# Mold on the Indiana University Bloomington Campus: A Review of Conditions, Procedures and Impacts

**Indiana University School of Public and Environmental Affairs**
**V600 Mold Capstone Course**

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## Executive Summary

The School of Public and Environmental Affairs' V600 Mold Capstone course addresses the growth and presence of mold at Indiana University, Bloomington (IUB) and its impact on human health and issues of building integrity. The course also examines the current remediation procedures and administrative policies related to mold. The goal of the course is to generate a report for IUB policymakers that contains information and recommendations which may prove useful to the University community.

The report establishes a scientific background on the characteristics of mold and mold growth, explores the conditions necessary for mold growth as are relevant to the IUB campus, and examines possible legal actions that may be taken against the University or on the University's behalf. The report further connects the presence of mold to many detrimental health effects and assesses the current processes, resources, and responses used by the administration in addressing mold issues.

With respect to the conditions for mold growth and the presence of mold on campus, many mold-related health impacts may be associated with a decline in building conditions. The report examines this possibility as a result of inadequate Repair and Rehabilitation (R & R) funding for buildings, including an exploration of the role of building managers and their experiences.

With respect to the current administrative process, the report assesses roles, responses, and resources of the major, relevant University actors as they relate to the resolution of mold problems on campus. These offices include: the Chancellor's Office, the Office of the President, the Office of Environmental, Health & Safety Management (EHS), Physical Plant, Human Resources, Risk Management, the Architect's office, and Residential Programs and Services (RPS). Each of these offices are analyzed with respect to the extent of implemented training and training programs available, administrative response protocols, and the availability of dedicated financial resources.

The report utilizes a statistical Monte Carlo simulation to analyze the financial impacts of mold at IUB. Using IUB demographic data, salary information, and information from relevant literature sources in an effort to reveal the underlying costs of mold in University buildings, this analysis projects lost productivity and health care costs. Included are numerous case studies of individuals within the University that illuminate the concerns and needs of sensitive individuals.

The report concludes with recommendations that, if followed, will better enable the University to address any future issues of mold at IUB. In brief, these recommendations include exploring alternative avenues for funding, reassessing financial allocations regarding building integrity, improving building maintenance practices and materials, providing training for critical University employees, and implementing a more structured communication process among departments and administration.

# I. Introduction

## I.A. Course Description and Project Goals

The V600 Capstone Project is the culmination of learning for Master of Public Affairs and Master of Science in Environmental Science students at the School of Public and Environmental Affairs. This capstone was initiated by Professor Diane Henshel to provide students an opportunity to integrate policy and science in an interdisciplinary framework. Students created and developed this project to fully evaluate the mold problem at Indiana University Bloomington. Final products include this report, an informational website, and a series of presentations given to key IUB campus stakeholders.

Indiana University has an acknowledged mold problem that has never been comprehensively evaluated. At this time, the University does not seem to have an encompassing strategy to address the current problems and how to prevent future problems. The goal of this project was to identify mold problems on campus and provide recommendations to IUB administrators on how best to address these issues.

## I.B. Introduction to Key Players

Interim Chancellor Kenneth R.R. Gros Louis is responsible for implementing the academic mission of the Bloomington Campus. This responsibility is additionally shared by the Vice Chancellors and Deans, who oversee IUB's academic, administrative support, and auxiliary support units. Please see the organizational chart of the IUB Chancellor's Office provided in the appendix. (see Appendix B, Chart 1). Indiana University Bloomington's academic units include 12 schools and colleges, and other academic programs. Academic units report to the Vice Chancellor for Academic Affairs and Dean of Faculties, Ms. Jeanne Sept. Annual assessments on academic unit's operating revenues fund administrative support units serving IUB. Auxiliary units report to the Vice Chancellor for Auxiliary Services, Mr. Bruce Jacobs. These auxiliary units are generally self-supporting and include, for example, Residential Program Services. The Vice Chancellor for Student Affairs and Dean of Students, Mr. Richard McKaig, oversees student support services, which includes the Student Health Center.[1]

Mr. Terry Clapacs is the Vice President and Chief Administrative Officer of IUB and reports directly to the President of the University, Dr. Adam Herbert. The following Departments report to Mr. Clapacs: Intercollegiate Athletics, Bureau of Facilities Programming & Utilization, Facilities, Finance & Equal Employment Opportunity, Risk Management, University Architect's Office, Office of Environmental Health and Safety Management (EHS), University Human Resource Services, University Police (IUPD), University Purchasing Department, University Real Estate & Economic Development, and University Travel Management Services.[2] A complete organizational chart of the Vice President and Chief Administrative Officer is located in Appendix B, Chart 2.

The Physical Plant, directed by Mr. Hank Hewetson, is unique at IUB because they are held directly accountable to Mr. Clapacs in the Office of the Vice President and Chief

[1] Interview with Mr. Jim Donges, Assistant Vice Chancellor for Budget, on 30 March 2005; *IUB Summary Data for Financial Planning—FY 2004-2005*, p. 16.

[2] The Office of the Vice President and Chief Administrative Officer, Indiana University [on-line]; available from http://www.indiana.edu/~vpa/html/department.htm; Internet; accessed 23 April 2005.

Administrative Officer, but the Chancellor's Office controls the Physical Plant's budget. Mr. Hewetson oversees the following departments within Physical Plant: Electronics, Training & Development, Maintenance, Facilities, Materials & Contracts, Utilities, and Building Services. He also participates in the oversight of the University Engineer and the Campus Division.[3] The Physical Plant's organizational chart is available in Appendix B, Chart 3.

## I.C. Paper Roadmap

This paper contains seven major sections. The next section provides background information on the biology of mold. The third and fourth sections detail the presence of mold on the IUB campus and the IU administrative hierarchy relevant to the mold prevention and remediation process. Respectively, the fifth, sixth, and seventh sections analyze building maintenance budget shortcomings, mold-related health care costs, and the effectiveness of administrative policies regarding mold. The final section provides recommendations to address key issues discovered in the previous analyses.

[3] The Department of Physical Plant, Indiana University, Bloomington [on-line]; available from http://www.indiana.edu/~phyplant/html; Internet; accessed 23 April 2005; *Physical Plant flowchart* [on-line]; available from http://www.indiana.edu/~phyplant/html/body_organization_chart.html; Internet; accessed 23 April 2005.

# II. Background on Mold

## II.A. What is Mold?

Molds are a group of organisms that belong to the kingdom Fungi.[4] Fungi are neither animals nor plants and are classified in a kingdom of their own. Fungi include molds, yeasts, mushrooms, and puffballs. There are over 20,000 species of mold. Some of the most commonly found indoor mold colonies include *Aspergillus, Cladosporum*, and *Stachybotrus*. Of these, *Stachybotrus* and *Aspergillus* are the two species most frequently linked to adverse health effects.

Mold, like other fungi, play a key role in breaking down organic materials like plants, leaves, and other natural materials. They differ in size, shape, and color among species. They reproduce by releasing microscopic spores into the air, which can enter buildings and homes through windows, cracks, doors, and vents. Each spore that germinates can give rise to new mold growth, which in turn can produce millions of spores. Live spores act like seeds, forming new mold growths when they find the right conditions.

