboard or medium density fiberboard, or pre-manufactured product containing such materials, intended for installation in a building, that do not comply with section 131.14 of the New York City Health Code on formaldehyde limits.

## Supporting Information

### Issue - Expanded

Formaldehyde is a colorless, flammable, strong-smelling gas that is often used as a fungicide and germicide. The use of urea-formaldehyde resins as adhesives by the forest products industry is due to this chemical's low cost, ease of use under a wide variety of conditions, low cure temperatures, water solubility, resistance to microorganisms and to abrasion, hardness, excellent thermal properties, and lack of color.<sup>1</sup>

Materials that contain formaldehyde can release formaldehyde gas into the air. The Environmental Protection Agency (EPA) classifies formaldehyde as a probable human carcinogen, and the International Agency for Research on Cancer lists formaldehyde as a known human carcinogen.<sup>2</sup> Formaldehyde was also designated as a toxic air contaminant (TAC)<sup>3</sup> in California in 1992 with no safe level of exposure.<sup>4</sup> High concentrations of formaldehyde may trigger attacks in people with asthma.<sup>5</sup> Studies have also found a link between exposure to formaldehyde and increased incidence of nasal cancer, nasopharyngeal cancer, and leukemia.<sup>6</sup> Exposure to formaldehyde is known to cause eye, nose, and throat irritation, nausea, fatigue, skin rash, difficulty in breathing and sensitization.<sup>7</sup>

As a volatile organic compound (VOC), formaldehyde also contributes to ground-level ozone formation (smog). When VOCs are released into the air, the organic compounds react with nitrogen oxides to form ozone. High concentrations of ground-level ozone can cause respiratory problems and exacerbate asthma, emphysema, and bronchitis. Ground-level ozone also adversely affects the local ecosystem, damaging or weakening trees and plants, and reducing forest growth and crop yield.<sup>8</sup>

### Environmental & Health Benefits

Limiting formaldehyde in wood products will reduce exposure to a known human carcinogen.<sup>9 10</sup>

This proposal was found to have a positive, indirect environmental impact.

This proposal was found to have a high positive health impact per building and to impact a large number of buildings. It was thus given a health score of 3.

### Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1<sup>st</sup> draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.0% to 0.0%, depending on building type. This proposal was estimated to increase first capital costs by up to 0.01%, depending on building type. It was thus categorized as not incurring a capital cost increment.

### Precedents

The requirements of this proposal are consistent with regulations in the California Code of Regulations<sup>11</sup> and formaldehyde limits in the 2008 California Green Building Standards Code.<sup>12</sup>

### HT 3: RESTRICT CANCER-CAUSING FORMALDEHYDE IN BUILDING MATERIALS

Numerous federal agencies have established limits on formaldehyde for their own buildings or non-standard housing. The EPA has established a limit of 0.0163 ppm for formaldehyde in its new buildings.<sup>13</sup> HUD has established a limit of 0.4 ppm for formaldehyde in mobile homes.<sup>14</sup> FEMA has also established a maximum exposure limit of less than 0.016 ppm for temporary housing units.<sup>15</sup>

The federal Agency for Toxic Substances and Disease Registry summarized the state of regulation of formaldehyde in 1999 as follows:

Several international, national, and state authorities have established regulations or guidelines for the use and production of formaldehyde. OSHA has established the permissible exposure limit (PEL) 8-hour time-weighted average (TWA) at 0.75 ppm and the 15-minute Short-Term Exposure Limit (STEL) at 2 ppm. The EPA sets regulations for reporting quantities used and how much formaldehyde can legally be produced from automobile exhaust; the FDA also has regulations about the use of formaldehyde in the food you eat.

Non-enforceable guidelines have also been established for formaldehyde. The American Conference of Governmental and Industrial Hygienists (ACGIH) has established a ceiling limit for occupational exposure (Threshold Limit Value [TLV]) of 0.4 ppm. NIOSH has a recommended exposure limit for occupational exposure (8-hour TWA) of 0.016 ppm, and a 15-minute ceiling limit of 0.1 ppm.”<sup>16</sup>

#### LEED

LEED rating systems do not adhere to guidelines denoting a permissible level of formaldehyde. Rather, it is the absence of urea-formaldehyde resins that is required for LEED. While the LEED criteria differ from this proposal, projects complying with the recommendations of this proposal will inevitably find it more feasible to acquire LEED points. However, additional research and attention to product specifications will be required to verify conformance.

The following credits may apply:

- LEED NC-EQ cr.4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products;
- LEED CI-EQ cr.4.4 Low-Emitting Materials, Composite Wood and Laminate Adhesives;
- LEED EB-MR cr.3 Optimize Use of IAQ Compliant Products;
- LEED for Schools-EQ cr.4 Low-Emitting Materials;

Although building classified in R-3 occupancy are not included, other residential projects applying under the LEED for Homes rating system may be eligible for credit MR cr.2.

#### Implementation & Market Availability

“No added formaldehyde” products are widely available. Examples of manufacturers who offer alternative building materials in the New York market include Columbia Forest Products<sup>17</sup>, Homasote and Viroc.<sup>18</sup> A search on the Columbia Forest Products website identified 4 suppliers within 10 miles of the NYC metro area that carry their products. Twenty businesses were also found to either carry Homasote products or offer assistance with obtaining products within 6 miles of lower Manhattan.

The California EPA website includes a list of over 600 mills that have been identified by a California Air Resources Board (CARB)-approved Third Party Certifier as producers of CARB compliant composite wood products.<sup>19</sup>

The use of alternative resin binders are also being researched by manufacturers. However, no new products have been identified that can replace urea-formaldehyde (UF) that do not raise some other environmental health concerns.<sup>20</sup>

#### Notes

The US Department of Housing and Urban Development has set formaldehyde emission standards in manufactured homes,<sup>21</sup> preempting states and their political subdivisions from enacting such regulations.

Pressed wood products, especially those containing urea-formaldehyde glues, are a major source of formaldehyde. These products are manufactured using urea-formaldehyde resins which are used as interior-grade adhesives in many wood products and in finish coatings applied to hardwood cabinetry and furniture. Such products include particleboard used as flooring underlayment, shelves, cabinets, and furniture; hardwood plywood wall panels; and medium density fiberboard used in drawers, cabinets and furniture. When the surfaces and edges of these products are unlaminated or uncoated they have the potential to release more formaldehyde.<sup>22</sup>

Urea-formaldehyde resins are chemically unstable and can release formaldehyde from unreacted formaldehyde trapped in the resin and from the hydrolytic decomposition of the resin polymer itself. It is the release of the unreacted formaldehyde that is primarily responsible for high initial indoor formaldehyde levels. There does not appear to be a population threshold for the irritant effects of formaldehyde, and sensitization may result in symptom initiation even at low levels of exposure.<sup>23</sup>

How to quantitatively relate measured air levels of formaldehyde to cancer risk is uncertain. Because many other factors play a role in the development of cancer and because formaldehyde is ubiquitous in the environment, no

definitive level can be established that places humans in a “high-risk” category. The safest way to reduce risk for cancer is to limit exposure. Clinically useful biologic markers, such as blood or urine tests, also are lacking, further complicating the ability to link exposure with outcome. Because formaldehyde plays integral physiologic roles and has a short half-life in the body, determining what is necessary for normal physiologic function and what is excessive and potentially harmful is difficult. In general, the lower the level and shorter the duration of exposure, the lower the risk for cancer and other health effects.<sup>24</sup>

## ENDNOTES:

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<sup>1</sup> ANTHONY H. CONNER, UREA-FORMALDEHYDE ADHESIVE RESINS, 2 POLYMERIC MATERIALS ENCYCLOPEDIA, (1996), available at <http://www.fpl.fs.fed.us/documnts/pdf1996/conne96a.pdf>.

<sup>2</sup> Clifford Weisel, et al., Relationships of Indoor, Outdoor, and Personal Air: Collection Methods and Descriptive Analyses, , 130:1 HEALTH EFFECTS INST. 1-107 (2005).

<sup>3</sup> As defined by the California Health and Safety Code § 39655 (2005). (Definition: (a): an air pollutant which may cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health. California Health and Safety Code, Section 39655 (a): an air pollutant which may cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health.)

<sup>4</sup> State of California EPA, Air Resources Board, Composite Wood Products ATCM, <http://www.arb.ca.gov/toxics/compwood/compwood.htm> (last visited July 21, 2009).

<sup>5</sup> Ibid.

- <sup>6</sup> The National Cancer Institute, Formaldehyde and Cancer Risk, <http://www.cancer.gov/cancertopics/factsheet/risk/formaldehyde> (last visited Oct. 14, 2009).
- <sup>7</sup> U.S. EPA, An Introduction to Indoor Air Quality: Formaldehyde, <http://www.epa.gov/iaq/formalde.html> (last visited Jan. 12, 2010).
- <sup>8</sup> U.S. EPA, Ground-level ozone: Health and Environment, <http://www.epa.gov/air/ozonepollution/health.html>. (last visited Jan. 12, 2010).
- <sup>9</sup> International Agency for Research on Cancer, IARC Classifies Formaldehyde as Carcinogenic to Humans, <http://www.iarc.fr/en/media-centre/pr/2004/pr153.html>. (last visited Jan. 13, 2010).
- <sup>10</sup> U.S. EPA, Integrated Risk Information System (IRIS): Formaldehyde, <http://www.epa.gov/iris/subst/0419.htm>. (last visited Jan. 13, 2010).
- <sup>11</sup> CAL. CODE, Tit. 17 § 93120-93120.12, (2008).
- <sup>12</sup> CAL. CODE, Tit. 24 § pt. 11 § 804, (2008), available at [http://www.documents.dgs.ca.gov/bsc/2009/part11\\_2008\\_calgreen\\_code.pdf](http://www.documents.dgs.ca.gov/bsc/2009/part11_2008_calgreen_code.pdf).
- <sup>13</sup> U.S. EPA, Testing for Indoor Air Quality, § 1.81.9 3 (2007), available at <http://www.epa.gov/rtp/campus/environmental/018109.pdf>.
- <sup>14</sup> US Consumer Product Safety Commission, An Update on Formaldehyde: 1997 Revision, (2007) <http://www.cpsc.gov/cpsc/pub/pubs/725.html> (last visited Jan. 13, 2010).
- <sup>15</sup> FEMA, 2009 DISASTER HOUSING PLAN, (2009) <http://www.fema.gov/pdf/emergency/disasterhousing/FEMA2009HousingPlan.pdf>.
- <sup>16</sup> Agency for Toxic Substances and Disease Registry, Public Health Statement for Formaldehyde, (1999), <http://www.atsdr.cdc.gov/toxprofiles/phs111.html> (last visited Jan. 13, 2010).
- <sup>17</sup> Cora Roelofs, et al., Encyclopedia of Earth, Alternatives for Significant uses of Formaldehyde in Massachusetts (2008) [http://www.eoearth.org/article/Alternatives\\_for\\_significant\\_uses\\_of\\_formaldehyde\\_in\\_Massachusetts](http://www.eoearth.org/article/Alternatives_for_significant_uses_of_formaldehyde_in_Massachusetts). (Columbia Forest Products offers a soy-based resin hardwood veneer core plywood panel (Purebond) that can be used to make cabinets, built-in furniture, paneling, shelving, doors and other uses requiring a high end wood product. Purebond is superior to formaldehyde-resin plywood from a health perspective as it eliminates potential formaldehyde exposures for users. However, its production involves use of epichlorohydrin as an intermediate. Epichlorohydrin is classified as a probable human carcinogen and poses other hazards to human health and the environment. This chemical could be a hazard to workers and the environment during production. Both Purebond and formaldehyde-resin plywood exhibit a similar environmental profile with regard to minor ecotoxicity. Technically, Purebond is similar to formaldehyde-containing plywood for the parameters of appearance/construction, fire resistance, and product availability. It has a glue bond superior to that of urea-formaldehyde plywood under conditions of moisture, but its warp resistance has not been fully assessed. Purebond is currently available at a similar cost to formaldehyde-resin plywood.).
- <sup>18</sup> Ibid. [http://www.eoearth.org/article/Alternatives\\_for\\_significant\\_uses\\_of\\_formaldehyde\\_in\\_Massachusetts](http://www.eoearth.org/article/Alternatives_for_significant_uses_of_formaldehyde_in_Massachusetts) (last visited on Jan. 25, 2010), (Homasote and Viroc offer alternatives to softwood plywood panels (Homasote's recycled paper panel boards and Viroc's wood fiber Portland cement panels). Neither product presents a health hazard to building occupants, but there are some occupational exposure concerns, such as exposure to wood and cement dust during cutting. Both products are superior to formaldehyde-resin plywood from the perspective of carcinogenicity of the binder. The Homasote panels are superior from the perspective of irritant in binder, while the Viroc panels are similar to formaldehyde-resin plywood on this metric. Both products are superior to formaldehyde-resin plywood from the perspective of ecotoxicity and natural resource conservation. However, the Viroc product is inferior from an energy intensity life cycle perspective. Technical and performance criteria of interest for these uses include strength, weight, response to moisture, storage, handling, fastening, finishing, fire resistance, thermal resistance, and mold, rot and insect resistance. Both alternatives present some advantages and some disadvantages on these metrics. For example, Homasote is superior to formaldehyde-resin panels on several measures including resistance to insects, rot, and mold, and is inferior on certain other measures, such as impact resistance and tensile strength. Viroc is superior on measures including resistance to insects, rot, and mold, fire resistance, and impact resistance, and inferior on parameters such as tensile strength. Both Viroc and Homasote panels must be thicker and heavier than formaldehyde-resin panels to withstand an equivalent load over the same span.).
- <sup>19</sup> State of California EPA, List of Mills Producing CARB Compliant Composite Wood Products (2009), <http://www.arb.ca.gov/toxics/compwood/tpc/listofmills.htm> (last visited Jan. 13, 2010).
- <sup>20</sup> HEALTHY BUILDING NETWORK, GLOBAL HEALTH AND SAFETY INITIATIVE, FACT SHEET: ALTERNATIVE RESIN BINDERS FOR PARTICLEBOARD, MDF AND WHEATBOARD (2008) <http://www.healthybuilding.net/healthcare/Alternative%20Resin%20Binders.pdf> (last visited Jan. 13, 2010).
- <sup>21</sup> 24 U.S.C. § 3280.308 (1984).
- <sup>22</sup> US Consumer Product Safety Commission, An Update on Formaldehyde: 1997 Revision, (2007) <http://www.cpsc.gov/cpsc/pub/pubs/725.html> (last visited Jan. 13, 2010).
- <sup>23</sup> THAD GODISH, AIR QUALITY 357-60 (2d ed. 1990).
- <sup>24</sup> CENTERS FOR DISEASE CONTROL AND PREVENTION, FINAL REPORT ON FORMALDEHYDE LEVELS IN FEMA-SUPPLIED TRAVEL TRAILERS, PARK MODELS, AND MOBILE HOMES 4-5 (2008), available at <http://www.cdc.gov/nceh/ehhe/trailerstudy/pdfs/FEMAFinalReport.pdf>.

# HT 4: KEEP STREET CONTAMINANTS OUT OF BUILDINGS

*New York City Health Code*

Proposal developed by the Materials & VOCs Committee

## Summary

### Issue:

Foot traffic brings many indoor air contaminants and bacteria into buildings. These particulates irritate the respiratory system and can trigger asthma.

### Recommendation:

Require new buildings to install permanent entry mat systems to capture particulates.

## Proposed Legislation, Rule or Study

*Amendments to the New York City Health Code:*

1. Add a new Section 131.14 as follows:

§131.14 Entrance particulate control. (a) Public entrances of any new building, other than any building classified under the New York City Building Code in occupancy group R-3, or with a floor plate less than 3000 square feet, shall install a permanent mat system to capture particulates entering the building.

(b) For the purposes of this section, “permanent mat system” shall mean a permanently installed grate, grille or slotted system and recessed collection area that allows for the capture of particulates that are carried into buildings by normal foot traffic. The permanent mat system shall be at least six feet long, measured in the primary direction of travel, and no less wide than the width of the entry opening. Revolving doors may alternatively include the mat system within such doorway.

## Supporting Information

### Issue - Expanded

Many indoor air contaminants enter buildings via foot traffic. During dry weather conditions, 1,000 people can track a quarter pound of dirt per day into a building.<sup>1</sup> Since vacuums only pick up about 10% of dirt from carpets, requiring permanent entry mat systems will result in better indoor air quality.<sup>2</sup> According to a microbiologist at the University of Arizona, “as many as 5,000 bacteria can cling to one square inch of footwear... 100 times more than can be found on a similar-sized area of a toilet seat.”<sup>3</sup>

### Environmental & Health Benefits

A New York City Department of Health report indicates that buildings with LEED certification show improved post-construction indoor air quality by lowering levels of PM10s (particles smaller than 10 microns). The preliminary findings were recently presented at the American Academy of Allergy, Asthma, and Immunology annual meeting.<sup>4</sup>

This proposal was found to have no significant positive environmental impact.

This proposal was found to have a low positive health impact per building and to impact a large number of buildings. It was thus given a health score of 2.

### Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1<sup>st</sup> draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs. It was thus categorized as not incurring a capital cost increment.

### Precedents

The 2008 California Green Building Standards Code requires permanent entryway systems be installed at all entryways connected to the outdoors.<sup>5</sup>

Numerous Agencies and School Systems include recommendations or requirements for entry systems, including but not limited to:

- NYC School Construction Authority “Green Schools Guide”<sup>6</sup>
- Washington State Department of Health
- National Best Practices Manual for High Performance Schools
- Minnesota Department of Health
- Texas Department of State Health Services

Additional Agencies recommending Entry Systems:

- EPA Indoor Air Quality Building Education and Assessment Model
- Battery Park City Guidelines for Commercial Buildings and Residential Buildings
- WTC Redevelopment Projects Sustainable Design Guidelines (LMDC, PANYNJ, NYSERDA)

### LEED

LEED NC Indoor Environmental Quality Credit 5, Indoor Chemical and Pollutant Source Control, requires that projects employ permanent walk-off entryway systems at main building entrances that are directly connected to the outdoors. This recommended code revision is in accordance with LEED criteria.

LEED CI Indoor Environmental Quality Credit 5, Indoor Chemical and Pollutant Source Control, identifies the locations for permanent entryway systems at all high volume exterior entryways within the tenant area. These are not necessarily main public entrances to the building. Therefore, additional entryway systems beyond what these recommendations outline may be required in order to comply with LEED CI.

LEED for Homes credit EQ8, Contaminant Control, requires installation of permanent walk-off mats at each entry. Although this proposal excludes buildings in occupancy group R-3, other residential buildings applying for certification under this LEED rating system must comply to receive this credit.

Entryway systems are only one component of the LEED NC, CI, and LEED for Homes EQ credits and providing the mat system does not guarantee compliance.

This recommendation will also facilitate achieving LEED NC and LEED CI credit EQ3.2, Construction IAQ Management Plan, Before Occupancy and LEED EB credit EQ3, Construction IAQ Management Plan. These points are concerned with reducing overall Indoor Air Quality problems throughout the building or space.

### Implementation & Market Availability

There are no known implementation issues for this proposal. Permanent mat systems are widely available. Permanent mat systems require detailing of finish and structural floor to receive mat system and maintain flush floor conditions consistent with the ADA Accessibility Guidelines for Buildings and Facilities (ADAAG).

### Notes

The Committee discussed at length what buildings and entrances should be covered by this proposal. The Committee used the 2004 ADAAG as a basis to decide these questions and its deliberations are noted below.

How to define public entry? The committee sought precedents for the definition of public entry. NYC Building Code defines a public entrance as “an entrance that is not a service entrance.” The 2004 ADAAG defines public entrance as any entrance that is not service or restricted. Example – a manufacturing facility might have an area for administrative workers which would be considered a public entrance, while the entrance for the processing area would be considered a service entrance. Entrance to a parking facility would be considered a service entrance.

How to not create undue hardship for manufacturing processing? The Committee concluded that the NYC Building Code definition, which excludes service areas, covers the concept of exemption for manufacturing processing areas. The Committee also felt that by limiting the requirement to new buildings, hardship that may be present for rehab projects, such as not having sufficient depth to recess floor mat, would be avoided.

How to not create undue hardship for small establishments (primarily retail and restaurant/hospitality)? ADAAG 2004 allows exceptions for facilities less than 3,000 sf as explained in the Preamble to the ADA Guidelines and published in the Federal Register on July 23, 2004.

## ENDNOTES:

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<sup>1</sup> Amy Streeton, Walk-Off Mats are Green & Contribute to Building Safety, <http://www.mcmorrowreport.com/sfm/articles/mats.asp> (last visited Jan. 13, 2010).

<sup>2</sup> Ibid.

<sup>3</sup> Today's Facility Manager, Walk Off Mats can Aid in Healthy Facilities, <http://todaysfacilitymanager.com/facilityblog/2009/01/walk-off-mats-can-aid-in-healthy-facilities.html> (last visited Jan. 13, 2010).

<sup>4</sup> E. Horner, et al., Green buildings: LEED Certification Requirements for Indoor Airborne Particles Can Reduce Indoor PM10 Exposure, 123:2 J. OF ALLERGY AND CLINICAL IMMUNOLOGY (2009).

<sup>5</sup> CAL. CODE, Tit. 24 § pt. 11 § 804, 43-44 (2008), available at [http://www.documents.dgs.ca.gov/bsc/2009/part11\\_2008\\_calgreen\\_code.pdf](http://www.documents.dgs.ca.gov/bsc/2009/part11_2008_calgreen_code.pdf).

<sup>6</sup> NYC DEP'T. OF ED., NYC SCHOOL CONSTRUCTION AUTHORITY. GREEN SCHOOLS GUIDE (2007), <http://source.nycsca.org/GreenSchools/nycgsg-031507.pdf>.

# HT 5: FILTER SOOT FROM INCOMING AIR

*New York City Mechanical Code*  
Proposal developed by the Energy & Ventilation Committee

## Summary

### Issue:

HVAC systems bring outside air into buildings, along with airborne pollutants. Without proper filters, this can lower the quality of indoor air.

### Recommendation

Require the use of HVAC systems that filter soot and other pollutants from indoor air.

## Proposed Legislation, Rule or Study

*Amendments to the New York City Mechanical Code*

1. Add a new Section 605.2.1 as follows:

**605.2.1 Standards for air handlers.** Air handlers with a design capacity greater than or equal to 5,000 cfm, any portion of which provides outdoor air ventilation shall utilize a MERV 11 or greater filtration system.

## Supporting Information

### Issue - Expanded

Air handling equipment from the start has been equipped with filters as a means of protecting and keeping clean internal components such as coils, fans and the ductwork distribution system itself. A clean system is an energy efficient system as dirt accumulation on coils reduces heat transfer and increases pressure drop. Filtering of this type tends to have at best Minimum Efficiency Reporting Value (MERV) of 7 to 8 (in accordance with ASHRAE standard 52.2), which will have an arrestance of greater than 90% of particles with 3 microns diameter and above.

There has been increased health concerns with particles 2.5 microns and smaller because they stay suspended in the air for long periods and are able to penetrate deep into the lungs. This measure proposes establishing a filtering requirement with a minimum MERV value of 11 which has an arrestance of greater than 95% of particles 1 to 3 microns in size. Typical particles of this size tend to be termed "soot" in the outdoor urban environment and form part of automobile, bus, and truck emissions. Other particles of this size include: Legionella bacteria, lead dust, coal dust, welding fumes, and nebulizer drops.

Several issues were examined before arriving at the MERV 11 selection. First there appear to be diminishing returns at filter efficiencies beyond MERV 11-13. A study has noted that increasing filter efficiency beyond these values in residential building has only a marginal decrease in the concentration of fine particles<sup>1</sup>. This is probably due to unfiltered air infiltrating the buildings through cracks and crevices around windows and doors and indoor particulate generation from within the space itself.

Second, there are additional maintenance and operations cost associated with higher levels of filtration. In general an additional set of filters, called prefilters are more likely to be required on filtration systems higher than MERV 11. The prefilters extend the life of the higher efficient final filters, but require additional maintenance and are more expensive. Increased filter efficiency also requires additional fan energy to push the air through the filter.

MERV 11 is a practical balance between the competing parameters and recognizes the increased awareness of the hazards associated with very small particles.

### Environmental & Health Benefits

Clean air can help support worker comfort leading to greater productivity with the expectation of increased company profitability. The avoidance of a headache or two is of substantial value in the workplace, while avoidance of a lost day of work has this measure paying for itself. From a community benefits standpoint cleaner air should lessen respiratory related illnesses and the associated health costs of such issues.

A New York Department of Health report indicates that buildings with U.S. Green Building Council LEED-certifications help reduce post-construction indoor air pollution by lowering levels of PM10s (particles smaller than 10 microns). The preliminary findings were recently presented at the American Academy of Allergy, Asthma, and Immunology annual meeting.<sup>2</sup>

This proposal was found to have no significant positive environmental impact.

This proposal was found to have a high positive health impact per building and to impact a small number of buildings. It was thus given a health score of 2.

### Cost / Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1<sup>st</sup> draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.09%. It was thus categorized as incurring a medium capital cost increment.

### Precedents

Other state and city energy codes have requirements or recommendations for using high efficiency HVAC filters to help maintain better indoor air quality. In Boulder, Colorado, the Boulder Revised Code includes a section called Green Building and Green Points Program, similar to the LEED system, which awards points for various green building features. In the Indoor Air Quality section, projects using a high efficiency HVAC filter are awarded 1 point.<sup>3</sup>

In addition, New York City's PlaNYC calls for a reduction in pollutants classified as PM 2.5, or soot.<sup>4</sup> The report indicates that buildings and industry accounts for 55% of PM 2.5 emissions.

### LEED

This proposal does not have a direct correlation to LEED.

### Implementation and Market Availability

Low capacity packaged air handling systems (below 5,000 cfm) might have difficulty achieving this benchmark due to filter size and pressure drop. It would be anticipated that these difficulties would diminish with time as advanced filter media become more prevalent and HVAC equipment manufacturers adjust to code requirements.

## ENDNOTES:

<sup>1</sup> W.J. Fisk, et al., *Performance and cost of particle air filtration technologies*, 12:4 INDOOR AIR (2008).

<sup>2</sup> E. Horner, et al., *Green buildings: LEED certification requirements for indoor airborne particles can reduce indoor PM10 exposure?*, 123:2 J. Allergy & Clinical Immunology (2009).

<sup>3</sup> City of BOULDER, CO., REVISED CODE tit. 10, ch. 10-7.5 (2008), available at <http://www.colocode.com/boulder2/chapter10-7-5.htm>.

<sup>4</sup> CITY OF NEW YORK, PLAN NYC, A GREATER, GREENER, NEW YORK, 120 (2007) available at [http://www.nyc.gov/html/planyc2030/downloads/pdf/report\\_air\\_quality.pdf](http://www.nyc.gov/html/planyc2030/downloads/pdf/report_air_quality.pdf).

# HT 6: ENSURE VENTILATION AIRFLOW IN RESIDENCES

*New York City Mechanical Code*

## Summary

### Issue:

The new requirements for ventilation in the Building Code save a great deal of energy. However, if the systems are not adjusted properly, the energy savings will come at the expense of indoor air quality.

### Recommendation:

In new construction, require improved design parameters, testing, and balancing for exhaust ventilation systems.

## Proposed Legislation, Rule or Study

*Amendments to the New York City Mechanical Code:*

1. Add a new Section 516 as follows:

### **SECTION MC 516: KITCHEN AND BATHROOM EXHAUST SYSTEMS**

**516.1 General. Mechanical exhaust systems**, in Occupancy Groups R1 and R2, shall meet the following criteria:

1. Maintain a minimum negative static pressure of 0.2" w.g. at the furthest register or grille in the system.
  2. Be provided with adjustable speed controls: systems 2,000 CFM or less shall be provided with direct drive fans with speed controls; systems greater than 2,000 CFM shall be direct drive with speed controls or belt drive with variable frequency drives.
  3. Dampers installed in intermittent systems shall be UL Class 1, low leakage type with local switch control.
  4. Exhaust fans serving intermittent systems shall shutdown on no demand.
  5. Each exhaust grille assembly must be equipped with a self-balancing damper that responds to changes in duct pressure to allow a constant airflow (+/- 20%) over a range of operating pressures from 0.2 in WC to the greater of: 0.5 in WC or the maximum system operating pressure at the particular exhaust register/grille. Adjustable register assemblies that allow for the free area to be manually adjusted in the field shall not be permitted to meet this requirement. Self-balancing dampers shall be designed and installed so that they may be easily removed for cleaning or replacement.
  6. In central exhaust systems, the minimum requirements for continuous exhaust ventilation at kitchen and bath outlets in Table 403 shall not be exceeded by more than 100%. Timers shall not be installed on systems designed based on continuous ventilation rates in Table 403.
  7. All transverse joints in exhaust duct systems shall be sealed including but not limited to connections between ductwork and registers/grilles, branch connections and duct connections to roof membrane/deck, etc. In existing buildings, all connections between ductwork and registers/grilles and duct connections to roof membrane/deck shall be sealed at the time of substantial repair/upgrade work including roof fan replacement.
  8. Except where noted, all of the requirements in this section apply to existing systems at the time of substantial repair/upgrade work including roof fan replacement.
  - 9.
2. Amend Section 403 to add a note under Table 403.3 as follows:
    - i. The ventilation rate shall be the minimum rate required at the air outlet. Total fan airflow rate shall include a duct leakage component equal to 15% of outlet design flow.

3. Amend Section 202 to include the following definition:

**Joint, Transverse Duct:** Transverse joints are connections of two duct sections oriented perpendicular to airflow, including but not limited to connections between ductwork and registers/grilles, spin-ins, taps, and other branch connections, access door frames and jambs, duct connections to equipment and duct connections to roof membrane/deck, etc.

## Supporting Information

### Issue- Expanded

The lower kitchen, bath and corridor ventilation requirements in the new 2008 New York City construction code compared to the 1968 code will result in 10% - 30% reductions in heating energy use in residential buildings and 50% reductions in exhaust fan electricity use for all buildings with kitchen or bath central exhaust ventilation systems. However, these energy benefits will come at the expense of indoor air quality if the code does not address the reality of the balancing issues associated with systems that attempt to exhaust a relatively small amount of air from multiple locations in a building. The lower kitchen and bath exhaust ventilation rate requirements in the new 2008 code are acceptable for indoor air quality only if these exhaust rates are actually realized. As the exterior envelopes of buildings are tightened to reduce energy waste, effective ventilation system performance is becoming that much more critical. In addition to new construction, this code will apply when ventilation systems in existing buildings are being renovated. Existing ventilation ductwork originally designed for 100+ CFM per kitchen and 50 CFM per bath per the 1968 code is ideally suited to be rehabbed to exhaust lower airflow rates from these spaces per the 2008 code. In this case, existing ductwork is effectively over sized, which reduces the pressure drop between the exhaust fan and individual exhaust registers/grilles. Such a reduction in pressure drop has two primary benefits: (1) improved balancing performance and (2) reduced fan electricity use.

### Environmental & Health Benefits

As the exterior envelopes of buildings are tightened to reduce energy waste, effective ventilation system performance is becoming that much more critical. The proposed changes will preserve the energy benefits of the 2008 code while assuring adequate indoor air quality.

This proposal was found to have no significant positive environmental impact.

This proposal was found to have a high positive health impact per building and to impact a small number of buildings. It was thus given a health score of 2.

### Cost / Savings

This proposal is not expected to have any significant impact on capital costs.

### Precedents

Other Jurisdictions:

1. Note that multi-story central kitchen and bath ventilation systems with severe balancing problems are much more represented in NYC than in other locations. As such, NYC should be a leader on these issues.
2. California's Title 24 requires pressure testing of HVAC ducts.

### LEED:

LEED requires building designs to comply with ASHRAE Standard 62.1 as a prerequisite and buildings are commissioned to ensure that they perform as designed. The proposed code change is consistent with these LEED prerequisites.

### Implementation and Market Availability

1. Passive, self-balancing dampers that regulate airflow by responding to changes in duct pressure without the requirement of electric power are an off-the-shelf technology.
2. Improved duct sealing strategies are well known to the industry.
3. In practice, proposed language change to 513.10.5 means that belt driven fans are acceptable and all direct drive fans should have speed controllers, which are very low cost and readily available add-ons.

### Notes:

1. The following supporting findings are from a recent New York State Energy Research and Development (NYSERDA) research project undertaken by Steven Winter Associates to assess the performance of conventional bath and kitchen central exhaust ventilation systems and to evaluate performance upgrades:<sup>1</sup>
  - One-time balancing of conventional systems with manually adjustable registers (even if done properly) is subject to particular environmental conditions at the time of balancing (wind and stack effect). In a tall building, a system balanced in the winter will not be balanced in the summer.
  - Conventional adjustable registers have relatively large free areas that result in relatively small pressure differences across the registers. Such small pressure differences result in significant fluctuations of exhaust airflow in response to changing outdoor ambient conditions (wind and stack effect).
  - Measurements of the leakage of 30 exhaust shafts in new NYC multifamily buildings indicate that the leakage levels required by the new code are not realistically achievable without code language that calls out in greater detail the particular leakage locations that must be addressed in these systems.
  - In order to function properly, an exhaust ventilation system must operate at a high enough pressure to minimize the impact of fluctuations due to wind and stack effect. Leaky duct systems make operation of systems at

sufficiently high pressures difficult.

2. Relevant parts of the New York City Mechanical Code:

All of the following sections below impact the performance of central exhaust ventilation systems:

403.1 Ventilation system... The system to convey ventilation air shall be designed and installed in accordance with Chapter 6.

403.3.4 Balancing. Ventilation systems shall be balanced by an approved method. Such balancing shall verify that the ventilation system is capable of supplying the airflow rates required by Section 403.

513.10.5 Fans... Calculations and manufacturer's fan curves shall be part of the documentation procedures.

603.2. Duct sizing. Ducts installed within a single dwelling unit shall be sized in accordance with ACCA Manual D or other approved methods. Ducts installed within all buildings shall be sized in accordance with the ASHRAE Handbook of Fundamentals or other equivalent computation procedure.

603.9. Joints, seams and connections. All longitudinal and transverse joints seams and connections in metallic and nonmetallic ducts shall be constructed as specified in SMACNA HVAC Duct Construction Standards.

603.17. Registers, grilles and diffusers. Duct registers, grilles and diffusers shall be installed in accordance with the manufacturer's installation instructions. Balancing dampers or other means of supply air adjustment shall be provided in the branch ducts or at each individual duct register, grille or diffuser.

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<sup>1</sup> Party Walls, (Steven Winter Associates, Norwalk, CT.), Nov/Dec 2007, available at <http://www.swinter.com/partywalls/PWNov-Dec07.pdf>.

# HT 7: REDUCE MOLD IN BATHROOMS

*New York City Building Code*  
Proposal developed by the Materials & VOCs Committee

## Summary

### Issue:

Mold is common in moist areas of many buildings, such as showers. Exposure to mold can cause negative health effects, including allergic responses, asthma and other respiratory irritations.