When mold spores land they require moisture, nutrients, and a suitable place to thrive and grow. More specifically, mold growth will be accelerated where there is a lack of sunlight, and there is a lack of air movement. Mold growth on surfaces can often be seen in the form of discoloration that can range in color from orange to green to brown to black. There are thousands of types of mold that exist in the United States and a mixture of tiny mold particles is normally present in the air and settled dust of most indoor environments.

## II.B. Mold in Buildings

### *II.B.1. Conditions for Mold Growth*

Mold requires four conditions for growth: 1) moisture above 50% relative humidity; 2) the presence of nutrients from organic material like cellulose; 3) subdued lighting; and 4) moderate temperatures (molds grow best between 68 and 86° F).[5] These conditions exist in almost any building, and moisture is the most easily controlled variable. Given the above conditions, mold reproduces in 48 hours[6] and multiplies exponentially.[7]

### *II.B.2. Increased Mold Awareness*

The proliferation of mold problems in recent years is explained by the shift from traditional stone and brick construction to cellulose-based products after World War II, and the move to tighter, more energy–efficient buildings in the 1970s that do not allow moisture to

[4]U.S. Environmental Protection Agency, *Mold Remediation in Schools and Commercial Buildings*, Appendix [on-line] available from: http://www.epa.gov/mold/append_a.html; Internet; accessed April 2005.
[5] Leonard V. Zumpano, S. Hartley, and K. H. Johnson, "The Problem of Indoor Mold for Portfolio and Property Managers," *Journal of Real Estate Portfolio Management* 9, no. 2 (2003).
[6] Vincent M. Torres and Richard L. Corsi, *Potential Health and Safety Implications of the Texas Department of Insurance's Restructuring of Residential Property Insurance Policies.* Texas Institute for the Indoor Environment, The University of Texas at Austin, 2002.
[7] Rick Poppe and S. Charney, "Managing the Risk of Mold in the Construction of Buildings," *Constructor* 85, no. 5 (2003).

escape.[8] In addition, new insulation and siding construction practices trap moisture and create conditions for mold growth.[9]

### *II.B.3. Scope of the Problem*

Mold not only causes health problems, as discussed in the next section, but along with moisture, can damage floors, ceilings, and walls.[10] The overall cost for mold repair and health-related lawsuit settlements in 2002 was $1.3 billion nationwide.[11] Many insurance experts believe that mold will become as big an environmental and legal issue as asbestos.[12] Because of the potential liability issues, it is difficult for property owners to obtain insurance coverage for mold—any insurance plans now exclude mold problems.[13]

### *II.B.4. Moisture and Mold Growth Prevention*

Eliminating moisture and providing an escape for any trapped water is the best way to prevent mold problems.[14] A study by the Canada Mortgage and Housing Corporation found that 90% of building leaks were at "interfaces" – windows cracks, wall-roof connections, balconies, etc.[15] Several guidelines exist for preventing moisture leaks. Prevention measures include fixing leaks and cracks, insuring proper ventilation, removing carpet from bathrooms and kitchen areas, and replacing mold-damaged drywall with non-cellulose alternatives.[16] Builders, architects, and owners should consider mold issues from the initial building design phase.[17] A wall drainage hole known as a weep is one simple design element that allows trapped moisture to easily escape to the outside before it leads to mold problems.[18] During construction, building materials should be covered with a tarp and activities sequenced so materials are exposed for the shortest possible time.[19] A later section provides an in-depth analysis of design, prevention, and maintenance activities specific to the IUB campus.

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[8] Peter D. Baker and Chris B. Makepeace, "Adapting Persist for the Prevention of Water Accumulation in Residential Wood Frame Construction," in *Buildings VII/Wall Design and Building Science - Practices* (2002); Charles H Eccleston, "Toxic Mold: The Next Asbestos?" *Environmental Quality Management* 2004; Torres and Corsi.

[9] Bob Aalberts and R. W. Hoyt, "Appraisers and Toxic Mold: Legal and Valuation Issues.," *Journal of Real Estate Practice and Education* 6, no. 2 (2003).

[10] Ibid.

[11] Jean A. Chapman, et al., "Toxic Mold: Phantom Risk Vs Science," *Annals of Allergy, Asthma, & Immunology* 91 (2003).

[12] Aalberts and Hoyt; Eccleston, "Toxic Mold: The Next Asbestos?" Evan Mills, "Climate Change, Insurance, and the Buildings Sector: Technological Synergisms between Adaptation and Mitigation," *Building Research and Information* 31, no. 3-4 (2003).

[13] Patrick Wielinski, "'Toxic' Mold Part Iii.," *Constructor* 83, no. 12 (2001); Zumpano, Hartley, and Johnson.

[14] Poppe and Charney, "Managing the Risk of Mold in the Construction of Buildings."

[15] M. D Lawton, *Reacting to Durability Problems with Vancouver Buildings*, ed. M. A. Lacasse and D. J. Vanier, Durability of Building Materials and Components (Ottawa: Institute for Research in Construction., 1999).

[16] Zumpano, Hartley, and Johnson.

[17] Poppe and Charney, "Managing the Risk of Mold in the Construction of Buildings."

[18] Ibid.

[19] Michael F Dehmler, "'Toxic' Mold Part Ii," *Constructor* 83, no. 11 (2001).

## II.C. Mold and Health

Exposure to mold can be detrimental to the health of susceptible individuals.[20] The health effects of mold exposure are influenced by a number of factors, including duration and frequency of exposure to mold, the potency (or strength) of the mold, and individuals' sensitivities.[21] In addition, people may be co-exposed to multiple molds or molds and microbes and induce additive or synergistic health impacts.[22] While ingestion of contaminated food can be a major pathway for mold exposure, this report will focus specifically on inhalation exposure because this is the pathway by which most IUB faculty, staff, and students will be exposed.[23]

### *II.C.1. Types of Health Effects*

Storey et al. has categorized the health effects of mold into four groups: toxic reactions, infections, allergic or hypersensitivity reactions, and irritant reactions.[24] Several studies have documented the relationship between mold and allergic and hypersensitivity reactions. As reported by the Institute of Medicine (IOM), mold exposure is most commonly associated with allergic reactions including hypersensitivity pneumonitis, allergic asthma, and allergic rhinitis/conjunctivitis.[25] A Finnish study linked the risk of asthma to the "presence of visible mold and/or mold odor in the workplace," whereas it found no association between water damage in homes and adult-onset asthma.[26] The IOM supports this finding, arguing that there is "inadequate or insufficient evidence to determine whether an association… exits" between mold exposure and the onset of asthma.[27] After holding age, sex, region of residency, parents' education, and parental hypersensitivity to environmental allergens constant, Beate found an association between risk of allergic sensitization and the number of *Cladosporium* and *Asperigullus* spores in the air.[28] In addition, Gent found that after controlling for socioeconomic status, mother's asthma/allergy history, season, and specified housing characteristics, infants that

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[20] Redd, Stephen. *State on the Science of Molds and Human Health*. Centers for Disease Control and Prevention. accessed 25 January 2005 [on-line] available from: http://www.cdc.gov/nceh/airpollution/images/moldsci.pdf.