### Recommendation:

Require the use of mold-resistant gypsum board and cement board in water-sensitive locations.

## Proposed Legislation, Rule or Study

*Amendments to the New York City Building Code:*

1. Amend section 2501.1.1 as follows:

**2501.1.1 General.** Provisions of this chapter shall govern the materials, design, construction and quality of gypsum board, lath, gypsum plaster, cement plaster and cement board.

2. Add a new definition to section 2502 as follows:

**CEMENT BOARD.** A fiberglass reinforced concrete sheet most commonly used under floors or as a tile backing board.

3. Add a new section 2506.3 as follows:

**2506.3 Gypsum and cement board in showers, and water closets, and other areas likely to be subject to water or moisture damage.**

**2506.3.1 Cement board only.** The walls of all shower and bath surrounds up to six feet above the finished floor shall be composed of cement board, fiber-cement or glass mat gypsum backers in compliance with ASTM C 1178, C 1288 or C 1325 and installed in accordance with manufacturer recommendations. Gypsum board shall not be permitted in such locations.

**2506.3.2 Mold resistance.** In any area where there will be direct exposure to water or that is subject to continuous high humidity, any gypsum board or cement board used on walls or ceilings shall be rated as mold resistant (rating of 10) in accordance with ASTM D3273-00 and water-resistant gypsum board (“greenboard”) shall not be permitted. Such areas shall include the following:

1. walls of basements and other below grade rooms;
2. walls of mechanical rooms and closets housing air conditioning equipment;
3. rear walls of fan coil/unit ventilator type HVAC unit chases;
4. ceilings beneath cold water pipes;
5. ceilings beneath air handlers in ceiling plenums;
6. ceilings of bathrooms;
7. walls of plumbing and electrical chases;
8. walls of laundry rooms;
9. walls beneath kitchen sinks and splash areas above sinks;

10. walls behind kitchen stoves; and.
11. walls of bathrooms other than walls specifically required to be cement board.

## Supporting Information

### Issue - Expanded

Molds can grow on almost any surface as long as moisture and oxygen are present. Molds can be allergens, irritants, and even produce toxic substances (mycotoxins).<sup>1</sup> They can also trigger asthma attacks and other chronic conditions.<sup>2</sup> In New York City, where the asthma hospitalization rate in some neighborhoods is four times as high as the national average, complaints of mold infestations are on the rise. In 2008, the City's 311 service received 7,658 mold-related complaints of which 6,566 were from residential locations. As of July 2009, the City has received 5,779 mold-related complaints—almost a 32% increase over the same period in 2008.

While it is impossible to eliminate all mold and its spores in the indoor environment, mold growth can be controlled.<sup>3</sup> To prevent the proliferation of mold—and address associated health impacts from mold exposure discussed below—this proposal requires the use of cement board in areas that are subject to constant moisture. Cement board has better long-term performance than paper-faced gypsum core and water-resistant products because it does not mold, mildew or physically break down in the continued presence of moisture or leaks.

Most manufacturers of drywall and water-resistant drywall (often referred to as “greenboard”) agree that in areas continually exposed to water such as showers and tubs, cement board is the best choice to prevent the formation of mold. Water and water vapor easily pass through ceramic tile grout and cause the paper facing of drywall to disintegrate. Water-resistant drywall is not recommended for areas that are subject to constant moisture such as bathrooms and laundry areas and should not be used as tile substrate.

This proposal also requires the use of mold-resistant drywall instead of regular drywall for other water-sensitive areas such as laundry rooms and basements. Mold resistant drywall is waterproof and can inhibit the growth of mold on the surface of the panel.

### Environmental & Health Benefits

Enhanced safety and quality of life are expected with the reduction in exposure to biocontaminants such as mold. Mold results from moisture problems, poor maintenance, or inadequate ventilation and has been known to cause and exacerbate serious, sometimes life threatening respiratory diseases which themselves can lead to chronic respiratory conditions.<sup>4</sup> Inhalation of fungal spores, fragments, or mycotoxins can lead to or exacerbate allergic reactions and cause infections, eye irritation, cough, congestion, headache, and fatigue. Severe illnesses such as Organic Dust Toxic Syndrome (ODTS) and pulmonary hemosiderosis have also been attributed to fungal exposures. Illnesses can result from both high level, short-term exposures and lower level, long-term exposures.<sup>5</sup>

For these reasons, and because measurements of exposure are not standardized and biological markers of exposure to fungi are largely unknown, it is not possible to determine “safe” or “unsafe” levels of exposure for people in general.<sup>6</sup> This proposal is a precautionary measure to address increasing citywide incidents of mold infestation.

This proposal was found to have a positive, indirect environmental impact.

This proposal was found to have a low positive health impact per building and to impact a large number of buildings. It was thus given a health score of 2.

### Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1<sup>st</sup> draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.0% to 0.2%, depending on building type. It was thus categorized as incurring no to a medium capital cost increment.

### Precedents

The 2006 International Residential Code (IRC) requires the use of cement, fiber-cement or glass mat gypsum backers for wall tile in tub and shower areas and wall panels in shower areas.<sup>7</sup> It also prohibits the use of water-resistant gypsum backing board where there is direct exposure to water.<sup>8</sup>

Similarly, the City of Palo Alto, CA, prohibits the use of gypsum products in steam showers and that the use of

greenboard in shower and tub compartments.<sup>9</sup> The California Building Code strictly mandates the use of cement board as a base for wall tile in tub and shower areas and also in all wall and ceiling panels in shower areas.<sup>10</sup> This proposal is less strict than California's Building Code in that the requirement only applies to walls of all shower and bath surrounds up to six feet above the finished floor.

In addition, the design and construction guidelines and standards in some states prohibit the use of greenboard in bathroom and laundry areas. In the State of Massachusetts, for example, the Department of Housing and Community Development requires the use of cement backer boards in wet areas "such as tub surrounds, showers, janitor's closets or for entry vestibules/stairwells subject to freezing temperatures" and specifically states that "moisture-resistant paper-faced drywall is **not** acceptable as a backer."<sup>11</sup>

**LEED**

There are no LEED credits directly affiliated with this proposal to utilize mold-resistant materials. However, the LEED ratings systems incorporate provisions under the Indoor Air Quality Divisions for air ventilation. Adequate ventilation will assist in protecting materials from moisture. Therefore, while the proposal will not assist in achieving LEED certification, it is in conformance with the intent of LEED.

LEED for Homes specifically addresses dehumidification systems in EQ cr. 3 Moisture Control.

**Implementation and Market Availability**

There are no known implementation issues for this proposal. Materials are readily available. Most U.S. gypsum board manufacturers have developed gypsum board products that are mold and mildew resistant and score highly on the ASTM D3273-00 mold resistance standard test method.

## ENDNOTES:

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<sup>1</sup> U.S. EPA, *A Brief Guide to Mold, Moisture and Your Home: Mold Basics*, <http://www.epa.gov/mold/moldbasics.html> (last visited Jan. 13, 2010).

<sup>2</sup> *Ibid.*

<sup>3</sup> U.S. EPA, *Mold*, <http://www.epa.gov/mold/index.html> (last visited Jan. 13, 2010).

<sup>4</sup> U.S. EPA, *Indoor Air Quality in Large Buildings*, <http://www.epa.gov/iaq/largebdgs> (last visited Jan. 13, 2010).

<sup>5</sup> NYC Dept. of Health and Mental Hygiene, *Guidelines on Assessment and Remediation of Fungi in Indoor Environments* (2008), <http://home2.nyc.gov/html/doh/html/epi/moldrpt1.shtml#health> (Human exposure indoors occurs via inhalation, through physical contact (dermal exposure), or ingestion. Whether or not symptoms develop in people exposed to fungi depends on the nature of the fungal material (e.g., allergenic, toxic, or infectious), the amount of exposure, and the susceptibility of exposed persons. Susceptibility varies with genetic predisposition to allergic reactions, age, state of health, and concurrent exposures. Exposure to mold through renovation work may also lead to initiation or exacerbation of allergic or respiratory symptoms.).

<sup>6</sup> Harris County Public Health and Environmental Services, *General FAQ's about Mold*, <http://www.hcphe.org/eph/moldfaqs.htm> (last visited Jan. 19, 2010).

<sup>7</sup> INTL. RES. CODE § R702.4.2 (2006) (The International Residential Code states that “cement, fiber-cement or glass mat gypsum backers in compliance with ASTM C1288, C1325 or C1178 and installed in accordance with manufacturers’ recommendations shall be used as backers for wall tile in tub and shower areas and wall panels in shower areas.”); and INTL. BUILDING. CODE § 2509.2 (2003) (In comparison, the International Building Code requires the use of water resistant gypsum backing board when gypsum board is used as a base for tile and wall panels in showers and tubs. Ideally, gypsum board should not be used at all in wet areas. The backing paper on gypsum board provides excellent food for mold to grow. Alternatives to gypsum board include concrete masonry, ceramic tile on cement backer board, or cement plaster, which perform well in high-moisture areas.).

<sup>8</sup> INTL. RES. CODE § R702.3.8.1 (“Water-resistant gypsum backing board shall not be used where there will be direct exposure to water.”). (Additionally, section 2509.3 of the International Building Code (2003) contains a similar provision, prohibiting the use of gypsum board, including water-resistant gypsum backing board, over a vapor retarder in a shower or bathtub. Although water-resistant gypsum board is required when used as a base for tiles or wall panels in showers and tubs under, in extreme conditions, even water-resistant gypsum board will not provide an adequate level of moisture protection. Installing water-resistant gypsum board over a vapor retarder would create a waterproof membrane on both sides of the gypsum board. Moisture would become trapped in the gypsum board, causing it to fail. Ideally, gypsum board should not be used at all in wet areas.).

<sup>9</sup> CAL. BLDG. CODE § 2508.2 & 2509.3 (2008)

<sup>10</sup> OHIO BLDG. CODE 4101 § 2509, available at <http://codes.ohio.gov/oac/4101:1-25> (“Cement, fiber-cement or glass mat gypsum backers in compliance with ASTM C 1178, C 1288 or C 1325 and installed in accordance with manufacturer recommendations shall be used as a base for wall tile in tub and shower areas and wall and ceiling panels in shower areas.”).

<sup>11</sup> STATE OF MASSACHUSETTS, DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT, *DESIGN AND CONSTRUCTION GUIDELINES AND STANDARDS, DIVISION 9: 09 30 00 TILE, 2 (JUNE 2007)* available at [www.mass.gov/Ehed/docs/dhcd/ph/dcguidestandard/tile.pdf](http://www.mass.gov/Ehed/docs/dhcd/ph/dcguidestandard/tile.pdf).

# HT 8: IMPROVE AIR QUALITY DURING & AFTER CONSTRUCTION

*New York City Building Code*  
Proposal developed by the Construction Practices Committee

## Summary

### Issue:

Construction activities can lead to the release of substances, such as volatile organic compounds (VOCs) and particulates, that have an adverse effect on the health of construction workers and occupants alike.

### Recommendation:

Provide ventilation during construction, protect the HVAC system from contaminants and absorptive materials from moisture, and flush out bad air before occupancy.

## Proposed Legislation, Rule or Study

*Amendments to the New York City Building Code:*

1. Amend Section 3302.1 to include the following defined terms:

**APPROVED AIR FILTER.** An air cleaning device that achieves either a minimum efficiency reporting value of 8 as measured by ANSI/ASHRAE 52.2-2007 (Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size) or an average efficiency of 30% as measured by ANSI/ASHRAE 52.1-1992 (Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter).

**DUST-PRODUCING CONSTRUCTION OPERATIONS.** Construction activities, including sweeping, sanding, grinding, cutting, and polishing, that result in the dispersal of particles into the air.

**HEPA FILTER.** High efficiency particulate air filter capable of removing 99.97% of airborne particles that are at least 0.3 micrometers (Qm) in diameter.

**IMPERMEABLE SEPARATION.** A barrier, typically composed of plastic, sheetrock, or plywood, that prevents the transmission of dust and air from construction areas to occupied spaces.

2. Add a new Section 3303.15 as follows:

### **3303.15 Protecting indoor air quality.**

#### **3303.15.1.1 Cleanliness of HVAC system.** Construction sites shall comply with the following:

- 1) Supply and return ductwork delivered to and stored at sites shall be sealed on both ends with a dust barrier to prevent contamination. The ends of installed ductwork shall be sealed daily to prevent dust and debris from settling inside the ductwork.
- 2) During dust-producing construction operations, HVAC system openings shall be protected from dust and contamination by either temporarily sealing such openings in the construction work areas or, if the system is in use, installing an approved air filter over each return opening. Prior to occupancy of any space, air filters in such space shall be replaced.

**3303.15.1.2 Ventilation during construction operations.** In enclosed spaces without an outside air source, such as operable windows or an opening in the exterior wall, the HVAC system shall be run during construction activities if it is functional. If the HVAC system is not functional and there is no outside air source, then construction workers may open any operable windows for the purposes of temporary ventilation or thermal comfort. This permission may be suspended during precipitation or severe cold that could damage building materials or systems.

**3303.15.1.3 Protecting occupied spaces.** At any time that construction work is in progress in an occupied building:

**HT 8: IMPROVE AIR QUALITY DURING AND AFTER CONSTRUCTION**

1. An impermeable separation shall be maintained between work areas and adjacent occupied spaces to reduce the flow of contaminants into the occupied space.

**Exception.** Elevators or elevator shafts.

3303.15.2 Other air quality protection measures during construction.

- 1) Absorbent materials including, but not limited to, insulation, sheetrock, carpet, ceiling tile, fabric, and fabric based materials shall be protected from moisture at all times prior to installation. During storage, such materials shall be within an enclosure, protected with a waterproof cover, and raised above the floor.
- 2) During sweeping, dust shall be suppressed with wetting agents or sweeping compounds. When using such agents and compounds, the work space shall be ventilated in accordance with manufacturer recommendations.
- 3) Any accumulated water on a floor surface shall be removed immediately.
- 4) Any vacuum used indoors prior to the issuance of a temporary certificate of occupancy for the work area shall be equipped with a HEPA filter.

**3303.15.3 Post-construction flush out.** After construction work is completed, sites with an indoor work area greater than 5,000 square feet shall comply with either Section 3303.15.2.1 or 3301.15.2.2.

**3303.15.3.1 Flush out option.** Flush the interior air through either of the following methods:

- 1) Prior to occupancy of a portion of a structure intended for any occupancy classification, deliver a total air volume of 14,000 cubic feet of outdoor air per gross square foot of indoor work area while maintaining an internal air temperature of at least 60 degrees Fahrenheit and a relative humidity no greater than 60%.
- 2) Prior to occupancy of a portion of a structure intended for any occupancy classification other than Institutional Groups I-1, I-2, I-3 and I-4 or Residential Groups R-1, R-2 and R-3 or that is to be occupied by persons more than 21 hours per day, deliver a total air volume of 3,500 cubic feet of outdoor air per gross square foot of work area while maintaining an internal air temperature of at least 60 degrees Fahrenheit and a relative humidity no greater than 60%. After occupancy, until a total of 14,000 cubic feet per square foot of outside air has been delivered to the indoor work area, ventilation of the indoor work area shall commence at least 3 hours prior to occupancy at a rate of 0.3 cubic feet per minute of outside air per square foot and continue throughout such occupancy.

**3303.15.3.2 Testing option.** Demonstrate safe air quality through air quality testing that complies with Sections 3303.15.3.2.1 and 3303.15.3.2.2.

**3303.15.3.2.1 Maximum concentrations.** Prior to occupancy, demonstrate through air quality testing that no substance listed in Table 3303.15.3.2.1 is present in concentrations greater than that permissible in such table.

**Table 3303.15.3.2.1**

**Maximum Permissible Concentration of Air Contaminants**

<u>Contaminant</u>	<u>Maximum Permissible Concentration</u>
<u>Formaldehyde</u>	<u>50 parts per billion</u>
<u>Particulates (PM10)</u>	<u>50 micrograms per cubic meter</u>
<u>Total Volatile Organic Compounds</u>	<u>500 micrograms per cubic meter</u>
<u>4-Phenylcyclohexene</u>	<u>6.5 micrograms per cubic meter</u>

<u>Carbon Monoxide</u>	<u>9 parts per million and no greater than 2 parts per million above outdoor levels</u>
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**3303.15.3.2.2 Air quality testing procedures.** Air quality testing shall follow the following procedures:

- 1) Indoor air quality testing shall be conducted after construction ends and prior to occupancy using testing protocols in accordance with the United States Environmental Protection Agency Compendium of Methods for the Determination of Air Pollutants in Indoor Air.
- 2) All air samples shall be conducted during normal hours in which the work area is intended to be occupied, and with the building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
- 3) All interior finishes shall be installed, including but not limited to millwork, doors, paint, carpet, and acoustic tiles. Non-fixed furnishings such as workstations and partitions are not required to be in place for the testing.
- 4) The number of sampling locations will vary depending on the size of the building and number of ventilation systems. For each portion of the work area served by a separate ventilation system, there shall be no less than one sampling point per 25,000 square feet, or for each contiguous floor area, whichever is smaller, and shall include areas with the least ventilation and greatest presumed source strength.
- 5) Air samples shall be collected between three feet and six feet from the floor to represent the breathing zone of occupants, and over a minimum four-hour period.
- 6) When retesting indoor work areas where one or more substance was present in concentrations greater than that permissible in Table 3303.15.3.2.1 in prior tests, samples shall be taken from the same locations as the first test.

**Supporting Information**

**Issue - Expanded**

Indoor air quality is important to everyone, since Americans spend about 90% of their time indoors. Both construction workers on the job site and building occupants face a range of health risks from indoor air quality.

On construction sites, tasks such as abrasive blasting, emptying bags of cement, cutting wood and masonry, painting, gluing, cleaning with solvents, welding, and using diesel-powered heavy equipment contribute to poor indoor air quality. Data from the National Center for Health Statistics indicate that construction workers face an increased risk of dying from lung cancer compared to the general population; for crane operators, the risk is 80% higher.<sup>1</sup>

Workers are often discouraged from opening windows during construction activities, limiting access to a ready source of fresh outside air. If the option is available, workers should be able to open windows to increase ventilation levels or, if possible, permanent building ventilation systems should be run to increase the amount of fresh air delivered to the construction workers. This will contribute to a better working environment for the construction workers.

Ventilation systems, if unprotected, can become contaminated with dust, debris, and/or organic material that could support the growth of mold. Covering ductwork at the manufacturer’s facility and covering ductwork as it is installed will reduce contamination and provide the permanent building occupants with a cleaner air delivery system.

Buildings under construction can be open to the outdoors, permitting moisture infiltration and high humidity. Coupled with the right temperature range and a food source, this can create conditions that support mold growth. Absorptive materials should be protected from moisture by covering them and keeping them off the floor, and by delaying the loading of such materials as long as is reasonable practical.

New or fresh adhesives, paints, carpets, and sealants emit volatile organic compounds (VOCs) that can be irritating or even harmful to the respiratory system. Other Green the Codes proposals limit the amount of VOCs allowed in building products, but there will still be residual VOCs in building interiors upon completion of a project. Ultimately these VOC’s dissipate once the tenant occupies the space and operates the air systems or opens windows to circulate air. Prior to building occupancy, the level of VOCs in the air should be reduced to acceptable levels. This can be accomplished by flushing out air from the building for a defined duration, or as an alternative, sampling the air to demonstrate that the VOCs in the space are within acceptable levels.

Currently, the operation of permanent ventilation systems is at the discretion of the owner / builder. This proposed code amendment will avoid situations where the permanent ventilation system is turned off for cost or convenience, promoting better indoor air quality in buildings under construction by increasing the amount of fresh air delivered to workers.

### **Environmental & Health Benefits**

This proposal will improve air quality on the job site and after construction work has occurred. As a result, it will improve the health of construction workers and building occupants.

This proposal was found to have no significant environmental impact.

This proposal was found to have a high positive health impact per building and to impact a large number of buildings. It was thus give a health score of 3.

### **Cost & Savings**

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.02% to 0.09%, depending on building type. It was thus categorized as incurring a low to medium capital cost increment.

### **Precedents**

New York City already has laws in place requiring all new school construction to align with the New York City Green Schools Guide, which includes two Indoor Air Quality measures. These measures, based on similar credits in the LEED rating system, are Q2.1R: Construction IAQ Management Plan, During Construction and Q2.2R: Construction IAQ Management Plan, Before Occupancy. Measure Q2.1R requires the management plan to meet the IAQ Guidelines for Occupied Buildings of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) and use filters with a Minimum Efficiency Reporting Value (MERV) of 8. Measure Q2.2R requires a full flush-out be done prior to occupancy.<sup>2</sup>

California requires rooms where activities produce hazardous fumes or chemicals to exhaust the fumes and isolate them from adjacent spaces. Filters that provide a MERV of 13 are also required in occupied areas of mechanically ventilated buildings.<sup>3</sup>

### **LEED**

This proposal will facilitate achievement of the following credits: LEED NC-EQ cr. 3.1 & 3.2 Construction IAQ Management Plan; LEED CI-EQ cr. 3.1 & 3.2 Construction IAQ Management Plan; LEED EB-EQ cr. 3 Construction IAQ Management Plan; LEED for Schools EQ cr. 3.1 & 3.2 Construction IAQ Management Plan; and LEED for Homes EQ cr. 8 Contaminant Control.

To earn credits under the LEED 2009 rating systems, during construction projects must meet or exceed the recommended Control Measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines For Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3). Since the measures outlined in this proposal do not make reference to these standards, project teams must research to verify LEED compliance for individual projects.

Air filtration devices are required by LEED to achieve a minimum efficiency reporting value of 8 as measured by ANSI/ASHRAE 52.2-2007. Therefore, this proposal has a direct relationship with LEED for filtering media standards.

LEED for Homes does not follow these criteria, and has its own established guidelines. Some aspects of this proposal will be applicable.

### **Implementation & Market Availability**

This proposal is similar to credits outlined in current LEED rating systems, which many projects throughout the country have used as guidelines for implementing similar measures. Most of the largest construction companies, including those with active projects in New York City, have already successfully implemented similar measures on completed projects. Items such as filters and components to construct impermeable barriers are readily available in the marketplace.

Concerning method 1 of 3303.15.3.1, a 14,000 cf / sf flushout in a regular commercial building typically translates to 10-12 days of continuous flushout. High rise residential buildings relying on operable windows as their primary ventilation methods typically lack sufficient mechanical ventilation capacity to meet the intent of a flush out.

**Notes**

- 1) The committee broadly supported the proposition that green building standards should address indoor air quality during construction, not just during occupancy. The committee also noted that worker health and safety is regulated by OSHA, although the construction industry, particularly smaller-scale projects, does not always comply with these standards. Thus, there is a need to balance the reality of construction practice with the fact that air quality would be adequate on all sites if there were full compliance with OSHA. The committee considered a range of requirements to ventilate spaces during construction, including requiring fans to bring fresh air directly from the outside. Ultimately, the committee settled on a requirement that HVAC systems (if working) be activated during construction and that workers have the option of opening windows when the HVAC system is not operational. Doing so is standard practice in well-managed construction projects and will improve air quality in a reasonable and cost-effective manner.
- 2) Requiring that ductwork be delivered to the site sealed at both ends results in a substantial increase in transportation impacts since it prevents the ductwork from being “nested” one inside the other. According to several local sheet metal (ductwork) fabricators, an inability to deliver ductwork nested can increase the number of truck trips by as much as 30%. The committee decided to proceed with the requirement of sealing supply and return ductwork because it offers a direct benefit to the building occupant and there may be alternative means of nesting ductwork or reducing travel trips that could still protect ductwork from contamination during delivery. Exhaust ductwork, on the other hand, should not be sealed to keep the number of truck trips as low as possible. The proposal expressly limits the requirement that ductwork be delivered covered to supply and return ducts, and does not extend the requirement to exhaust ducts (which has no impact on indoor air quality).
- 3) Sealing the ends of lined ductwork could capture moisture inside the duct that could condense and sustain mold growth. To avoid this build up, sheet metal fabricators should make a minor perforation in the seal to allow moisture to escape.

**ENDNOTES:**

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<sup>1</sup> NATL. INSTIT. FOR OCCUPATIONAL SAFETY AND HEALTH, WORK-RELATED LUNG DISEASE SURVEILLANCE SYSTEM (2008), <http://www2a.cdc.gov/drds/WorldReportData/pdf/N2006T13-02a.pdf>.

<sup>2</sup> NEW YORK CITY SCHOOL CONSTRUCTION AUTHORITY, *NEW YORK CITY GREEN SCHOOLS GUIDE* (March 15, 2007), available at <http://source.nycsca.org/GreenSchools/nycgsg-031507.pdf>, 106-109.

<sup>3</sup> CAL. CODE, Tit. 24 § pt. 11 § 804 (2008), available at [http://www.documents.dgs.ca.gov/bsc/prpsd\\_stds/2007/2007\\_cgbsc\\_9-23-08.pdf](http://www.documents.dgs.ca.gov/bsc/prpsd_stds/2007/2007_cgbsc_9-23-08.pdf).

# HT 9: PHASE OUT DIRTY BOILER FUELS

*New York City Fuel Gas Code*  
Proposal developed by the Materials & VOCs Committee

## Summary

### Issue:

Boilers that use #4 and #6 fuel oils emit a substantial portion of the city's air pollution.

### Recommendation:

Do not issue new permits for boilers using #4 and #6 fuel oils, and require all new burners to utilize only #2 fuel oil and/or gas fuel. The issue addressed by this proposal is already under consideration by the City.

## Proposed Legislation, Rule or Study

*Amendments to the New York City Fuel Gas Code*

1. Add a new Section 631.4 as follows:

631.4 Phase Out of Boilers Using #4 and #6 Fuel Oil.

631.4.1. New boilers. No new boiler shall utilize #4 or #6 fuel oil.

631.4.2. New burners. Any new burner for an existing boiler shall only utilize #2 fuel oil and/or gas fuel.

631.4.2. Permit modification. No burner or boiler that uses #2 fuel oil and/or gas fuel shall covert to use #4 or #6 fuel oil.

Exceptions:

1. If the commissioner determines the building does not have access to gas fuel.

## Supporting Information

### Issue - Expanded

According to New York City's analysis of National Emissions Inventory data from the U.S. Environmental Protection Agency, heating oil is responsible for approximately 14% of local emissions of fine particulate matter (PM 2.5) and is a significant source of NOx, a precursor to smog. The burning of heating oil emits large quantities of particulate matter because of its high sulfur content - heating oil contains 2000-3000 parts per million of sulfur compared with 15 parts per million for on-road diesel. Because of heating oil and other sources, New York City does not comply with federal Clean Air Act standards for PM 2.5.

Particulate matter is made up of many compounds, most of which are highly toxic, but some sources of particulate matter are worse than others. PM 2.5 from residual heating oil tends to have high levels of nickel, vanadium and elemental carbon. PM 2.5 and ozone are linked to respiratory problems, such as: irritation of the airways, coughing, or difficulty breathing; decreased lung function; aggravated asthma; development of chronic bronchitis; irregular heartbeat; heart attacks; and premature death in people with heart or lung disease. New York City asthma rates are consistently higher than elsewhere; 300,000 children in the City have been diagnosed with asthma and hospitalizations cost over \$10,000 per visit and over \$240 million a year. In addition, cardiovascular disease is the number one cause of death, killing over 22,000 New Yorkers a year.

The effect of heating oil on local air quality is exacerbated by the fact that the oil is burned in the midst of densely populated areas, creating high levels of exposure. It will be difficult, if not impossible, to improve air quality in the City without reducing the use of No. 4 and No. 6 fuel.

The New York City Department of Environmental Protection issues permits for space heating equipment and approximately 9,900 permit holders use No. 4 or No. 6 oil as their primary or secondary fuel. This proposal addresses both new boilers and new burners, which is the portion of the boiler that injects and ignites a fuel air mixture into the

combustion chamber. There are some known instances of boilers using #2 fuel oil or gas fuel converting to #4 or #6 fuel oil – the proposal would prohibit this practice.

### **Environmental & Health Benefits**

Conversion from dirtier residual oils (#4 and #6) to cleaner fuels (natural gas or #2) has the potential to reduce the emissions of particulate matter and other pollutants, as well as reduce CO<sub>2</sub> emissions.

Improvements in air quality – particularly reductions in PM 2.5 and ozone precursors – will improve the health of New Yorkers. A recent study in the New England Journal of Medicine showed that decreases in PM 2.5 were associated with increases in life expectancy.<sup>1</sup> An analysis by the City of New York, using emission factors from EPA AP-42, shows that conversion of No. 6 boilers to No. 2 oil will decrease PM emissions by approximately 52% and NO<sub>x</sub> emissions by approximately 61%. Conversion of existing permitted No. 6 boilers to natural gas would reduce PM pollution by 86% and NO<sub>x</sub> pollution by approximately 73%.

This proposal was found to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

This proposal was found to have a high positive health impact per building and to impact a large number of buildings. It was thus given a health score of 3.

### **Cost & Savings**

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1<sup>st</sup> draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase capital cost by between \$0.01 and \$0.10/square foot depending on the building type. It was thus categorized as incurring no to a low capital cost increment.

### **Market Availability**

National Grid and Con Ed are confident in their ability to absorb additional demand for natural gas. The amount of natural gas already used in NYC is many times more than would be required to replace residual oil. NYSERDA figures show that natural gas use in New York City is approximately 262 trillion BTUs a year. The energy content of residual heating oil in New York City is approximately 46 trillion BTUs, or 17% of the energy content of current natural gas use. Therefore, conversion phased in over 20 years means an average 1-1.5% increase per year.

In addition, regional gas supply is increasing. Millennium Pipeline began service in December 2008, with the potential of bringing an additional 525,000 mmBTU per day and 1/3 of capacity is free. Other new projects include the Iroquois, Algonquin, Empire and Islander East pipelines. Williams is in the preliminary stages of developing an expansion of its existing Transco pipeline to the Northeast to accommodate new Rocky Mountain sources, and the plans include new lateral connections to Manhattan and the Rockaways.

### **Precedents**

There are no known precedents for this proposal.

### **LEED**

There are no LEED credits associated with this proposal.

## **ENDNOTES:**

<sup>1</sup> C. Arden Pope III, et al., Fine-Particulate Air Pollution and Life Expectancy in the United States, 360:4 N. ENGL. J. MED. 376-86 (2009) available at <http://content.nejm.org/cgi/content/full/360/4/376>.

# HT 10: PHASE OUT TOXIC & INEFFICIENT LIGHT FIXTURE COMPONENTS

*New York City Building Code*

Proposal developed by the Lighting & Daylighting Committee

## Summary

### Issue:

The EPA banned the manufacture of polychlorinated biphenyls (PCBs) in 1978, but old and inefficient ballasts containing PCBs are still in use today. PCBs are chemicals that bioaccumulate in the environment, threaten the reproduction of many species of plants and animals, and are linked to certain cancers.

### Recommendation:

Institute a mandatory phased removal of all existing PCB and magnetic ballasts, starting with the largest buildings by 2013 and working down to all buildings by 2019.

## Proposed Legislation, Rule or Study

*Amendments to the New York City Building Code:*

- Delete Chapter 34 (Reserved) and add a new Chapter 34 as follows

CHAPTER 34  
GREEN BUILDING STANDARDS

SECTION BC 3401  
DEFINITIONS

**3401.1 Definitions.** The following words and terms shall, for the purposes of this chapter, have the following meanings.

LAMP. A device that produces light from electricity.

BALLAST. A device used with an electric discharge lamp to obtain the necessary circuit conditions (voltage, current, and wave form) for starting and operating the lamp.

MAGNETIC BALLAST. A ballast that operates at 60 hertz internally, generally with lower efficiency than an electronic ballast.

PCB BALLAST. A magnetic ballast in which internal insulation is provided by dielectric fluids including polychlorinated biphenyls (PCBs).

ELECTRONIC BALLAST. A ballast that operates at an internal frequency of 20 kilohertz or higher, at considerably higher efficiency than a magnetic ballast.

SECTION BC 3402  
HAZARDOUS MATERIALS

**§3402.1 Replacement of Magnetic ballasts.**

a. The owner of any building shall inspect the ballasts in such building and remove any magnetic ballasts. The owner shall file a report according to the schedule described in Section 3402.2, signed by an approved professional, that states if magnetic ballasts were found in the building and, if so, the number of such magnetic ballasts. If magnetic ballasts were found, the report shall include documentation demonstrating that the magnetic ballasts were removed and either:

1. All magnetic ballasts were collected by a hazardous waste transporter with a United States Environmental Protection Agency identification number; or

2. An approved professional determined which magnetic ballasts were PCB ballasts and only such PCB ballasts were collected by a hazardous waste transporter with a United States Environmental Protection Agency identification number.

**§3402.2 Applicability:** The department shall establish a schedule for certification of compliance with Section 3402.1. Such schedule shall ensure that buildings with areas described below shall comply with the requirements of Section 3402.1 prior to the following dates:

1. January 1, 2013: buildings 1,000,000 square feet or more;
2. January 1, 2016: buildings between 50,000 and 999,999 square feet; and
3. January 1, 2019: all buildings.

## Supporting Information

### Issue - Expanded

Ballasts are electronic devices used to control the start and operation of electrical gas discharge lamps, such as fluorescent light bulbs and neon lights. There are two types of ballasts – old, “magnetic” ballasts and modern, “electronic” ballasts. Compared with electronic ballasts, magnetic ballasts are energy inefficient and can also cause a noticeable flicker and humming sound. If they were manufactured before 1979, it is also likely that they contain polychlorinated biphenals (PCBs). In contrast, electronic ballasts use substantially less energy, do not cause flicker or hum, and do not contain PCBs.

PCBs are found in older magnetic ballasts because until 1979 they were commonly used in the manufacture of small capacitors contained in those ballasts. PCBs have been demonstrated to cause cancer, as well as have a variety of other adverse health effects on the immune system, reproductive system, nervous system, and endocrine system. They have been banned from use and production in the United States since 1978.<sup>1 2</sup>

According to California’s Consumer Energy Center, replacing magnetic ballasts and T-12 lamps with electronic ballasts and T-8 lamps will reduce energy use by 17-48% depending on the particular lamps and ballast.<sup>3</sup> In many cases, given the better performance of T-8 lamps, one can also remove some T-12 fixtures entirely, further reducing lighting energy use.

### Environmental & Health Benefits

Phasing out magnetic ballasts will reduce energy consumption and greenhouse gas emissions and improve air quality. It will also reduce the potential for human exposure to PCBs.

This proposal was found to have a low, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have a low, positive health impact per building and to impact a large number of buildings. It was thus given a health score of 2.

### Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1<sup>st</sup> draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase capital cost by \$3.60/square foot. It was thus categorized as incurring a higher capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in more than ten years depending on the building type.

### Precedents

The California Department of Education (CDE) and Department of Toxic Substances Control (DTSC) recommend removal of pre-1979 PCB ballasts from schools as soon as practicable. They recommend that school districts planning modernization projects should include PCB fluorescent light ballast removal where pre-1979 lighting systems are still in use.<sup>4</sup>

### LEED

For existing buildings, LEED EB-EQ Prerequisite 4 addresses reducing the potential exposure of building occupants to PCB’s. This proposal would directly assist projects in compliance with LEED.