[21] Eaton, David and Curtis D. Klaassen. 2003. *Principles of Toxicology*. Edited by Curtis D. Klaassen. Casarett & doull's essentials of toxicology. New York: McGraw-Hill Medical Publishing Division.

[22] Eaton and Klaassen (2003) 11. (A synergistic effect is one where the effects of two agents combined are greater than the effect of each agent individually); Huttunen, Kati. 2004. Synergistic interaction in simultaneous exposure to *streptomyces californicus* and *stachybotrys chartarum*. *Environmental Health Perspectives* 112, no. 6. (Unfortunately, little is known about the synergistic effects of molds and other air-born pathogens. Additional research is needed in this area.)

[23] Klaassen, Curtis D. 2001. *Casarett & Doull's toxicology: The basic science of poisons*. New York: McGraw-Hill Medical Publishing Division.; (For example, toxicological studies have shown the toxin aflatoxin $B_1$ to be a potent carcinogen of the liver (Klaassen 1076)).

[24] Storey, Eileen. 2004. Guidance for clinicians on the recognition and management of health effects related to mold exposure and moisture indoors. Farmington, CT: University of Connecticut Health Center, Center for Indoor Environments and Health.

[25] Redd, Stephen. *State on the Science of Molds and Human Health*. Centers for Disease Control and Prevention. accessed 25 January 2005. [on-line] available from: http://www.cdc.gov/nceh/airpollution/images/moldsci.pdf., 3.

[26] Jaakkola, Marrita S. 2002. "Indoor dampness and molds and development of adult-onset asthma: A population-based incident case-control study." *Environmental Health Perspectives* 110, no. 5: 543-548.

[27] Storey, Eileen. 2004. *Guidance for clinicians on the recognition and management of health effects related to mold exposure and moisture indoors.* Farmington, CT: University of Connecticut Health Center, Center for Indoor Environments and Health.

[28] Beat, Jacob. 2002. "Indoor exposure to molds and allergic sensitization." *Environmental Health Perspectives* 110, no. 7: 647-654.

had at least one elder sibling with asthma and were exposed to large amounts of the mold *Pennicilium* are at risk of developing persistent coughs and/or wheezing.[29]

Through the production of mycotoxins, molds can also trigger toxic responses. While allergens only affect people with allergic sensitivities, mycotoxins have the ability to affect almost all people that come in contact with them.[30] Of particular concern are reports of Infant Pulmonary Hemorrhage (IPH) in children whose rooms possessed elevated levels of mold spores. Flappan et al. investigated a case of IPH in the Cleveland suburbs and found mold species in the home including *Stachybotrys atra* and *Aspergillus Pennicillium*.[31] The Centers for Disease Control, however, has concluded that there is not enough evidence to suggest the association between *Stachybotrys atra* and IPH.[32] In addition, fungal toxins can cause Organic Dust Toxic Syndrome (ODTS), which has flu-like symptoms such as fever and respiratory symptoms.[33]

Irritant reactions are also associated with mold exposure. Molds create a variety of volatile organic compounds (VOCs), including aldehydes, esters, alcohols, and aromatic compounds. Volatile organic compounds give moldy areas their distinctive musty odor. If VOCs concentrations are high, they can promote irritation of the eyes, skin rashes, headache, and fatigue.[34] Given that mold can negatively impact human health, it is necessary to minimize mold exposure indoors.

## II.D. Introduction to Legal Issues and Potential Liability

### *II.D.1. Legal Issues at the University Level*

Recently, mold has received a good deal of attention in the media. High profile legal cases brought by Erin Brockovich and Ed McMahon, as well as rather large awards in several cases have raised public awareness about mold issues. For example, in 2002 a Texas jury in *Ballard v. Fire Insurance Exchange*, awarded the plaintiff homeowners more than $32 million[35] in compensatory and punitive damages. As a result of this kind of recent legal activity, several states passed laws about mold exposure, the insurance industry became rather alarmed, and people involved in any way with property found themselves potentially liable for injuries caused by mold.

The majority of mold cases are filed against insurance companies. According to the Insurance Information Institute (III), the concern about mold was greatest from 2001 to 2002, but is not as great a concern now as it once was for the insurance industry as people have become more educated about mold and at least 39 states have approved mold exclusions.[36] However, the

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[29] Gent, Janneane. 2002. "Levels of household mold associated with respiratory symptoms in the first year of life in cohort at risk for asthma." *Environmental Health Perspectives* 110, no. 12: 781781-786.

[30] Storey, Eileen. 2004. *Guidance for clinicians on the recognition and management of health effects related to mold exposure and moisture indoors.*

[31] Flappan, Suan M. 1999. "Infant pulmonary hemorrhage in a suburban home with water damage and mold," *Environmental Health Perspectives* 107, no. 11: 927-931.

[32] Redd, Stephen. *State on the science of molds and human health*. Centers for Disease Control and Prevention.. [on-line] available from: http://www.cdc.gov/nceh/airpollution/images/moldsci.pdf. Internet; accessed January 25, 2005.

[33] Storey, Eileen. 2004. *Guidance for clinicians on the recognition and management of health effects related to mold exposure and moisture indoors*.

[34] Ibid., 26.

[35] Since reduced to $7.2 million.

[36] Robert P. Hartwig, *Mold and Insurance*, Insurance Information Institute. (2003) 8, 18

III predicts increased claims involving "apartments/condos/co-ops, office structures, schools, and municipal buildings."[37] For example, in July 2003, United Airlines employees filed a class action suit against the Denver and the county in which it resides for breaching their "duty to maintain the airport in a reasonably safe condition" by "failing to correct the airport's poor environmental conditions despite having knowledge of such problems."[38]

Indiana University is self-insured up to a limit, after which point Factory Mutual Insurance Company covers claims. The limit the University is responsible for was doubled within the last year to $2 million, therefore, the University should take special care to ensure it does not expose itself to liability. Additionally, the potential for a class-action suit is a concern as there are large and often organized groups of employees and students in a University setting. This section will outline current laws about mold in Indiana, and liability issues including: potential suits that could be brought against the University and potential legal action that the University could take against others.

### *II.D.2. Mold-Related Federal and Indiana State Law*

At present, there is no accepted national regulatory standard for mold. In 2002, a bill was introduced in Congress entitled the United States Toxic Mold Safety and Protection Act, but died in committee. The proposed legislation would have:

- Required the Environmental Protection Agency, National Institute of Health, and the Centers for Disease Control and Prevention to collaborate in researching the health effects related to mold.
- Required the U.S. Department of Housing and Urban Development to study the impact of construction standards on mold growth.
- Forced EPA to publish national standards for mold inspection, remediation, toxicity, and protection of mold remediators.
- Required mold inspection before selling or leasing property, as well as restricting the federal government from making, insuring, or guaranteeing a mortgage without mold inspection.
- Created and mandated a licensing system for mold inspectors and remediators.[39]

The question still remains as to what approach policymakers should use to regulate mold and Indoor Air Quality (IAQ). Available regulatory approaches include setting acceptable limits for mold and other IAQ pollutants. The regulatory framework is further complicated by the distinction between occupational and public health risk policies. Occupational standards involve assessing limits based on healthy adults exposed 8 hours a day, 40 hours a week, for 50 weeks of the year. In contrast, public health standards address exposures to the general population, including sensitive subgroups over long periods of time. Because of these complications, comprehensive federal and state legislation has not yet been developed for setting exposure limits for mold and IAQ pollution.

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[37] Ibid. 5, 13.
[38] Ibid 6.
[39] H.R. 1268. *United States Toxic Mold Safety and Protection Act* [on-line] available from: http://www.house.gov/conyers/Mold_Bill.pdf; Internet; accessed 24 March 2005.

Currently, there are no Indiana state laws governing minimum standards for mold exposure. House Bill 1253 (2002) proposed mold standards and required the Indiana State Department of Health (ISDH) to offer regulations regarding toxic mold limits, but it failed to pass. However, in 2002, the Indiana General Assembly passed Senate Bill 407, which allows the ISDH to adopt rules establishing indoor air quality in schools' inspection and evaluation programs to assist schools in developing plans to improve indoor air quality. It also established an advisory panel to work with the department to develop plans and best management practices for school air quality.[40] However, none of the subsequent 2003 or 2004 mold bills passed, so there is currently no taskforce.

According to the Indiana Environmental Institute, the direction of Indiana legislation is likely to focus on revising the Indiana building code in the future rather than trying to establish a "mold policy" or minimum threshold guidelines for mold.[41] Indiana Code §§ 32-21-5-1--12 does require sellers of property containing 1-4 dwelling units to complete a Seller's Residential Real Estate Sales Disclosure form. Rules adopted under the law [42] establish the disclosure form, which requires sellers to disclose knowledge of hazardous conditions on the property, including radon gas and mold.[43]

### *II.D.3. Liability*

To recover damages for mold related harm, plaintiffs generally must establish that the mold caused their harm. There are in fact, three causation issues in any toxic mold case.[44] The first is the cause of the moisture filtration, because mold requires moisture to grow. The second issue is whether the moisture infiltration caused growth of a mold that is associated with human health effects. Finally, the plaintiff must show that the damages they are claiming were in fact caused by the mold. Once the causation elements are established, the plaintiff must show that some party is liable for the moisture problem. This is true whether the plaintiff is the University or if the plaintiff is a student or employee. The most vulnerable part of a plaintiff's mold claim is the causal link between exposure to mold and the complaint of health problems because there is a lack of definitive scientific evidence linking mold exposure to serious health conditions.[45]

There are multiple causes of action a plaintiff can pursue in a toxic mold case. Negligence is used most often. Breach of contract involves the construction of the buildings in question. Actions involving insurance can include: bad-faith breach of insurance contract; unfair and deceptive trade practice; consumer fraud; fraudulent misrepresentation; and negligent misrepresentation. Elements of landlord tenant law can be used, including: breach of implied warrant of habitability; breach of covenant to repair; failure to disclose; and constructive eviction. If there are any relevant state or federal laws, violations can result in legal action.

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[40] IN Code §§ 20-10.1-33-1; 21-2-15-4; Habegger and Seamands, Mold Litigation: Recent Developments in *Indiana Continuing Legal Education Forum, Mold Litigation: The Problem Keeps* Growing (2004). 8

[41] E-mail correspondence with Mr. Bill Beranek, Executive Director, Indiana Environmental Institute, 31 March 2005.

[42] 876 Indiana Admin. Code 1-4-1,2

[43] Indiana Commission on Public Records; *Seller's Residential Real Estate Sales Disclosure* [on-line]; available from: http://www.in.gov/icpr/webfile/formsdiv/46234.pdf; Internet; accessed March 2005.

[44] Lawrence A Vanore, Legal Strategies and Techniques in Toxic Mold Litigation in *Indiana Continuing Legal Education Forum, Mold Litigation: Issues Under the Microscope* (2003) 6.

[45] Randall L. Erickson, Esq. and Theresa C. Lopez, Esq. Crowell & Moring LLP; *There's A Fungus Among Us: The Current Epidemic of Toxic Mold Litigation* (2003) [on-line]; available from: http://www.crowell.com/pdf/ConstructionUserQuarterly9_03.pdf; Internet; accessed April 2005.

Additionally, people have sued for workers compensation and have even made constitutional claims. This section will address those causes of action most relevant to IUB, a public, self-insured institute of higher education. Therefore, this section provides a survey of cases that deal mainly with University, school, public property, or employer-employee cases where such law exists.

### *II.D.4. Potential Actions Against the University*

If a University student or employee is the plaintiff (injured party), they must establish causation and show that the University (defendant) is liable for the mold problem. There are several causes of action a plaintiff could pursue to achieve this goal. The next sections will describe different kinds of cases plaintiffs could bring against the University.

### *II.D.4.a. Negligence*

Negligence is the action most universally brought against targeted defendants in toxic mold litigation. To prove negligence in a toxic mold case, a plaintiff must show the following by a preponderance of the trial evidence: [46]

- Defendant owed a duty of care to plaintiff.
- Defendant breached its duty by a failure to exercise ordinary or reasonable care that a person of ordinary prudence would use under similar circumstances.
- The breach was the proximate cause of injury damage or loss to plaintiff.
- Plaintiff suffered personal injury or property damage.

A negligence case relevant to IUB is the Indiana case of Junita Martin in *Coleman v. Charles Court*.[47] Ms. Martin was employed by a social services agency in Muncie from 1979 through October 2000. In 1998, Martin was diagnosed with the fungal disease histoplasmosis, which initially infects the lungs. She filed her complaint against the agency claiming her disease was caused by hazardous airborne spores from bird droppings, high levels of carbon monoxide, mold, and inadequate ventilation. Martin died two years later. The Indiana Appellate court found that the case failed the third element of a negligence case: no evidence that the workplace exposure to mold and other contaminants proximately caused her disease or death.

### *II.D.4.b. Intentional Tort*

Like IUB, the defendant in *Leonard v. Board of Governors of Wayne State University*[48] is a public, four year educational institution. In this case, an employee unsuccessfully brought an action for intentional tort against the University for moldy conditions in her office. The court

[46] Daniel J. Penofsky, J.D, Litigating Toxic Mold Cases 92 *Amjur Trials* 113 (2004); (Preponderance of evidence means the greater weight of the evidence required in a civil (non-criminal) lawsuit for the trier of fact to decide in favor of one side or the other. This preponderance is based on the more convincing evidence and its probable truth or accuracy, and not on the amount of evidence.) definition [on-line] available from: http://dictionary.law.com/ Internet; accessed 2005.

[47] *Coleman v. Charles Court LLC et al.,* 2003 WL 22389867 (Ind. Ct. App. Oct. 16, 2003). *See Also* "Mold, Workplace did Not Cause Fungal Disease, Death" 2 *Andrews Mold Litigation Reporter* 3, (2003).