### Implementation & Market Availability

There are no known implementation issues for this proposal. Electronic ballasts are readily available.

## ENDNOTES:

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<sup>1</sup> U.S. EPA, PCBs: Basic Information, <http://www.epa.gov/epawaste/hazard/tsd/pcbs/pubs/about.htm> (last visited Jan. 25, 2010).

<sup>2</sup> DEBRA JACOBSON, PRINTER'S NATIONAL ENVIRONMENTAL ASSISTANCE CENTER, FACT SHEET: PCB AND DHP IN LIGHTING BALLASTS, (2004) <http://www.pneac.org/sheets/pdfs/PCBinBallast.pdf>.

<sup>3</sup> California Energy Commission, Consumer Energy Center, Lighting Questions and Answers, <http://www.consumerenergycenter.org/lighting/lighting-faq.html> (last visited Jan. 25, 2010)

<sup>4</sup> U.S. EPA, Region 9: PCBs: Storage and Disposal, <http://epa.gov/region09/toxic/pcb/ballast.html> (last visited Jan. 25, 2010).

# HT 11: CONVENE TASK FORCE ON RECYCLING FLUORESCENT LIGHT BULBS

## Study

Proposal developed by the Lighting & Daylighting Committee

## Summary

### Issue:

Despite increased use of fluorescent lamps and ballasts, there is a lack of public information about these lights and limited options for their safe disposal.

### Recommendation:

The Department of Sanitation should convene a task force to study and determine the best bulb recycling program for NYC.

## Proposed Legislation, Rule or Study

*The Department of Sanitation should convene a task force to study the most effective options for recycling ballasts and mercury-added light bulbs from users not already required to do so under federal, state or local law. The goals of the task would be to determine:*

- A. For linear lamps (fluorescent tubes) and ballasts, the best recycling program to implement in New York City. The majority of spent linear lamps and ballasts is generated by commercial and large residential building users, many of whom are already required to collect and handle them as hazardous waste or Universal Waste under state and federal law.
- B. For compact fluorescent lamps (CFLs), evaluate the advantages and disadvantages of requiring the recycling of CFLs in New York City. This portion of the study should result in a recommendation of whether NYC should require CFL recycling at this time and, if so, recommend the appropriate program.

In order to make its determinations, the task force should undertake the following tasks:

- (1) Estimate the volume and diversion potential of fluorescent light bulbs and ballasts in 2009 and future years.
- (2) Identify a range of possible methods for collection and recycling of spent light bulbs and ballasts (each a "recycling method"), including the responsibilities of various entities (consumer/building manager, retailer, manufacturer, government) under each scenario. For CFLs, the considered recycling methods shall include, but not be limited to, the following: (i) a refundable deposit system; (ii) requiring take-back from retailers; (iii) expansion of the current city collection program; and (iv) providing significant assistance to existing, voluntary programs.
- (3) Evaluate each potential recycling method, including factors such as convenience, likely compliance rate, potential citywide impact, estimate of costs, burden and monitoring requirements; such evaluation shall also consider safe handling methods, potential for breakage and liability issues.
- (4) Consider implications for special groups, such as small retailers and mail-order purchasers, especially for CFL recycling.
- (5) Recommend an education program on the importance of recycling light bulbs and ballasts, proper management and opportunities for recycling; this program should address building managers, consumers and retailers, and should consider product labeling and information at collection locations.
- (6) Identify the steps required to implement the recommended recycling method, including action required by city government and target dates for implementation.

## Supporting Information

### Issue - Expanded

Mercury exists in several forms, including elemental and metallic mercury, which are the types used in fluorescent light bulbs. At room temperature, elemental mercury can evaporate and become an invisible, odorless toxic vapor. When fluorescent bulbs are broken in landfills, the evaporated mercury eventually settles into water or land, where it can be washed into water streams. Once deposited, microorganisms can convert it to methylmercury, a highly toxic form of mercury that builds up in fish, shellfish, and animals that eat fish.<sup>1</sup>

## HT 11: CONVENE TASK FORCE ON RECYCLING FLUORESCENT LIGHT BULBS

All fluorescent bulbs contain mercury, which is necessary for their operation. The amount varies, depending on the type, manufacturer and when the bulb was manufactured. The amount in linear fluorescent lamps ranges from 3.5-15 milligrams, with the older linear tubes (T-12s) at the higher end. Lighting manufacturers have reduced the amount of mercury over the years, and low-mercury linear tubes (with green tips or green markings) are more common. These contain 3.5-4 milligrams of mercury. Compact fluorescents contain an average of 5 milligrams of mercury, although this also varies by manufacturer and type.<sup>2</sup> Overall, CFLs and linear fluorescent lamps are responsible for a very small portion of national mercury emissions<sup>3</sup> and pose a limited health risk if handled properly. However, the potential for direct human exposure from improper handling and breakage means these lamps warrant greater attention than might otherwise be apparent.

Disposal of spent fluorescent bulbs is regulated under federal and NYS laws and these regulations require that all bulbs be handled as hazardous waste or "universal waste." Certain small businesses and residences are exempt. Despite the regulations in place, EPA estimates that approximately 76% of bulbs are improperly discarded.<sup>4</sup>

### **Environmental & Health Benefits**

New York State Department of Environmental Conservation (NYS DEC) and the U.S. Environmental Protection Agency (EPA) have identified mercury as a persistent and toxic pollutant that accumulates in the environment. According to NYS DEC, "the removal of mercury-containing products from the waste stream prior to incineration is a cost-effective means of reducing the generation of mercury from solid waste management facilities."<sup>5</sup>

This proposal was found to have a positive, indirect environmental impact.

This proposal was found to have no significant positive health impact.

### **Cost & Savings**

This proposal is for a study, which will have no direct impact on construction costs.

### **Precedents**

Several states including California, Maine and Massachusetts have mandated recycling of CFLs.<sup>6 7 8</sup> These and other states require used CFLs be brought to special recycling facilities or dropped off at various municipal and retail outlets, such as Home Depot stores, that offer collection of CFLs for recycling.

The EPA recommends recycling CFLs since all parts of the bulbs can be recycled and used for new CFLs. Because mercury is a hazardous material, the EPA warns against disposing of CFLs in regular trash that might be incinerated or sent to landfills where the mercury can seep into the environment.<sup>9</sup> NYS DEC strongly recommends the recycling of all mercury-containing lamps by both businesses and households.<sup>10</sup>

### **LEED**

This proposal will not directly assist in meeting LEED requirements. However, LEED does address mercury levels in light bulbs.

LEED EB-MR Prerequisite 2 Toxic Material Source Reduction addresses reducing the amount of mercury brought into buildings through purchases of light bulbs. LEED EB-MR Cr.6 Additional Toxic Material Reduction can be achieved by establishing and maintaining a toxic material source reduction program.

Should the recommendations in this proposal be implemented, projects could subsequently collect the recyclable light bulbs, and/or divert the material as part of construction waste management. This would help make these projects eligible for additional Materials and Resources credits across most rating systems.

### **Implementation & Market Availability**

This proposal requires additional consumer education on the proper use and disposal of CFLs, in addition to recycling information in order to heighten consumer awareness and participation in the recycling effort.

There is an established network of mercury lamp recyclers for both linear tubes and compact fluorescent bulbs.

## ENDNOTES:

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<sup>1</sup> U.S. EPA, Mercury: Basic Information, <http://www.epa.gov/mercury/about.htm> (last visited Aug. 3, 2009).

<sup>2</sup> U.S. EPA, Mercury-Containing Light Bulb (Lamp) Frequent Questions, <http://www.epa.gov/epawaste/hazard/wastetypes/universal/lamps/faqs.htm> (last visited Sep. 23, 2008).

<sup>3</sup> ENERGYSTAR, FREQUENTLY ASKED QUESTIONS: INFORMATION ON COMPACT FLUORESCENT LIGHT BULBS (CFLs) AND MERCURY (2008), [http://www.energystar.gov/ia/partners/promotions/change\\_light/downloads/Fact\\_Sheet\\_Mercury.pdf](http://www.energystar.gov/ia/partners/promotions/change_light/downloads/Fact_Sheet_Mercury.pdf). (If all CFLs sold in 2007 (290 million) were sent to landfills, rather than recycled, it would result in 0.13 metric tons of mercury emissions. This would represent just 0.1% of all mercury emissions caused by humans in the US.)

<sup>4</sup> Ibid.

<sup>5</sup> N.Y. ENVTL. CONSERV. LAW ch. 145 (2004), available at <http://www.dec.ny.gov/chemical/8853.html>.

<sup>6</sup> Maine Bureau of Remediation and Waste Management, Fluorescent Light Bulb Information, <http://maine.gov/dep/rwm/homeowner/fluorescent.htm> (last visited Jan. 25, 2010).

<sup>7</sup> Massachusetts Department of Environmental Protection, Consumer Information: Compact Fluorescent Lamps (CFLs), <http://mass.gov/dep/toxics/stypes/cflinfo.htm> (last visited Jan. 25, 2010).

<sup>8</sup> CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL, FACT SHEET: MANAGING HAZARDOUS WASTE (2007), [http://dtsc.ca.gov/HazardousWaste/Mercury/upload/HWMP\\_FS\\_Fluorescent\\_Tubes\\_Trash.pdf](http://dtsc.ca.gov/HazardousWaste/Mercury/upload/HWMP_FS_Fluorescent_Tubes_Trash.pdf)

<sup>9</sup> U.S. EPA, Mercury-Containing Light Bulb (Lamp) Basic Information, <http://www.epa.gov/epawaste/hazard/wastetypes/universal/lamps/basic.htm> (last visited Jan. 25, 2010).

<sup>10</sup> NYS Department of Environmental Conservation. Disposal Options for Fluorescent and HID Lamps in New York State, <http://www.dec.ny.gov/chemical/9088.html> (last visited Jan. 25, 2010).

# HT 12: REDUCE OVERSIZED BATTERIES IN EMERGENCY LIGHTING

*New York City Building Code*

Proposal developed by the Lighting & Daylighting Committee

## Summary

### Issue:

Much emergency lighting is powered by batteries, which contain heavy metals and other hazardous substances. By mandating twice as much emergency illumination as the rest of the country, the NYC building code promotes excessively large battery systems.

### Recommendation:

Reduce the required level of emergency lighting, thereby reducing battery size.

## Proposed Legislation, Rule or Study

*Amendments to the New York City Building Code:*

1. Amend Section 1006.3.2 as follows:

1006.3.2 Performance of System. Emergency lighting facilities shall be arranged to provide initial illumination that is at least an average of [2 foot-candle (22 lux)] 1 foot-candle (11 lux) and a minimum at any point of [0.2 foot-candle (2.15 lux)] 0.1 foot-candle (1.1 lux) measured along the path of egress at floor level. Illumination levels shall be permitted to decline to 0.6 foot-candle (6.46 lux) average and a minimum at any point of 0.06 foot candle (0.646 lux) at the end of the emergency lighting time duration. A maximum-to-minimum illumination uniformity ratio of 40 to 1 shall not be exceeded.

## Supporting Information

### Issue - Expanded

The vast majority of buildings in New York City rely on batteries to provide power for emergency lighting equipment when normal power fails. There are two basic technologies used for these batteries: lead-acid (also referred to as sealed lead-acid, sealed lead-calcium, valve-regulated lead acid, VRLA, or SLA), and nickel-cadmium (Ni-Cd). Lead-acid batteries are much more common because they are cheaper, but both are extremely toxic.

Children who ingest lead can suffer from damage to the brain and nervous system, behavior and learning problems, such as hyperactivity, slowed growth, hearing problems, and headaches. Adults can suffer from reproductive problems, high blood pressure and hypertension, nerve disorders, memory and concentration problems, and muscle and joint pain.<sup>1</sup>

The United States EPA has found cadmium to potentially cause nausea, vomiting, diarrhea, muscle cramps, salivation, sensory disturbances, liver injury, convulsions, shock and renal failure when people are exposed to it at unsafe levels for relatively short periods of time. Long-term exposure has the potential to cause kidney, liver, bone and blood damage.<sup>2</sup>

Ni-Cd rechargeable batteries were estimated to represent approximately 75 percent of the cadmium found in municipal solid waste<sup>3</sup> in 1995. Lead-acid batteries represent approximately 65 percent of the lead found in municipal solid waste in 1995.<sup>3</sup>

Sometimes the batteries used to power emergency lighting equipment are clustered together in a central location (often called a central inverter). Central inverters always use lead-acid batteries, and often contain in excess of 750 lbs. of lead. When they fail (after 10-15 years), they are usually recycled, partly because special handling is required for anything this heavy, and partly because the lead itself is valuable.

But central inverters are relatively rare. Much more often smaller batteries are installed within individual emergency light fixtures. These batteries are a mix of lead-acid and Ni-Cd. 2-4 lb. batteries are common in these installations, and they need to be replaced every 5-15 years. Even though these should be recycled, anecdotal evidence suggests that

these are often disposed of as regular trash because they are smaller, and they fail one at a time, making it more difficult for building maintenance personnel to make special arrangements for their proper disposal.

The risk of contamination within buildings is unknown. Under ordinary operating conditions the toxic materials remain sealed within the emergency lighting units. However, if these units are damaged by physical abuse or fire they could leak out and contaminate a building interior.

These products are still on the market because there is no economical alternative. Nickel-metal hydride (NiMH) batteries are about 3 times as expensive as lead-acid, and lithium ion batteries are 6-8 times as expensive. Because of this increased cost, almost no emergency lighting manufacturers incorporate these technologies into their products. Despite all of this, if reducing light levels in egress areas were to compromise safety in buildings, it would be a bad idea. But there is no evidence to indicate that this will happen. On the contrary, New York City's current code requires double the illuminance in the rest of the nation (see precedents listed below).

Our current understanding of vision indicates that there is almost no improvement in evacuation times when light levels are increased from 1 foot-candle to 2 foot-candles average illuminance.<sup>4</sup> Rather, once the critical threshold of about 0.5 foot-candles is reached there is little benefit to increasing light levels further. The codes used in the rest of the nation are conservative in requiring 1 foot-candle of illumination.

### **Environmental & Health Benefits**

Better enforcement of existing disposal laws and increased awareness among building maintenance personnel would help keep lead and cadmium out of landfills, but the best course of action is to reduce the quantity of toxic materials being installed in our buildings in the first place. There is a one-to-one relationship between the emergency light levels required by code and the number of batteries required to meet that light level. Halving emergency light level requirements will halve the amount of lead and cadmium installed in our buildings. All things being equal, this will halve the amount of these materials that eventually end up in our landfills.

Similarly, halving egress light levels will halve the amount of energy being used to illuminate means of egress. Since the lights in means of egress are currently required to operate 24 hours a day, 365 days a year, this adds up to a great many lights burning in empty corridors, stairwells, and parking garages around the city.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

### **Cost & Savings**

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1<sup>st</sup> draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to lower capital costs if implemented.

### **Precedents**

The National Fire Protection Association's Life Safety Code (NFPA 101 - 2009) 7.9.2.1 states that, "Emergency lighting facilities shall be arranged to provide initial illumination that is not less than an average of 1 ft-candle (10.8 lux) and, at any point, not less than 0.1 ft-candle (1.1 lux) measured along the path of egress at floor level."<sup>5</sup> The following codes all use identical language:

- International Building Code (I.B.C. 2006) 1006.4
- Massachusetts State Building Code, 780 C.M.R. 1006.4, which is the building code for the City of Boston
- 2003 Seattle Building Code 1006.4.2

The New York City Building Code is based on the IBC 2006 and uses the same language as IBC 2006, but the values have been doubled.

### **LEED**

Due to improved energy performance resulting from these measures, this proposal may assist in compliance with LEED prerequisites for Energy & Atmosphere under most of the rating systems.

These recommendations will also facilitate achieving LEED Energy and Atmosphere credits:

- LEED NC-EA cr.1 Optimize Energy Performance
- LEED EB-EA cr.1 Optimize Energy Performance
- LEED ND-GCT cr.2 Energy Efficiency in Buildings

- LEED for Schools EA cr.1 Optimize Energy Performance
- Additional credits under LEED pilot programs

These credits require exceeding the minimum standards established by the Energy and Atmosphere prerequisites.

LEED CI-EA cr.1.1 Optimize Energy Performance, Lighting Power, specifically addresses reducing lighting power throughout the entire tenant space. According to the LEED CI Reference Manual, for commercial interior projects, the reduction of interior lighting power stands to be the greatest energy conservation method available. Therefore, this proposal will have a significant positive impact on LEED certification.

**Implementation and Market Availability**

There are no known implementation issues for this proposal.

## ENDNOTES:

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<sup>1</sup> U.S. EPA, Lead in Paint, Dust and Soil, <http://www.epa.gov/lead/pubs/leadinfo.htm#facts> (last visited June 16, 2009).

<sup>2</sup> U.S. EPA, Consumer Factsheet on Cadmium, [http://www.epa.gov/OGWDW/contaminants/dw\\_contamfs/cadmium.html](http://www.epa.gov/OGWDW/contaminants/dw_contamfs/cadmium.html) (last visited Jan. 21, 2010).

<sup>3</sup> U.S. EPA, IMPLEMENTATION OF THE MERCURY-CONTAINING AND RECHARGEABLE BATTERY MANAGEMENT ACT (1997), <http://www.epa.gov/osw/hazard/recycling/battery.pdf>.