[48] *Leonard v. Board of Governors of Wayne State University* (Mich.App.,2003)

defined an intentional tort as existing "only when an employee is injured as a result of a deliberate act of the employer and the employer specifically intended an injury. An employer shall be deemed to have intended injury if the employer had actual knowledge that an injury was certain to occur and willfully disregarded that knowledge." The court of appeals determined that the case turns on whether Wayne State knew that the plaintiff would suffer an injury if she was exposed to the moldy conditions in her office. Therefore, the plaintiff must show that the defendant had actual knowledge that she was unusually sensitive to *aspergillus*, and that her unusual sensitivity made it a certainty that she would become ill.[49]

### *II.D.4.c. Action for a Civil Rights Violation*

Indiana University is a state actor and similar to a school district. In *Greene v. Plano, I.S.D.*[50] a school district employee filed a claim on behalf of herself and a representative putative class. She unsuccessfully argued the school district's actions in allowing her workplace to become contaminated with toxic mold violated her right to be free from state occasioned damage to a person's bodily integrity as protected by the substantive due process clause under the Fourteenth Amendment to the United States Constitution. Under "state created danger" theory of liability, the environment created by state actors must be dangerous, they must know it is dangerous, and, to be liable, they must have used their authority to create an opportunity that would not otherwise have existed for a third party's crime to occur.[51] The court found this argument unpersuasive as it has only been recognized in situations where the state has created or increased an individual's danger from third persons.

### *II.D.4.d. Landlord-Tenant Laws*

The University serves as a landlord for many people utilizing on and off campus housing. Landlord-tenant laws are governed by state law. In Indiana, under IC 32-31-8-5, landlords have the following duties:

Sec. 5. A landlord shall do the following:

(1) Deliver the rental premises to a tenant in compliance with the rental agreement, and in a safe, clean, and habitable condition.

(2) Comply with all health and housing codes applicable to the rental premises.

(3) Make all reasonable efforts to keep common areas of a rental premise in a clean and proper condition.

(4) Provide and maintain the following items in a rental premises in good and safe working condition, if provided on the premises at the time the rental agreement is entered into:

(A) Electrical systems.

(B) Plumbing systems sufficient to accommodate a reasonable supply of hot and cold running water at all times.

(C) Sanitary systems.

(D) Heating, ventilating, and air conditioning systems. A heating system must be sufficient to adequately supply heat at all times.

(E) Elevators, if provided.

(F) Appliances supplied as an inducement to the rental agreement.

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[49] Ibid. at 2.

[50] *Greene v. Plano, I.S.D.*, 227 F. Supp. 2d 615, 171 *Ed. Law Rep*. 760 (E.D. Tex. 2002).

[51] 42 U.S.C.A. § 1983

A tenant has a right to bring an action against a landlord under Indiana Law if three conditions are met:

(1) The tenant gives the landlord notice of the landlord's noncompliance with a provision of this chapter.
(2) The landlord has been given a reasonable amount of time to make repairs or provide a remedy of the condition described in the tenant's notice. The tenant may not prevent the landlord from having access to the rental premises to make repairs or provide a remedy to the condition described in the tenant's notice.
(3) The landlord fails or refuses to repair or remedy the condition described in the tenant's notice.

The condition described in IC 32-31-8-5(1) is commonly known as the Implied Warranty of Habitability. If the University was notified of a mold problem that affected the habitability of the residence, and failed or refused to remedy the problem, the tenant could seek damages under this law. The lessee may argue that such conditions constitute a constructive eviction. The remedy sought may include the remediation of the contaminant problem. In addition, the lessee may withhold rent until the condition is fixed.

In *Mazza v. Schurtz*,[52] a California jury awarded more than $2.7 million in damages to a family who sued the owner and property manager of their apartment for failing to properly maintain and repair the apartment after they had repeatedly complained about water intrusion and mold. The family alleged that the mold resulted in a number of health problems.

### *II.D.4.e. Workers' Compensation*

In *Crossett School District v. Gourley*,[53] the Arkansas Court of Appeals heard a case brought by a teacher against her employer school district. A new heating and air-conditioning system was installed in Carolyn Gourley's classroom in the summer of 1989. Leaks in the system caused mold to develop, which irritated the teacher's pre-existing allergies. In her claim brought before the Workers' Compensation Commission, Gourley was compensated for the occupational disease she developed from exposure to mold. On appeal, the school district argued that appellee had not proven that her employment increased the risk of developing the occupational disease she contracted. The Arkansas Court of Appeals found otherwise, holding that even though the exposure to mold was not particular to the occupation of a teacher, in this case, it was apparent that her exposure to mold was due to her employment, thus increasing her risk.

### *II.D.5. Potential Legal Action the University Could Take Against Others*

If the University is the plaintiff (injured party), they must establish causation and show that a third party such as a builder or contractor (defendant) is liable for the mold problem. There are several causes of action the University could pursue to recover against a third party. The next sections will describe different kinds of cases the University could bring against the defendants.

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[52] Habegger and Seamands, Mold Litigation: Recent Developments *in Indiana Continuing Legal Education Forum, Mold Litigation: The Problem Keeps Growing* (2004) 8 citing *Mazza v. Schurtz,* No. 00A S04795 (Cal. Super. Ct., Sacramento County, Nov 2001).
[53] *Crossett School District v. Gourley*, 50 Ark. App. 1, 899 S.W.2d 482 (Ark.App.,1995).

### *II.D.5.a. Action for Breach of Contract*

If construction defects cause the University significant damages due to mold, the University may have a cause of action against that company. The elements of an action for breach of contract are as follows: [54]

- A valid contract existed between the parties.
- Plaintiff complied with all terms, conditions, and performance obligations.
- Defendant failed to perform at least one material contractual term, condition, or obligation.
- There is no defense to, discharge, or exoneration of defendant's duty to perform.
- Plaintiff suffered a loss as a result of defendant's lack of performance.

Actions for breach of contract in the toxic mold case may be brought against virtually any party, including a residential building owner or landlord, an insurer, general contractor, and remediation contractor. A plaintiff must prove the action by a preponderance of the trial evidence.

The court in *Centex-Rooney Const. Co., Inc. v. Martin County*, [55] awarded $14 million in damages to a county courthouse. The county (1) proved that construction defects caused moisture problems in the buildings resulting in extensive mold growth, (2) established through expert testimony that because of this moisture, the buildings were infested with two highly unusual toxic molds, (3) several experts attested to the accepted scientific principle linking exposure to these two molds with health hazards, (4) the county established that the purpose of its remediation process was to remove the existing mold and prevent new mold growth, and (5) the defects expanded the scope of the remediation process thereby justifying the increased costs for redesign, repair, reconstruction, and relocation.

### *II.D.5.b. Negligence*

The University could bring a negligence claim against various actors including contractors, design professionals, and manufactures of building components as long as they could prove the same elements of negligence outlined in the previous section.[56] In *Siman v. James Mock Inc*, a group of homeowners sued a concrete subcontractor alleging that the concrete contained too much water, causing the concrete to be porous and permeable, which resulted in the transmission of water and thus mold growth. The homeowners received $2.1 million for the watery concrete.[57]

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[54] Ibid.

[55] *Centex-Rooney Const. Co., Inc. v. Martin County*, 706 So. 2d 20 (Fla. Dist. Ct. App. 4th Dist. 1997).

[56] See previous section, Negligence, II.D.4.a

[57] Habegger and Seamands, Mold Litigation: Recent Developments at 4 *in Indiana Continuing Legal Education Forum, Mold Litigation: The Problem Keeps Growing* (2004) c*iting Siman v. James Mock Inc*., No 778957 (Cal. Super. Ct., Orange County, June 2001).

### *II.D.5.c Legal Summary*

The following conclusion offered by Crowell & Moring LLP accurately and succinctly sums up the current legal situation surrounding mold: "Unless a causal link between toxic mold exposure and serious health problems is scientifically established, it does not appear that toxic mold will become the next asbestos. That being said, mold litigation still remains a significant issue facing insurers, property owners, developers and contractors. The very large judgments in mold cases have been primarily associated with bad faith claims against insurance companies. The old proverb 'an ounce of prevention is worth a pound of cure' sums up nicely the approach to be taken in addressing mold issues. If parties who potentially face mold claims – which could be virtually everyone - would establish protocols to quickly respond, inspect, test and remediate damage from water intrusion and mold, most mold problems would never advance to the litigation stage. Moreover, paying the relatively small cost to address the problem in the early stage is preferable to paying an enormous breach of contract and/or tort judgment later."[58]

[58] Randall L. Erickson, Esq. and Theresa C. Lopez, Esq. Crowell & Moring LLP; *There's A Fungus Among Us: The Current Epidemic of Toxic Mold Litigation* (2003) [on-line]; available from: http://www.crowell.com/pdf/ConstructionUserQuarterly9_03.pdf; Internet; accessed 2005.

# III. Mold at Indiana University, Bloomington

An important aspect of assessing mold at IUB is recognizing that this is an issue that impacts the health and well-being of the University community. Not only are faculty and staff potentially exposed to favorable mold conditions in their office buildings, but students spending time in residence halls, classrooms, and common areas may also be exposed. Not everyone is negatively affected by mold or other adverse indoor air quality (IAQ) conditions, and of those who are affected, the degree of symptoms can vary greatly. Many health-related impacts of mold can be associated with declining building conditions – a result of limited funding for their rehabilitation and repair. Unfortunately, those who are adversely affected can rarely alter their daily routine to avoid suspect buildings.

## III.A. Current Status of Problem at IUB

### *III.A.1. IU Bloomington Building Status*

The IUB campus includes 488 buildings with over 15 million square feet of space.[59] Of these 488 buildings, roughly 71% have been under operation for at least 35 years, and by the University's estimation, approximately 58% of its academic and administrative space is in need of remodeling.[60] Bearing this in mind, building managers for each of these buildings should serve a pivotal role in preserving building integrity and operability.

To better understand the extent of mold and its causal factors at IUB we began by investigating the role of formal and informal building managers from academic, non-academic, and residence hall buildings.[61] On the IUB campus, building managers are the initial contacts for faculty, students, and staff to report any physical problems within a specific building (the building manager's role within the University structure will be further explained in a later section). In actuality, the initial contact person is often an employee of the Physical Plant or the Office of Environmental Health and Safety Management simply because the building manager is overlooked. Nevertheless, formal and informal building managers play an integral role in maintaining campus buildings since they may have first hand knowledge of the building(s) within their care as well as any problems associated with the building(s) that might lead to mold growth.

Given that we do not possess the necessary expertise to perform visual observations and sampling of potential mold growth within buildings, we created a Building Manager Questionnaire to obtain intimate information on past mold problems within buildings as well as current building conditions that could possibly lead to future mold growth. (see Appendix C, Building Manager Questionnaire).[62] We initially determined that the buildings queried would be a representative sample of campus buildings based on age, size, and building purpose; however, the availability of information (i.e. lacking complete building manager contact information) was

[59] Indiana University, *FACTBOOK 2004-2005* [on-line]; available from http://factbook.indiana.edu/fbook04/facilities/funds.shtml; Internet; accessed 27 March 2005.
[60] Ibid.
[61] Academic building is defined here as a building that predominantly has classrooms used to instruct students (i.e. Woodburn). A non-academic building is defined here as a building that predominantly has support services (i.e. Franklin Hall). A residence hall building is defined here as a building where students reside (i.e. Teter).
[62] All information pertaining to IUB building specifics and building managers, including the policy analysis section, references the information garnered from the questionnaire unless otherwise noted.

the driving force behind the decision regarding which building managers were actually solicited. Ultimately, 28 formal and informal building managers from different academic and non-academic buildings were contacted and sent the questionnaire (see Appendix C, Building Manager Questionnaire Contact List).[63]

The response rate was 36% with 10 building managers out of the 28 responding to the questionnaire. These response numbers do not include residence hall buildings. We initially contacted several residence hall building managers to obtain information from a representative sample of buildings; however, they were not permitted to provide us any information regarding the current building conditions or past mold problems. We found it imperative to obtain this information since Residence Program Services (RPS), which operates the residence halls, has been reported to be very effective in handling mold problems compared to other operations of the University. As a result, we were able to obtain two responses to the questionnaire from RPS Facilities Management and the building manager of Teter Residence Hall.

From the responses, we have learned the University has encountered mold problems in the past and is likely to face additional issues in the future. The next section will analyze the ten building manager responses, focusing on the current building practices contributing to the University's potential mold problem.

### *III.A.2. Materials Currently Used in IUB Buildings*

There are particular building materials that may become breeding grounds for mold if the precise conditions for moisture are present. The following are examples of known materials, structures, and systems used extensively on the IUB campus, which could contribute to moisture and/or mold problems. These include—but are not limited to—gypsum board (drywall), ceiling tiles, vinyl wallpaper, carpeting, low-quality air filters, a lack of insulation on pipes, drip catch-pans, rubber-sheeting with rock ballast roofing, and landscaping planters.

Gypsum drywall and ceiling tiles are usually cellulose based and therefore provide conditions and nutrients that are conducive for mold growth and reproduction. Carpet, if not replaced and especially following water damage, can also provide a prime environment for mold growth. Low quality air filters, or quality air filters if changed infrequently, will be ineffective at preventing the spread of mold. In some cases, the filters and the air handling unit can actually contribute to the spread of mold. The water-based heating and cooling systems utilized by many older buildings on campus also have the potential for moisture build-up due to condensation from lack of insulation on the pipes, overflowing drip catch pans, and general leaking of the implements.

Problems with leaks may arise due to the type of roofing material that many campus buildings employ, namely rubber sheeting with rock ballast. This rubber sheeting has the tendency to develop tiny holes, which allow water to seep under the roof, becoming trapped and thus creating a moist area without air movement. This creates an opportunity for water to continue to leak from the roof into lower parts of the building. Additionally, another source of moisture is landscaping planters that abut many of the buildings (e.g. SPEA) at IUB. The lining of the planters becomes compromised by punctures from gardening tools and the growth of plant roots, and consequently water seeps through the lining and into the adjoining building.