<sup>4</sup> ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA, THE IESNA LIGHTING HANDBOOK, Ch. 29, Fig. 29-1 (Mark Stanley Ray ed., IESNA, 9<sup>th</sup> ed., 2000).

<sup>5</sup> NATIONAL FIRE PROTECTION ASSOCIATION, NFPA 101: LIFE SAFETY CODE 101 § 7.9.2.1 (NFPA, 2009).

# HT 13: TREAT CORROSIVE CONCRETE WASTEWATER

*New York City Building Code*

Proposal developed by the Construction Practices Committee

## Summary

### Issue:

Concrete trucks, buckets and washout pump trucks are typically rinsed at construction sites, and the runoff is then directed to a stormwater drain. This water is corrosive and should not be discharged onto public streets or into rivers.<sup>1</sup>

### Recommendation:

Require wastewater from concrete mixer trucks to be either treated on site or returned to the manufacturing plant for treatment.

## Proposed Legislation, Rule, or Study

*Amendments to the New York City Building Code:*

1. Amend Section 3302.1 to include the following defined terms:

**CONCRETE BUCKET.** A receptacle of one half cubic yard or greater capacity used to convey concrete.

**CONCRETE WASHOUT WATER.** Wastewater from the rinsing of equipment used to mix, transport, convey, and/or place concrete manufactured by a permitted batch or mixing plant. Examples include concrete buckets, the concrete hose lines and pumps of concrete pump trucks, and the chute of concrete mixer trucks. This definition does not include equipment involved in the preparation, conveyance, or application of concrete mixed on site from bagged ready-mix.

**NORMAL SEWAGE.** See Section 24-523(a)(10) of the *Administrative Code*.

**SEWER SYSTEM.** See Section 24-523(a)(2) of the *Administrative Code*.

2. Add a new Section 3303.17 as follows:

**3303.17 Concrete washout water.** Concrete washout water from mixer trucks shall be collected and either:

1. allowed to evaporate;
2. returned to the concrete batch plant for treatment;
3. treated onsite to the standard of normal sewage prior to release into the sewer system; or
4. treated onsite prior to release into the sewer system according to a treatment protocol established by the commissioner.

## Supporting Information

### Issue - Expanded

Concrete contains Portland cement, and typically also antifreeze and fly ash or slag. The residue from these materials gives concrete washout water a pH above 12, which is comparable to Drano® Clog Removers. Concrete washout water also contains metals and metalloids, at least four of which are toxic<sup>2</sup>. Concrete washout water flowing down the street gutter can harm the public by direct contact or ingestion. Undiluted, the water would also be lethal to aquatic life. NYC's sewer system commonly outflows into local rivers.

Although NYC law prohibits the discharge of substances with a pH above 12 and that contain toxic materials to the City sewer system, the rule is not enforced for concrete washout water. Construction projects are permitted to release the water to the ground, street, and City sewer once it is filtered of sediment through the use of filter fabric and straw bales. This proposal requires projects to employ low cost and practical measures that are currently available to eliminate the

release of the primary source of untreated washout water, which results from rinsing the barrel and chute of mixer trucks.

For a 1.2 million square foot project, this strategy was estimated to prevent the release of approximately 163,500 gallons of untreated concrete washout water to neighboring city streets and the City sewer system. This equates to five times the amount of water in a 25 yard-long, three lane-wide and four foot-deep swimming pool.

**Environmental & Health Benefits**

Concrete contains Portland cement, as well as often antifreeze and fly ash or slag. The residue from these materials gives concrete washout water a pH above 12, which is comparable to Drano® Clog Removers.

In addition to a high pH, concrete washout water also contains the following metals, of which the first four—arsenic, chromium, lead, and zinc—are defined as toxic by the NYC building code and federal Clean Water Act:

- Arsenic
- Chromium
- Lead
- Zinc
- Aluminum
- Barium
- Calcium
- Iron
- Magnesium
- Manganese
- Potassium
- Selenium
- Sodium
- Vanadium

Concrete washout water also contains sulfur trioxide, which can react with water to form sulfuric acid.

A recent test of the concrete washout water from a local project confirmed the above information.

In addition to the dangers related to direct contact with the water, waste discharged into the City’s combined sewer system empties into the local rivers during Combined Sewer Overflow (CSO) events. These events occur about 50 times per year, on average, and up to 70 times per year at some outfall locations.<sup>3</sup>

This proposal was found to have a low positive health impact per building and to impact a small number of buildings. It was thus given a health score of 1.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

**Cost & Savings**

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1<sup>st</sup> draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to lower capital costs if implemented.

**Precedents**

1. California, Washington, Minnesota, and land areas where the EPA is the permitting authority prohibit construction sites greater than 1 acre from releasing concrete washout water to the ground, sewer system, or local water body without prior treatment.<sup>4</sup>
2. Section a(1) of Rules of the City of New York (RCNY) Title 15, Chapter §19-03, Materials and Substances Excluded from Public Sewers, currently prohibits construction materials from being discharged, allowed to run, leak, or escape into any public sewer. The rule also prohibits substances having the following characteristics from being discharged into the public sewer:
  - (9) Wastewater having a pH lower than 5.0 or higher than 12.0 or having any other corrosive property likely to cause damage to structures or equipment of the sewerage system or create a hazard to personnel;
  - 10) Toxic substances in such quantities, which the person knows or has reason to know, may when discharged from a single source or in combination with other sources:
    - (ii) limit the City’s options for operating its sewerage system or disposing of the sewage sludge, grit or scum generated at water pollution control plants;

(iii) be detrimental to the health of human beings, animals, or aquatic life;

Under this existing NYC law, concrete washout water should not be permitted to enter the City’s sewer system.

3. Section 16-119 of the Administrative Code of the City of New York states:

It shall be unlawful for any person, his or her agent, employee, or any person under his or her control to suffer or permit any dirt, sand, gravel, clay, loam, stone, rocks, rubble, building rubbish, sawdust, shavings or trade or household waste, refuse, ashes, manure, garbage, rubbish or debris of any sort or any other organic or non-organic material or thing or other offensive matter being transported in a dump truck or other vehicle to be dumped, deposited or otherwise disposed of in or upon any street, lot, park, public place or other area whether publicly or privately owned.

Under this existing NYC law, concrete washout water should not be permitted to be dumped on City streets.

**LEED**

All new construction and major renovation projects pursuing LEED certification are required to comply with the requirements of the EPA Construction General Permit (CGP). Compliance is mandated by Sustainable Sites Prerequisite 1. Thus all LEED projects in the City should already be following the requirements proposed herein (though none currently are doing so).

**Implementation & Market Availability**

A project with a large site area will be able to use watertight concrete washout bins, in which the water can be left until it evaporates. Permanent bins with a nonstick surface are best for this application, because the concrete can be slid out and recycled. The alternative is to use plywood boxes lined with a plastic sheet. Once the concrete cures in this type of box, the whole box has to be disposed of and the concrete cannot be recycled. Plywood boxes cost about \$400 to make.<sup>5</sup>

An alternative is to capture the water and return it with the truck to the concrete plant for treatment. Concrete plants have water treatment facilities by law because they generate a significant amount of washout water rinsing trucks and equipment themselves. An off-the-shelf solution for capturing the water and returning it to the plant costs about \$1,400 per truck to purchase and two hours to install. This solution consists of a pail that hooks onto the bottom of the concrete truck chute while the chute is being rinsed down. The pail empties into a 30-gallon tank installed on the truck. Back at the plant, the tank is emptied while the truck is rinsed down more thoroughly, as is currently the practice. For a large project (e.g. 1.2 million SF) about 10 trucks would need to be fitted out with the system to service the job effectively. Using the system could add 10-15 minutes to the washout process, but it also offers cost savings through the following:

- Reducing the need to chop concrete out of sewers, which costs about \$480 per session.<sup>6</sup> Current practice can result in sewers needing cleaning as often as once a week on a large project.
- Reducing the need for washout boxes (lined with filter fabric) on site. Current practice typically requires large jobs to fabricate 2 plywood washout boxes a week. The cost of this practice is about \$4,120 per month.<sup>7</sup>
- Reducing potential for fines related to sewer blockages: Fines range from \$350 - \$10,000.
- Reducing potential for personal injury related to concrete washout water.

Concrete Slurry Solutions ([www.concreteslurrysolutions.com](http://www.concreteslurrysolutions.com)) has developed a product as described above for capturing rinse water off the chute and returning it to the concrete plant for treatment with the truck. It is called the Concrete Washout Watchdog. It has been installed on the fleets of the following concrete manufacturers.

Strata Corp	West Fargo ND
Central Iowa RM	Ankeny IA
Crosslakes RM	Crosslakes MN
Cemstone	St. Paul MN
Superior Supplies	Santa Rosa CA
Nevada Ready Mix	Las Vegas NV
Sacramento Concrete	Sacramento CA
Over & Over Ready Mix	Sun Valley CA
Associated Ready Mix	Los Angeles CA
A&A Supply	Sacramento
Cadman	Redmond WA
Carl’s Ready Mix	Windsor CA
Catalina Pacific, Geiger Ready Mix	Kansas City MO
Matthew’s Ready Mix	Yuba City CA
Livingston Concrete	N. Highlands CA
Rinker Materials	Fairfield CA
Rinker Materials	Everett WA

Concrete Washout Systems™ offers permanent concrete washout boxes with a nonstick surface. The company has numerous containers at various sites throughout New Jersey and New York State. Recently completed jobs in NYC include Pier 53 (Trevcon), Pier 98 (D'Onofrio), The Willis Avenue Bridge (Kiewit), The Throgs Neck Bridge (American Bridge), East 80th Street (Ryan Associates), and several projects for Cross Country Construction, Atlantic Sub-Sea, DKN Concrete, and Gotham Construction. Current projects include Astoria Power Plant (Jingoli), World Trade Center (Rogers & Sons, Collavino Construction), and The Harlem River Tunnel (Kiewit).

Other off-the-shelf solutions are also available to satisfy the requirements of this proposal.

## ENDNOTES:

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<sup>1</sup> Riverkeeper, Sewage and Combined Sewage Overflows, <http://www.riverkeeper.org/campaigns/stop-polluters/cso> (last visited Jan. 12, 2010); New York Dep't of Environmental Conservation, Combined Sewer Overflow (CSO): Impact on Receiving Water and Recreational Activities, <http://www.dec.ny.gov/chemical/48595.html> (last visited Jan. 12, 2010). (The DEC page on CSO does not provide an estimate of the number of CSO events per year. A call to the office was not returned.).

<sup>2</sup> 33 U.S.C. §§ 1251-1376 (1948)(amended 1987) available at <http://www.fws.gov/laws/lawsdigest/FWATRPO.HTML> (last visited Jan 26, 2010). (New York City Building Code refers to the Federal Clean Water Act for its definitions of toxic substances).

<sup>3</sup> Riverkeeper, Sewage and Combined Sewage Overflows, <http://www.riverkeeper.org/campaigns/stop-polluters/cso> (last visited Jan. 12, 2010);

<sup>4</sup> U.S. EPA, National Pollutant Discharge Elimination System, <http://cfpub.epa.gov/npdes/stormwater/menuefbmps/index.cfm?action=browse&Rbutton=detail&bmp=117> (last visited Jan. 12, 2010); MINNESOTA POLLUTION CONTROL AGENCY, CONCRETE WASHOUT GUIDANCE: NPDES/SDS CONSTRUCTION STORMWATER PERMIT REQUIREMENTS (2009), <http://www.pca.state.mn.us/publications/wq-strm2-24.pdf>; CALIFORNIA STORMWATER QUALITY ASSOCIATION, CALIFORNIA STORMWATER BMP HANDBOOK (2003) <http://www.cabmphandbooks.com/Documents/Construction/WM-8.pdf>; Washington State Department of Ecology, Construction Stormwater General Permit, <http://www.ecy.wa.gov/programs/wq/stormwater/construction/#More%20Stormwater%20Guidance%20Information%20> (last visited Jan. 12, 2010).

<sup>5</sup> Assumes that the cost includes four sheets of plywood at \$75/box and one hour of carpenter time at \$100/hour.

<sup>6</sup> Assumes one sewer cleaning involves two laborers working for four hours at \$60/hour with benefits

<sup>7</sup> Assumes two boxes are fabricated each week at a cost of \$75/box of plywood and one hour of carpenter time at \$100/hr, and then two boxes are broken down at a cost of four hours of laborer time at \$60/hour.

# HT 14: REDUCE “RED TAPE” FOR ASBESTOS REMOVAL

*Rules of the City of New York*

Proposal developed by the Construction Practices Committee

## Summary

### Issue:

Products containing encased asbestos, such as vinyl tile or window putty, can be safely removed using simpler procedures than those required for the removal of crumbly asbestos products. While New York State allows the use of such simplified procedures, the New York City Department of Environmental Protection (NYCDEP) requires contractors to obtain a variance in order to do so.

### Recommendation:

NYCDEP should allow projects removing encased asbestos products to utilize approved, simpler procedures without a variance. This proposal was incorporated into DEP Rules prior to the issuance of this report.

## Proposed Legislation, Rule, or Study

*Rules of the City of New York, Title 15, Chapter 1*

NYCDEP should revise its filing procedures to allow the removal of non-friable asbestos materials via currently approved procedures without the necessity of applying for a variance. The standard procedures should allow the abatement of the three major categories of non-friable asbestos materials—vinyl asbestos tile; flat roofing materials; and other exterior ACM, including shingles, siding, putty, and caulking—without the administrative burden of a variance process. Note that there would be no change in the actual procedures required for the removal of products containing non-friable asbestos.

In response to a Task Force inquiry on this issue in fall 2008, NYCDEP agreed to modify its regulatory program to reflect the recommendations of the Task Force. DEP proposed the regulatory modifications in the City Record of September 11, 2009. They were finalized and became effective on November 13, 2009.

## Supporting Information

### Issue - Expanded

There is no additional explanation for this proposal.

### Environmental & Health Benefits

This proposal was found to have no significant environmental impact.

This proposal was found to have no significant health impact.

### Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1<sup>st</sup> draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs.

### Precedents

NY State Department of Labor (NYSDOL) has modified its regulations to allow the abatement of non-friable asbestos via an analogous generic procedure that was incorporated into their regulations in 2007. The NYSDOL process has thereby become a one-step process as compared to the NYCDEP two-step process.

**LEED**

LEED for Existing Buildings directly addresses asbestos abatement in LEED EB-SS EQ prerequisite 3, Asbestos Removal or Encapsulation. Since this issue is a prerequisite, the proposal will have a strongly positive influence on attaining LEED certification.

The recommendations outlined in this proposal will make asbestos abatement more feasible under certain conditions, and will therefore assist in achieving credit for LEED NC-SS cr.3 Brownfield Redevelopment; LEED for Schools SS prerequisite 2 Environmental Site Assessment; LEED for Schools SS cr.3 Brownfield Redevelopment; LEED ND (pilot program)-SLL cr.1 Brownfields Redevelopment; and LEED CI-SS cr.1 Option A, Brownfield Redevelopment, provided that certain provisions are met as specified by LEED.

Other LEED pilot programs address asbestos in a similar manner.

**Implementation & Market Availability**

The removal of this regulatory impediment will allow abatement of the three major categories of non-friable asbestos materials to be accomplished by specific published protocols via a less onerous regulatory process, while saving two to three weeks of administrative time for the contractor. As a result of this procedural change NYCDEP will be able to reassign staff to conduct higher priority work.

**Notes**

Under most conditions, NYCDEP does not treat vinyl asbestos tiles and asbestos shingles as friable. However, under extreme environmental conditions or standard drilling, sawing, sanding, etc. they would be considered friable asbestos material in which the release of asbestos fibers may easily result.<sup>1</sup>

**ENDNOTES:**

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<sup>1</sup> CITY OF NEW YORK EPA, REGULATORY INTERPRETATION MEMORANDUM TO THE BUREAU OF AIR RESOURCES ASBESTOS CONTROL PROGRAM, 1-87 (May 14, 1987).

# HT 15: ALLOW STAIRWAY USE

*New York City Building Code*

Proposal developed by the Physical Activity Committee

## Summary

### Issue:

Locked doors inhibit the use of stairs, deterring physical activity and fitness.

### Recommendation:

Encourage regular physical activity in buildings by requiring stair doors to be unlocked, while allowing exceptions for security access devices.

### Proposed Legislation, Rule or Study

*Amendments to the New York City Buildings Code*

1. Add a new definition for “STAIRWAY, PUBLIC ACCESS” to Section 1002.1 as follows:

STAIRWAY, PUBLIC ACCESS. A continuous stairway accessible from the ground floor lobby and to all floors, which enables building occupants to utilize stairs to travel between floors.

2. Add a new Section 1007.3.1 as follows:

1007.3.1 Public access stairway. At least one exit stairway shall function as a public access stairway. Doors opening into a public access stairway may not be locked from either side. However, doors opening into a public access stairway may be locked from the stair side provided that any such door shall be open to authorized occupants of each floor by use of security devices such as keys, codes or card key access, and provided that such locked door does not violate any other section of this code.

#### Exceptions:

1. Buildings no more than three stories in height that contain an unenclosed stairway open to building occupants at all levels.

2. Buildings having a stairway other than an exit stairway that serves all floors in the building is accessible to all building occupants.

## Supporting Information

### Issues - Expanded

The obesity epidemic is a major health crisis facing the American public, leading to a rapid increase in the incidence of type 2 diabetes and other ailments.<sup>1</sup> This crisis is particularly acute in NYC: fifty-eight percent of adults<sup>2</sup> and nearly 40 percent of elementary and middle school children<sup>3</sup> are overweight or obese. Rates of overweight and obesity in children in New York are higher than national rates (31 percent),<sup>4</sup> and prevalence of obesity and diabetes in NYC adults is also increasing faster than national prevalence rates.<sup>5</sup> Between 2002 and 2004, the prevalence of obesity and diabetes among NYC adults rose by 17 percent, while the national prevalence of obesity grew by 6 percent.<sup>6</sup> These trends have a direct impact on hospitalization costs from diabetes in NYC, which doubled between 1990 and 2003 to \$480 million yearly.<sup>7</sup> Additionally, obesity has been directly linked to coronary heart disease, different types of cancers, hypertension, high cholesterol, stroke, liver and gallbladder disease, sleep apnea, respiratory problems, and osteoarthritis.<sup>8</sup> Cardiovascular diseases, such as heart disease and strokes, are the leading cases of death in New York City.<sup>9</sup> Independent of weight, physical activity is also protective against cardiovascular disease, type 2 diabetes, some of our most common and deadly cancers such as colon cancer, osteoporosis, depression, and age-related cognitive decline.<sup>10</sup>

Stair climbing is a vigorous form of incidental physical activity, which can easily be incorporated into the daily lives of most able-bodied people. In many NYC buildings, stairways are locked on the stair side except for the point of egress from the building. As a consequence, occupants are impeded from using the stairs and instead resort to the elevator. In addition to difficult egress, stairways are often located at the sides or back of the building. Signage at key points to

help people locate staircases and encourage stair use is currently not required as part of the signage at elevators. Stairway doors are not required to have glass and allow for visibility of the stairs but are instead opaque and unwelcoming. All of the above make stairways difficult to locate and access, inconvenient, and uninviting to use.

To remedy this situation and to both allow and further promote stair use, the proposal calls for designating at least one stairway, which may be one of the fire stairs, as a public access stair. A public access stair will allow entry and egress at each floor, have doorways with visibility into stairs, and include signage. In order to address concerns for safety and security, which are the reason that stairways have been locked, the proposal allows the use of code or card key access, which can enable security to be maintained while stairways are accessible to the building occupants.

### **Environmental & Health Benefits**

Stair use burns calories, and research has linked stair use to other health benefits such as better cardiovascular health.<sup>11</sup> Stair climbing has been shown to raise individuals' good cholesterol levels.<sup>12</sup>

A comprehensive review of the literature conducted by the Task Force on Community Preventive Services convened by CDC has shown that increasing access to places for physical activity consistently increases physical activity.<sup>13</sup> Access to stairwells, in addition to stair signage prompting stair use for health benefits, stair visibility, convenience, width and aesthetics, facilitate increased stair use.<sup>14</sup> In studies of point-of-decision prompt signage, tailoring the health benefits to a specific group or community can further increase stair usage. For example, weight messages have been found to increase stair use in those who are overweight or obese.<sup>15</sup>

In a recent study by the NYC Dept of Health and Mental Hygiene, staff who reported using the stairs were less likely to be obese compared to staff who reported not using the stairs. The Health Department also modeled the potential impacts of increasing stair access alone and found it could prevent approximately 250,000 pounds (~8% of NYC annual average weight gain). Combining this with stair signage would result in an approximate doubling of impacts, resulting in prevention of ~550,000 pounds gained by New Yorkers each year (~18% of NYC annual average weight gain). Just as the control of major diseases of the past, such as cholera and tuberculosis, relied on drastic changes to living conditions, addressing the current epidemics relies on access to health-protecting and -promoting environments.<sup>16</sup> To this end, climbing stairs can be easily incorporated into a person's daily routine.

Decreased elevator use will also have a beneficial effect on the environment. Elevators in tall office buildings use approximately 4-7% of the building's energy.<sup>17</sup> This can result in as much as 15,000 Kilowatts used per year. As a comparison, heating a 1,700 square foot house electrically for an entire year uses only 7,100 Kilowatts per year.<sup>18</sup>

Overall, this proposal was found to have a positive, indirect environmental impact.

This proposal was found to have a high positive health impact per building and to impact a large number of buildings. It was thus given a health score of 3.

### **Cost & Savings**

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1<sup>st</sup> draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.0% to 0.02%, depending on building type. It was thus categorized as incurring no to a low capital cost increment.

### **Precedents**

Although we are unaware of legal precedents for promoting stair use per se outside of emergency circumstances, precedence for codifying physical-activity promoting design for health purposes exists in building codes elsewhere. In Berlin, Germany, building codes require the installation and maintenance of a playground for housing developments with six apartments or more. Under § 8 Sect. 2 of the Berlin Building Code, it is stated that "at least 4 sq. m. of usable play area per residential unit should be provided."<sup>19</sup> The size of the area should amount to at least 50 sq. m., and should be suitable for play by small children. If a construction project with more than 75 apartments is planned, the playground should also be suitable for play by older children. Exceptions are only admissible if the intended use of the building makes the presence of children unlikely. The care and maintenance of private playgrounds is generally the responsibility of the owner.

Although there is a lack of legal precedents for promoting stair use for exercise, corporations and schools have begun a movement to promote stair use for exercise. At Sprint Nextel's Overland Park office, the elevators run especially slowly in order to promote stair use. The California Department of Transportation office in California has an elevator that stops on every third floor, in order to prompt users who can take the stairs. At Virginia Commonwealth University, the newly designed business school has placed its elevator in a non-obvious place, and the stairs in a prominent area, in

order to promote stair use.<sup>20</sup>

### **LEED**

There are no routine LEED credits directly affiliated with this proposal. However, the Riverside Health Center, a NYC Department of Health and Mental Hygiene facility, received a LEED innovation credit for physical activity promoting design. One of the design elements include stairs that are accessible (a pre-requisite are stairs that are accessible to at least the building occupants).

The Riverside Health Center LEED innovation credit also includes the following design elements: stairs that are visible through the use of fire-rated glass on doors, located within 25 feet of the main building entrance, located on the principal path of travel on each floor and visible from the elevators, are 20 percent wider than the code minimum, and use of stair prompt signs at elevators and at stairs.

The physical activity promoting design items in the above LEED NC (New Construction and Major Renovations) innovation credit proposal also complement sustainable site credits to promote walking and biking (SS Credit 2, SS Credit 4.1 and SS Credit 4.2), as well as other LEED precedents for promoting occupant health, including tobacco smoke control (EQ Prerequisite) and indoor pollutant source control (EQ Credit 5). LEED ND (Neighborhood Development) also has at least six credits that have the specific stated intent to encourage physical activity and promote public health.

### **Implementation & Market Availability**

Multiple options for handling security issues are readily available. Additionally, if stair access is promoted and more people use the stairs within buildings, then such use will decrease risks that occur in less populated staircases.

## ENDNOTES:

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- <sup>1</sup> U.S. Department of Health and Human Services, The Surgeon General's call to action to prevent and decrease overweight and obesity, in Public Health Service, Office of the Surgeon General (2001) available at <http://www.surgeongeneral.gov/topics/obesity/>
- <sup>2</sup> New York City Dep't of Health and Mental Hygiene, Community Health Survey 2008, (2008) [http://sasebiweb100.health.dohmh.nycnet/SASStoredProcess/guest?\\_PROGRAM=%2FEpiQuery%2FCHS%2Fchs2008a&var=bmicat3&crude=uncrude](http://sasebiweb100.health.dohmh.nycnet/SASStoredProcess/guest?_PROGRAM=%2FEpiQuery%2FCHS%2Fchs2008a&var=bmicat3&crude=uncrude).
- <sup>3</sup> New York City Dep't of Health and Mental Hygiene. Obesity Begins Early: Findings Among Elementary School Children in New York City 2:5 NYC VITAL SIGNS (2003) available at <http://www.nyc.gov/html/doh/downloads/pdf/survey/survey-2003childobesity.pdf>.
- <sup>4</sup> Press Release, The New York City Department of Health and Mental Hygiene. Obesity and Diabetes Rising Faster in NYC than Nationally (Mar. 26, 2008) available at <http://www.nyc.gov/html/doh/html/pr2008/pr022-08.shtml>.
- <sup>5</sup> Press Release, The New York City Department of Health and Mental Hygiene. Obesity and Diabetes Rising Faster in NYC than Nationally (Mar. 26, 2008) available at <http://www.nyc.gov/html/doh/html/pr2008/pr022-08.shtml>.
- <sup>6</sup> Van Wye, G., et al., Obesity and diabetes in New York City, 2002 and 2004. 5:2 PREV CHRONIC DIS. 48 (2008).
- <sup>7</sup> NEW YORK CITY DEPARTMENT OF HEALTH AND MENTAL HYGIENE. DIABETES IN NEW YORK CITY: PUBLIC HEALTH BURDEN AND DISPARITIES (2007) available at [http://home2.nyc.gov/html/doh/downloads/pdf/epi/diabetes\\_chart\\_book.pdf](http://home2.nyc.gov/html/doh/downloads/pdf/epi/diabetes_chart_book.pdf).
- <sup>8</sup> Centers for Disease Control and Prevention. Overweight and Obesity: Health Consequences (2009) <http://www.cdc.gov/obesity/causes/health.html>.
- <sup>9</sup> New York City Department of Health and Mental Hygiene. Summary of Vital Statistics 2007 (2008) <http://www.nyc.gov/html/doh/html/vs/vs.shtml>. (last visited Jan 27, 2010).
- <sup>10</sup> Centers for Disease Control and Prevention. Physical Activity and Health: The Benefits of Physical Activity (2008) <http://www.cdc.gov/physicalactivity/everyone/health/index.html> (last visited Jan 27, 2010).
- <sup>11</sup> I.M. Lee and R.S. Paffenbarger, Jr., Physical activity and stroke incidence: the Harvard Alumni Health Study. 29:10 STROKE 2049-54 (1998); K.D. Brownell, A.J. Stunkard, and J.M. Albam, Evaluation and Modification of Exercise Patterns in the Natural Environment 137:12 AM J PSYCHIATRY 1540-5 (1980); and C. Zimring, et al., Influences of building design and site design on physical activity: research and intervention opportunities 28:2:2 AM J PREV MED 186-93 (2005).
- <sup>12</sup> C.A. Boreham, et al., Training effects of accumulated daily stair-climbing exercise in previously sedentary young women 30:4 PREV MED 277-81 (2000).
- <sup>13</sup> Task Force on Community Preventive Services, Recommendations to Increase Physical Activity in Communities 22 AM J PREV MED 67-72 (2002).
- <sup>14</sup> G. Nicoll, Spatial measures associated with stair use, 21:4 AM J HEALTH PROMOT 346-52 (2007); N.A. Kerr, et al., Increasing stair use in a worksite through environmental changes. 18:4 AM J HEALTH PROMOT 312-4 (2004); Centers for Disease Control and Prevention, StairWELL to Better Health (2007) <http://www.cdc.gov/nccdphp/dnpa/hwi/toolkits/stairwell/index.htm>. (last visited Jan. 28, 2008); and K.N. Boutelle, et al., Using signs, artwork, and music to promote stair use in a public building 91:12 AMERICAN JOURNAL OF PUBLIC HEALTH 2004-6 (2001). 91(12).
- <sup>15</sup> R.E. Andersen, et al., Can inexpensive signs encourage the use of stairs? Results from a community intervention. 129:5 ANN INTERN MED 363-9 (1998).
- <sup>16</sup> D. ROSNER, A SOCIAL HISTORY OF DISEASE IN THE 19TH AND EARLY 20TH CENTURY NEW YORK: LESSONS LEARNED FOR THE 21ST CENTURY (2008); M.M. JONES, PROTECTING PUBLIC HEALTH IN NEW YORK CITY: 200 YEARS OF LEADERSHIP; 1805-2005 (2005) available at <http://www.nyc.gov/html/doh/downloads/pdf/bicentennial/historical-booklet.pdf>; and J. DUFFY, A HISTORY OF PUBLIC HEALTH IN NEW YORK CITY: 1866-1966 (Russell Sage Foundation, New York ed. 1974).
- <sup>17</sup> 6TH WORLD CONGRESS OF THE COUNCIL ON TALL BUILDINGS AND URBAN HABITAT. TALL BUILDINGS AND URBAN HABITAT: CITIES IN THE THIRD MILLENNIUM, 559 (Feb-Mar. 2001).
- <sup>18</sup> H. SACHS, AMERICA COUNCIL FOR ENERGY-EFFICIENT ECONOMY, OPPORTUNITIES FOR ELEVATOR ENERGY EFFICIENCY IMPROVEMENTS (2005), Available at <http://www.aceee.org/buildings/com1 equip/elevators.pdf>.
- <sup>19</sup> BERLIN SENATE DEPARTMENT FOR URBAN DEVELOPMENT. CHILDREN'S PLAYGROUNDS: PRIVATE PLAYGROUNDS, available at [http://www.stadtentwicklung.berlin.de/umwelt/stadtgruen/kinderspielplaetze/en/private\\_spielplaetze/index.shtml](http://www.stadtentwicklung.berlin.de/umwelt/stadtgruen/kinderspielplaetze/en/private_spielplaetze/index.shtml).
- <sup>20</sup> N. Gautam, New Building Designs Help People to Fight Flab WALL STREET JOURNAL, November 18, 2005, available at <http://www.realestatejournal.com/propertyreport/office/20051118-naik.html>.

# HT 16: ENCOURAGE STAIRWAY USE WITH TRANSPARENT DOORS

*New York City Building Code*

Proposal developed by the Physical Activity Committee

## Summary

### Issue:

Opaque doors discourage stair use by making them difficult to locate, uninviting and less safe.

### Recommendation:

Require doors to public access stairs to include glass.

## Proposed Legislation, Rule or Study

*Amendments to the New York City Building Code:*

1. Add a new Section 1008.1.10 as follows:

1008.1.10 Glazing in doors. All doors in public access stairways required by Section 1007.3.1 shall have fire-protection rated glazing in accordance with Section 715.3.4.1. Glazing shall be present at eye level (between 5'7" and 6'5" measured from the floor), and shall encompass at least one third of the area of the door and half of the area of the door for doors accessible from the ground floor. Doors in any other stairway may include glazing that complies with Section 715.3.4.1.

## Supporting Information

### Issue - Expanded

For additional background see HT15 "Allow Stairway Use"

Stair climbing is a vigorous form of incidental physical activity that can easily be incorporated into the daily lives of most able-bodied people. Most doors to stairwells, however, are opaque, making the stairwells hard to find and uninviting. People also feel less safe traveling in spaces with limited visibility.

This proposal will require new stairwell doors for public access stairways (the proposal Allow Stairway Use requires each building to have at least one publicly accessible stairwell) to incorporate glass at eye level. Doing so will greatly improve stair visibility, increasing stair usage. It can also lead to a stronger sense of safety among people using the stairs, who may otherwise be uncomfortable traveling on a less visible staircase.

### Environmental & Health Benefits

For environmental and health benefits see HT15 "Allow Stairway Use"

### Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1<sup>st</sup> draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.0% to 0.02%, depending on building type. It was thus categorized as incurring no to a low capital cost increment.

### Precedents

For precedents see HT15 "Allow Stairway Use"

### LEED

For LEED information see HT15 "Allow Stairway Use"

**Implementation & Market Availability**

There are no known implementation issues for this proposal. Doors with fire-rated glass are readily available. As market demand for these doors increases, we anticipate supply of such doors to increase and costs to decrease.

# HT 17: PROMOTE STAIR USE THROUGH SIGNAGE

*New York City Building Code*

Proposal developed by the Health Committee.

## Summary

### Issue:

People are insufficiently aware of the health benefits of using stairs.

### Recommendation:

Encourage stair use by requiring signs that prompt stair use and that provide floor re-entry information.

## Proposed Legislation, Rule or Study

*Amendments to the New York City Building Code:*

1. Amend Section 1026.3 as follows:

1026.3 Stairway and elevator identification signs. Stairway floor number and stairway identification signs shall be provided in accordance with Section 1019.1.7. Elevator identification and emergency signs shall be provided in accordance with Section 3002.3. **Active living signs that prompt stair use and signs that provide floor re-entry information shall be provided in accordance with Section 3002.3.1.**

2. Add a new Section 3002.3.1 as follows:

3002.3.1 Active living signs. An approved pictorial sign of a standardized design at least 11" x 8.5" in size shall be posted adjacent to each passenger elevator call station on all floors that encourages occupants to use the exit stairways. The sign shall be in accordance with a design developed by the Department of Health and Mental Hygiene.

## Supporting Information

### Issue - Expanded

For additional background see HT15 "Allow Stairway Use"

Stair climbing is a vigorous form of incidental physical activity, which can easily be incorporated into the daily lives of most able-bodied people. Studies have shown that signage at points of decision, like elevators and escalators, consistently increases stair use. Signs that encourage stair use for health benefits and placed at elevators and escalators have been shown to increase stair use 6-129%, with a median increase of ~50% across multiple studies.<sup>1</sup> Weight-specific messages have been found to increase stair use in those who are overweight or obese.<sup>2</sup> In NYC, The Department of Health and Mental Hygiene, working with the Department of Design and Construction, GreeNYC, AIANY, and REBNY, launched a "Burn Calories, Not Electricity. Take the Stairs!" Campaign in May 2008. This campaign was evaluated in three New York City buildings, a 10-story affordable housing complex in the South Bronx, an 8-story academic building in Brooklyn, and a 4-floor health center in Manhattan. Increases in stair use were significant at all sites, even in the health center where baseline stair use was already extremely high (70%) likely due to good stair placement and aesthetics. In addition, a significant increase in the proportion of people taking the stairs up (which is classified as 'vigorous' activity) was observed. Long-term studies conducted at the 10-story building showed that stair use increases remained elevated at 9 months after simple stair prompt placement at elevator call areas and outside stairs. An Australian study found that employees of a healthcare facility were more likely to use the stairs when stair use was highlighted by signs.<sup>3</sup>

### Environmental & Health Benefits

For additional environment and health benefits see HT15 “Allow Stairway Use”

**Cost & Savings**

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1<sup>st</sup> draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs. It was thus categorized as not incurring a capital cost increment.