[63] All information pertaining to IUB building specifics and building managers, including the policy analysis section, references the information garnered from the questionnaire unless otherwise noted.

### *III.A.3. Problems of Primary Concern*

The responses from the Building Manager Questionnaire indicate that the most ubiquitous problem with campus buildings has been with leaking roofs (for a detailed list of building and mold conditions in campus buildings, see Appendix C, Building Manager Questionnaire Responses). This is due to poor construction, poor materials, the age of the roof in question, or the lack of repairs and maintenance. Of the ten responses we received, six of the buildings reported problems with roof leaks, currently and/or in the past.[64]

Another common source for water damage arises from chronic leaking of plumbing pipes (bathrooms, laboratory sinks, etc.), burst pipes (water mains, bathroom plumbing), and the subsequent collection of water on the floors below the water source. These incidents obviously cannot be foreseen, and thus are difficult to prevent. Windows also have a tendency to leak due to ineffective seals, from inadvertently being left open over long weekends or breaks, or simply from old age. Other concerns for water leaks and damage are those from the condensate from water-based heating/cooling systems, moisture from landscaping planters, exterior walls seeping moisture, and the occasional incident of sprinkler systems being triggered.

Building integrity problems are the number one issue to consider when addressing potential mold problems. Many building integrity problems, including the building envelope, exterior walls, windows, and the roof, will lead to water leaks and eventually create a prime environment for mold growth. Water leaks have become a large problem because an increased number of University buildings have roof leaks due to the lack of funding to fix them. [65]

## III.B. Human Health Implications and the IUB Community

The U.S. Environmental Protection Agency's (EPA) studies of human exposure to air pollutants indicate that indoor levels of pollutants may be two to five times greater, and at times more than 100 times greater, than outdoor levels. These levels of indoor air pollutants are of great concern because it is estimated that people spend an average of 90% of their time indoors. Comparative risk studies performed by the EPA and its Science Advisory Board have consistently ranked indoor air pollution among the top five environmental health risks to the public.[66]

At IUB, a failure to prevent indoor air problems, such as mold, or failure to respond to water leaks promptly, can have consequences such as:[67]

- Increasing potential for long-term and short-term health problems for students and staff.
- Impacting student and staff learning and working environment, comfort, and attendance.
- Reducing performance of faculty, and staff due to discomfort, sickness, or absenteeism.
- Accelerating building deterioration.

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[64] All information pertaining to IUB building specifics and building managers, including the policy analysis section, references the information garnered from the questionnaire unless otherwise noted.

[65] Presentation by Mr. Hank Hewetson, the Director of Physical Plant, in SPEA 272 on 8 February 2005.

[66] U.S. Environmental Protection Agency, *IAQ Tools for Schools Kit - IAQ Backgrounder* [on-line]; available from http://www.epa.gov/iedweb00/schools/tfs/iaqback.html#Why%20IAQ%20is%20Important%20to%20Your%20School; Internet; accessed 31 March 2005.

[67] U.S. Environmental Protection Agency, *IAQ Tools for Schools Kit - IAQ Backgrounder* [on-line]; available from http://www.epa.gov/iedweb00/schools/tfs/iaqback.html#Why%20IAQ%20is%20Important%20to%20Your%20School; Internet; accessed 31 March 2005.

- Reducing efficiency of the Physical Plant work time and equipment.
- Increasing the potential that schools will have to be closed, or occupants temporarily relocated.
- Straining relationships among University administration, staff, and students.
- Creating negative publicity that could damage the University's image and effectiveness, and creating potential liability problems.

Indoor air problems, such as mold, can be subtle and do not always produce easily recognizable impacts on human health or general well-being. Air quality at public universities is of particular concern. Proper maintenance of indoor air is more than an issue of "quality;" it encompasses safety and stewardship of the public's investment in the students, staff, and facilities.

Building occupants in IUB include the faculty, staff, students, and others who spend extended periods of time in these buildings. The effects of IAQ problems on occupants are often non-specific symptoms, rather than clearly defined illnesses. Symptoms commonly attributed to IAQ problems include:[68]

- Headache, fatigue, and shortness of breath.
- Sinus congestion, cough, and sneezing.
- Eye, nose, throat, and skin irritation.
- Dizziness and nausea.

Due to the varying sensitivity among individuals, one person may react severely to an IAQ problem such as mold, while surrounding occupants may not display any adverse effects. In other cases, symptoms may be widespread. In addition to different degrees of reaction, an indoor air pollutant or problem can trigger different types of reactions in different people.

Based to these reasons, it is extremely important to try to prevent and address mold issues as quickly as possible. In addition, the expense and effort to prevent mold problems could be considerably less than the costs to solve mold problems after they develop. This comparison of costs is explored further in Section VI. A focus on educating IUB faculty, staff, and students on the issue and causes of mold can play an important role in the prevention and timely remediation of problems.

### *III.B.1. IUB Community Case Studies*

Interestingly, when IUB individuals reportedly affected by mold were contacted, there was a great deal of concern regarding anonymity. Faculty and staff acknowledge that some of their peers are affected by mold, however when contacted, these individuals did not respond to inquiries or would speak only on the condition of anonymity. Some individuals revealed that they were concerned about their job security if they openly criticized the University's handling of mold-related issues. The following case studies are included to emphasize the human dimension of the mold problem on the IUB campus.

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[68] U.S. Environmental Protection Agency, *IAQ Tools for Schools Kit - IAQ Backgrounder* [on-line]; available from http://www.epa.gov/iedweb00/schools/tfs/iaqback.html#Why%20IAQ%20is%20Important%20to%20Your%20School; Internet; accessed 31 March 2005.

**CASE STUDY #1**

While cases of mold-related allergies often occur in isolation, in one of the offices on the IUB campus interviewed, multiple staff members suffer from allergy-like symptoms. Each of the individuals has worked for the University for numerous years, and all have had such symptoms for most of their employment in this office.

The individuals experience increased sinus infections, sinus-like headaches and runny noses. These symptoms do not persist in the home setting, only in their office. All have seen allergists and several regularly take prescription medication to alleviate their discomfort. One had to cease regular treatments due to the costs of the treatment and the related time off work. In one attempt to mitigate the problem, indoor air quality filters were installed, but this ultimately created more problems than it helped.

Several years ago, the staff members approached the building manager when they noticed their symptoms seemed somewhat correlated with rain events. Ceiling leaks were commonplace in the office, and the carpet and ceiling tiles were regularly saturated. The building manager took short-term actions to cleanup the water damage, and reportedly contacted a department faculty member, identified as the contact for EHS, to tell him of the staff's situation. After reviewing the situation, EHS told the staff members that the study did not find unusually high levels of mold present, and that the levels in their office were insignificant compared to levels found in other offices around campus.

Despite several recent changes to their office environment, their symptoms have not dissipated. EHS apparently has not followed up with the staff members, and some of the staff have become disheartened by the University's perceived lack of attention to the problem in their office. The staff feel that the air recirculation system in the building, the poor construction and insulation of the walls, and the leaky window walls contribute to an environment that promotes mold growth.