**Precedents**

For additional precedents see HT15 “Allow Stairway Use”

Although there are no known precedents for promoting stair use outside of emergency circumstances, precedence for codifying physical-activity promoting design for health purposes exists in building codes elsewhere. The Center for Disease Control found that Point of Decision prompts near elevators influenced people to take the stairs more often, especially when “the prompts [were tailored] to describe specific benefits or to appeal to specific populations.” Point of Decision prompts were found to be effective on their own, without any additional enhancement of stairs.<sup>54</sup>

**LEED**

For LEED information see HT15 “Allow Stairway Use”

**Implementation & Market Availability**

There are no known implementation issues for this proposal. Stair signs are readily available.

## ENDNOTES:

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<sup>1</sup> Guide to Community Preventive Services, Environmental and Policy Approaches to Physical Activity: Point-of-Decision Prompts to Encourage Use of Stairs, <http://www.thecommunityguide.org/pa/environmental-policy/podp.html> (last visited Jan. 19, 2010).

<sup>2</sup> R.E. Andersen, et al., Can inexpensive signs encourage the use of stairs? Results from a community intervention. 129:5 ANN INTERN MED 363-9 (1998).

<sup>3</sup> A. L. Marshall, et al, Can Motivational Signs Prompt Increases in Incidental Physical Activity in an Australian Health Care Facility, 17:6 HEALTH EDUCATION RESEARCH 748 (2002) available at <http://her.oxfordjournals.org/cgi/reprint/17/6/743>.

<sup>4</sup> The Guide to Community Preventive Services. Environmental and policy approaches to physical activity: point-of-decision prompts to encourage use of stairs. <http://www.thecommunityguide.org/pa/environmental-policy/podp.html>. (last visited Sept. 25, 2009).

# HT 18: ENCOURAGE STAIRWAY USE BY HOLDING DOORS OPEN

*New York City Building Code*

Proposal developed by the Health Committee

## Summary

### Issue:

One means of encouraging stair use is to hold doors open by magnets that release the doors when smoke is detected. But the building code does not permit the use of these magnetic devices for stair doors.

### Recommendation:

Allow the use of magnetic devices to hold doors open for stairs of three stories or less.

## Proposed Legislation, Rule or Study

*Amendments to the New York City Buildings Code*

1. Amend Section 707.7 as follows:

**707.7 Openings.** Openings in a shaft enclosure shall be protected in accordance with section 715 as required for fire barriers. Such openings shall be self-closing or automatic-closing by smoke detection. Automatic-closing by smoke detection is not permitted for required vertical exit doors.

### Exception:

The use of magnetic devices for automatic-closing by smoke detection for vertical exit doors shall be permitted only for a maximum of three interconnected floors for only one egress stairway, provided there are at least two means of egress.

## Supporting Information

### Issues - Expanded

For additional background see HT15 “Allow Stairway Use”

Stair use is good for public health and stairs are more likely to be used if doors are open. Research indicates that grand staircases in buildings tend to invite use. The evidence suggests that stairs attract more use when they are highly visible from paths of travel, easy to access, and feature finishes consistent with other public corridor finishes.<sup>11</sup> The NYC Building Code, however, does not permit the use of magnetic door holders for automatic-closing by smoke detection in the cases of vertical exit doors due to safety issues. If there is fire and one of the vertical exit doors does not close automatically, the smoke will spread out through the stairway very quickly – a phenomenon referred to as the ‘chimney effect.’ While the chimney effect is a serious concern where exit stairs connect multiple floors and not allowing for automatic-closing in these cases is a good practice, the chimney effect is not a serious issue for stairs that connect up to three floors.

To promote stair use, the proposal calls for allowing the use of magnetic door holders to hold exit stair doors in the open position on one of the egress stairways for the maximum of three interconnected floors, provided there are at least two means of egress. This proposal is consistent with the provision in the building code to allow open stairways for up to three stories and the one that allows open atriums up to three stories. Permitting the use of magnetic devices in these cases will provide high visibility and easy access of the stairs even if stairway doors are solid.

### Environmental & Health Benefits

For additional environment and health benefits see HT15 “Allow Stairway Use”

This proposal was found to have no significant positive environmental impact.

This proposal was found to have no significant positive health impact.

### Cost & Savings

This proposal is for a code allowance, which will have no direct impact on construction costs.

### Precedents

For additional precedents see HT15 “Allow Stairway Use”

The Kentucky Building Code and Kentucky Fire Code allow for stairway and corridor to be maintained in an open position by magnetic door holders interconnected to the fire alarm system. If doors are held open, the installation of a smoke detector at the topmost level of the stairway is required. The International Building Code also allows for use of such tested devices. In NYC, AIANY’s Center for Architecture obtained a reconsideration from the Department of Buildings to hold open the doors of its 3-story egress stairwell.

### LEED

For LEED information see HT15 “Allow Stairway Use”

### Implementation & Market Availability

Multiple options for handling security issues are readily available. This includes a range of electromagnetic door holders and closers, smoke curtain releasers, and other activation devices, which are used as an integral part of a fire, security or ventilation systems. These products are a battery powered, electromagnetic system linked by radio signals to a central controller, which can be a part of the existing building fire system or a separate fire system. Smoke detectors, fire alarm, and other sensors allow fire and smoke doors to be open under conditions. They can activate the magnetic door holders and shut doors as needed in the case of emergencies such as fires.

The products enable fire doors to be legally held in an open position to ease access through a building, in compliance with the Disability Discrimination Act.<sup>42</sup>

Products are well suited for wall, floor or ceiling mounting in a variety of plain or decorative finishes to fit the decor of both existing and new buildings. The high quality of the finish ensures that little or no servicing is required once these products are fitted. Unlike traditional fire door holders, magnetic door holders and closers do not require wiring (even though wired options are available) throughout the building, making the system more cost-effective and convenient to install.

## ENDNOTES:

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<sup>1</sup> G. Nicoll, *Spatial measures associated with stair use*, 21:4 AM J HEALTH PROMOT 346-52 (2007).

<sup>2</sup> Geofire Innovators of Fire Technology. Salamander is the Safe, Legal and Cost Effective Solution, <http://www.geofire.co.uk/Geofire-Products-Salamander-Wire-Free-Door-Holders.html>. (Last visited Jan 31, 2010).

# HT 19: PROVIDE ZONING BONUS FOR INVITING STAIRCASES

*New York City Zoning Resolution*  
Proposal developed by the Health Committee

## Summary

### Issue:

When stairs are easy to locate, convenient, and attractive they are well used. But in most new buildings, stairs are built as hidden necessities.

### Recommendation:

Reward buildings with a zoning bonus for designing stairs that are prominent and accessible.

## Proposed Legislation, Rule or Study

*Zoning Resolution of the City of New York*

Add the following:

### 12-10 Definitions "Floor Area"

... However the "floor area" of a building shall not include: <Add the following to the list>

Up to 50% of the stair area on any floor where the stairs meet the following criteria:

- i) On the main floor: located within 25 ft of and visible from the entrance, OR located and visible BEFORE elevator(s) from entrance, OR adjacent to and visible from at least the main elevator waiting area serving the lowest bank of the building; AND
- ii) On all other floors: more prominent than elevator from main path of travel, OR adjacent to and visible from at least the main elevator waiting area, OR visible and accessible from tenant areas; AND
- iii) Is 48 inches or wider; AND
- iv) Provides daylighting (e.g. extension of the Housing Quality bonus for daylighting in corridors) on each floor if the stair is located at the perimeter of a building and where the perimeter is not along a lot line; AND
- v) EITHER
  - a) is an open interconnecting stair additional to required fire stairs, OR
  - b) is an open interconnecting stair serving as a fire stair using allowable fire safety systems such as a deluge sprinkler system, OR
  - c) is an enclosed fire stair made visible and accessible by all of the requirements proposed for Building Code inclusion (see proposals with Health and Physical Activity Committee Ranking 1-3), except that minimum fire-rated transparent glazing used to provide visibility must be at least 50% of the door rather than 1/3 of the door, OR
  - d) any combination of a, b, and c on different floors.

\*Stairs as defined above do not include escalators.

### Exceptions:

The zoning bonus will not be granted if escalators are provided along with the best practice stairs or to buildings classified in Group H, High Hazard.

## Supporting Information

### Issue - Expanded

For additional background see HT15 “Allow Stairway Use”

Stair climbing is a vigorous form of incidental physical activity that can easily be incorporated into the daily lives of most able-bodied people. Stairs, however, are often difficult to locate, inconvenient, unpleasant, and inaccessible. Inclusion of at least one “Public Access Stair” in every building that allows access, is visible, and provides information encouraging stair use is critical for facilitating stair use to help address the urgent obesity crisis in New York City. These very basic and no cost or inexpensive requirements have been proposed for inclusion in the Building Codes. In addition to these basic requirements, however, are design factors, such as stair placement and location, which also play an important role in promoting stair use. Because the latter can be more costly and need to be determined on a case by case basis, these additional design factors should be included in zoning incentives (Floor Area Ratio Exemption).

The purpose of these design features is to make stairs more prominent than, or as prominent as, elevators in terms of placement, visibility, and aesthetics. This will make stairs a truly competitive and viable option compared to elevators for vertical transport of able-bodied persons in a building.

### Environmental & Health Benefits

For additional environment and health benefits see HT15 “Allow Stairway Use”

This proposal was found to have a positive, indirect environmental impact.

This proposal was found to have a low positive health impact per building and to impact a small number of buildings. It was thus given a health score of 1.

### Cost & Savings

This proposal is for a zoning bonus, and therefore have no direct impact on construction costs.

### Precedents

For additional precedents see HT15 “Allow Stairway Use”

Although there are no known precedents for promoting stair use outside of emergency circumstances, precedence for codifying physical-activity promoting design for health purposes exists in building codes elsewhere. The CDC, through its Healthy Workforce Initiative, has proposed several optional steps to increase stair usage. Through a pilot program at the Rhodes Building in Atlanta, Georgia they implemented a stair usage plan that included adding carpeting, artwork and music to the stairwells. The CDC also posted motivational signs near elevators that encouraged people to use the stairs as opposed to the elevator. Additionally, they installed tracking mechanisms to monitor people traveling in the staircase. The entire cost of this plan was \$16,000 for the five-story building.<sup>1</sup>

### LEED

For LEED information see HT15 “Allow Stairway Use”

### Implementation & Market Availability

There are no known implementation issues for this proposal.

## ENDNOTES:

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<sup>1</sup> Center for Disease Control and Prevention, StairWELL to Better Health, (2007), <http://www.cdc.gov/nccdphp/dnpa/hwi/toolkits/stairwell/index.htm>.

# HT 20: INCREASE AVAILABILITY OF DRINKING FOUNTAINS

*New York City Plumbing Code*

Proposal developed by the Water Efficiency & Building Stormwater Committee

## Summary

### Issue:

People buy and consume bottled water and sugary drinks, in large part, because there are not enough easily accessible water fountains. All bottled drinks stress the environment by wasting materials, using energy for transportation, and creating waste. Also, sugary drinks can contribute to chronic diseases.

### Recommendation:

Increase the number of required drinking fountains, and also require that they include faucets for filling bottles. Do not allow bottled water to substitute for fountains.

## Proposed Legislation, Rule or Study

*Amendments to the New York City Plumbing Code:*

1. Amend applicable portions of Table 403.1 as follows:

### DRINKING FOUNTAIN

Occupancies A-1, A-2, A-3 (Auditoriums)	1 per [500] <u>250</u>
Occupancies A-3 (Passenger terminals), A-4	1 per [1000] <u>500</u>
Occupancy A-3 (Places of worship)	1 per [1000] <u>333</u>
Occupancy M	1 per [1000] <u>500</u>

2. Amend Section 410 as follows:

410.1 Approval. Drinking fountains shall conform to ASME A112.19.1M, ASME A112.19.2M or ASME A112.19.9M, and water coolers shall conform to ARI 1010. Drinking fountains and water coolers shall conform to NSF 61, Section 9. Drinking foundations shall include both a drinking faucet and a separate faucet suitable for filling a bottle that is at least 10 inches high. Where water is served in restaurants, drinking fountains shall not be required. [In other occupancies, where drinking fountains are required, bottled water dispensers shall be permitted to be substituted for not more than 50 percent of the required drinking fountains.]

## Supporting Information

### Issue - Expanded

New Yorkers consume large amounts of bottled water and sugary drinks, resulting in negative health and environmental impacts.

The affect of sugary drinks on the obesity epidemic and related diseases such as diabetes has been described extensively in medical literature. But even consuming bottled water can carry health-related risks. In a 1999 study, the Natural Resources Defense Council found that one-third of tested bottled water had some level of contamination.<sup>i</sup>

Moreover, the plastic used to contain bottled water is believed to leach chemical phthalates into the water.<sup>ii</sup> Even when bottled water is as clean as tap water, consumers are not always aware what they are paying for - about 25% of bottled water is actually just bottled tap water.<sup>iii</sup>

The bottles themselves also affect the environment. Each year, billions of bottles of water are shipped to U.S. ports, creating vast quantities of global warming pollution and other air pollution. The transportation of bottled water from Western Europe to New York City alone releases an estimated 3,800 tons of global warming pollution.<sup>iv</sup> Although

bottles can be recycled, only about 13% make their way to recycling plants; the rest end up in landfills.<sup>v</sup> In addition, the amount of energy expended to transport the bottled water across states or from other countries means more fossil fuels are burned, emitting higher amounts of greenhouse gasses.

Despite negative health concerns and environmental impacts, New Yorkers still consume large amounts of sugary drinks and bottled water consumption doubled between 1999 and 2004.<sup>vi</sup> Part of the reason for these consumption habits is that New Yorkers have little choice because water fountains are hard to find. Even when fountains are available, some people do not use them from fear the spigot may be unsanitary.

This proposal would increase the number of drinking fountains required in places where large numbers of people gather and undo a previous change to the Plumbing Code that permitted the substitution of 50% of drinking fountains with bottled water dispensers. The proposal would also require fountains to include a separate faucet to fill bottles, which could be utilized by people who carry their own bottles or are concerned about using a public fountain.

### **Environmental & Health Benefits**

Reducing the consumption of sugary drinks and bottled water will improve the health of New Yorkers and reduce numerous environmental impacts from the transportation and production of bottles.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have a low positive health impact per building and to impact a small number of buildings. It was thus given a health score of 1.

### **Cost & Savings**

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1<sup>st</sup> draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by up to 0.01%.

### **Precedents**

There are no known precedents for this proposal. However, many municipalities throughout the U.S. and Canada have banned the purchase of bottled water using city funds, such as Seattle<sup>vii</sup>, San Francisco<sup>viii</sup>, and Toronto.<sup>ix</sup> Calls for better access to public water fountains have grown in conjunction with these bans.<sup>x</sup>

### **LEED**

There are no LEED credits affiliated with this proposal.

### **Implementation & Market Availability**

There are no known implementation issues for this proposal. Water fountain equipment is readily available.

### **Notes**

Drinking fountains typically include cooling units and water storage, in which bacteria could grow if the fountains are not used regularly. Buildings should consider periodic maintenance and testing of fountains.

## ENDNOTES:

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<sup>i</sup> NATURAL RESOURCES DEFENSE COUNCIL, SUMMARY FINDINGS OF NRDC'S 1999 BOTTLED WATER REPORT, <http://www.nrdc.org/water/drinking/nbw.asp> (last visited Jan. 21, 2010).

<sup>ii</sup> NATURAL RESOURCES DEFENSE COUNCIL, BOTTLED WATER, <http://www.nrdc.org/water/drinking/qbw.asp> (last visited Jan. 21, 2010).

<sup>iii</sup> Ibid.

<sup>iv</sup> Ibid.

<sup>v</sup> Ibid.

<sup>vi</sup> James Owen, Bottled Water Isn't Healthier Than Tap, Report Reveals, National Geographic News, NAT'L. GEOGRAPHIC NEWS, February 24, 2006, available at [http://news.nationalgeographic.com/news/2006/02/0224\\_060224\\_bottled\\_water.html](http://news.nationalgeographic.com/news/2006/02/0224_060224_bottled_water.html).

<sup>vii</sup> Colin Dunn, City of Seattle gives Bottled Water the Boot, Treehugger, Mar. 19, 2008, available at <http://www.treehugger.com/files/2008/03/city-of-seattle-bottled-water-ban.php>.

<sup>viii</sup> Associated Press, S.F. mayor bans bottled water at city offices, MSNBC, June 25, 2007, available at <http://www.msnbc.msn.com/id/19415446>.

<sup>ix</sup> CBC News, Toronto Council Approves Plastic Bag Charge, Bottle Plan, CBS NEWS, Dec. 3, 2008, available at <http://www.cbc.ca/consumer/story/2008/12/03/plastic-bags.html>; and Jennie Day-Burget, Toronto passes Bottled Water Ban, CITY OF PORTLAND Water Bureau, Dec. 4, 2008, <http://www.portlandonline.com/water/index.cfm?a=221126&c=45214>.

<sup>x</sup> Richard Girard, Where Have All the Water Fountains Gone?, ALTERNET, Oct. 29, 2008, [http://www.alternet.org/water/105051/where\\_have\\_all\\_the\\_water\\_fountains\\_gone/?page=entire](http://www.alternet.org/water/105051/where_have_all_the_water_fountains_gone/?page=entire).