The staff were unaware of the resources available to them on the EHS website and had not been administered the "Occupant Interview Form"[69] or notified of the "Occupant Diary Form"[70] by EHS. There was some additional uncertainty as to the efficacy of the faculty member or the building manager contacting EHS to report ongoing problems. The staff members had not independently contacted EHS. Some staff believe that a more detailed study on the IAQ of their office should be conducted, in the hopes that a problem would be detected and legitimized. They also thought that an informational sheet about mold and the appropriate contacts would be helpful, however, they were skeptical that other staff or faculty would attend a training session "if nothing will be done (about the problem) anyways". They implied that faculty and staff knowledge of mold is constrained by the perceived unwillingness of the University to permanently fix the mold-growth conditions in their workplace. The staff have resigned to living in discomfort in their office environment and continue to pay medical bills and miss workdays because of their persistent symptoms.

[69] IU Office of Environmental, Health, and Safety Management, *Occupant Interview Form* [on-line]; available from http://www.epa.gov/iaq/largebldgs/graphics/occint.pdf; Internet; accessed 8 April 2005.
[70] IU Office of Environmental, Health, and Safety Management, *Occupant Diary Form* [on-line]; available from http://www.epa.gov/iaq/largebldgs/graphics/occdiary.pdf; Internet; accessed 8 April 2005.

**CASE STUDY #2**

On the east side of Jordan Hall, which is considered the older section of the building, a female IUB employee regularly suffers from allergies to perfumes, some animals, and suspects allergies to molds as well. It is in this section of the building where her symptoms are the worst. Her symptoms include sneezing, watery and burning eyes, coughing, sinus problems and daily headaches. She additionally suffers from asthma and regularly takes prescription medication for her allergies.

The interviewee explained that several years ago, the older section of Jordan Hall experienced a large-scale flood over a holiday break. She reported that the entire east side of building was under several inches of water. Consequently, the drywall and ceiling tiles became water damaged. To rectify the water damage problem, she stated that EHS responded by removing and replacing the bottom portion of the wallboard in some of the affected areas. However, she claims that EHS glued the old wallpaper back down instead of replacing it. In an affected lab, employees were able to convince the building supervisors to install air register filters to catch a black precipitate that was blowing out of the vents and causing contamination problems in their cultures. Unfortunately, the filters were not properly sized and the contamination persisted. The employee was additionally concerned when supervisors justified not changing the filters by asserting "the more stuff trapped in them, the better filter they will be". The employee is especially concerned about the plans to join the science buildings by a tunnel because of the air and moisture that will pass between them.

The interviewee stated that when she has reported problems in the past, she had been given materials on how to process complaints and requests. In addition to taking samples of the black precipitate at the air registers, she feels that a number of additional things could be done to create a more healthy work environment. Such activities could include regularly changing or cleaning the building's primary filters and condensation pans; regularly cleaning the ductwork; properly installing or repair of leaky ductwork, and; installing mold-resistant ceiling tiles.

She believes that the University should be proactive, rather than reactive, in combating mold problems on campus. She feels that the University has not made a sufficient effort to keep faculty and staff informed of building-related mold concerns. This IUB employee's experience with mold is similar to the others in that she sees a need for increased attention to the issue.

**CASE STUDY #3**

Similar to the employee's experience in Case Study #2, Dr. José Bonner, IU Professor of Biology, first linked his allergy-like symptoms to mold after a flood in Jordan Hall. His symptoms began with constant exhaustion and throat-clearing, and progressed to the point that he is now unable to enter some buildings on campus because of the severity of his symptoms. Indoor air in mold-affected buildings or near compost piles exacerbates Dr. Bonner's symptoms; when distanced from such conditions, his symptoms gradually lessen. His sensitivity to exposure has increased over time.

In addition to the flooding incident mentioned above, Dr. Bonner notes that most IU air-handling systems induce his symptoms to some degree. This, he explains, is simply a function of the building materials used in air-conditioned, modern buildings. Many air-conditioning systems at IUB use un-insulated re-heat coils that condense atmospheric moisture. This condensate consequently drips onto cellulose-based ceiling tiles or paper-backed gypsum wallboard. The resulting conditions are excellent for mold growth.

When asked about the University's response to his problems, Dr. Bonner reports that the University responds to his air quality reports in a timely, state-of-the-art fashion in terms of monitoring and remediation work. He maintains that unfortunately, people who have become "hypersensitive" to IAQ concerns are generally thought not to be representative of the population overall. Dr. Bonner feels that the building industry tends to ignore the experiences and healthy work environment needs of hypersensitive individuals.

Dr. Bonner was absent the second half of each of two semesters because he was either incapacitated by his symptoms and awaiting sinus surgery, or recovering from visits to the emergency room. During these absences, the University had to find alternates professors to teach his courses. This lost productivity cost is further considered in Section VI. Because of his health concerns, Dr. Bonner has been unable to continue work in his laboratory or Jordan Hall. He avoids the building as much as possible and now works mostly from home where his symptoms are not as extreme.

**CASE STUDY #4**

The interviewee (who wishes to remain anonymous) has been working at the School of Public and Environmental Affairs (SPEA) for the past several years and has been experiencing allergic reactions to mold for the duration of this time. The interviewee was tested and formally diagnosed with mold allergies and asthma approximately one year ago. An ear, nose, and throat specialist and an immunologist concurred on the diagnosis. The interviewee's symptoms include headaches, stuffiness, constant sinus pressure, migraines, burning sinuses, and eye irritation.

The interviewee began to associate the symptoms with mold, in part because the employee in the position prior to him/her had experienced the same symptoms. Additionally, mold was found on the wall behind the employee's desk and on the ceiling tiles in the office. Water leaks had occurred in the building's hallways, which resulted from the outside sprinklers (which are no longer in use). The interviewee stated that her/his symptoms are worse when s/he is in SPEA.

Several years ago, the interviewee, along with five other SPEA staff, contacted EHS about mold and related health problems. Physical Plant staff responded the next day and replaced the moldy ceiling tiles. The interviewee reported that EHS did not request that s/he and the other SPEA staff fill out a complaint form. Since the interviewee's first request, s/he has had to file IAQ and mold complaints multiple times. For example, dust and particles were seen blowing out of the air vent in his/her office. This issue was brought to the attention of Chad Sweatman, the building manager, who vacuumed out the air vents. The interviewee received an air cleaning system for his/her office area, and was made responsible for replacing its filters.

While the response that the interviewee received was prompt, s/he feels that the attitude concerning his/her chronic symptoms is that "allergies are your own problem." The interviewee does not feel that the ultimate response was adequate because s/he, along with many other people in the building, is still experiencing severe allergic reactions to mold. Although the interviewee thought it would be helpful to have mold training, for faculty and staff, it is the primary recommendation of the interviewee that there be an outside organization, one not connected with the University, to address these issues.

The interviewee's reactions to mold have greatly affected his/her productivity at the University. S/he has already missed over ten days since the beginning of the 2004-2005 school year. Additionally, mold allergies have severely affected the employee's family on a regular basis. Costs for medical visits, antibiotics, and treatments such as acupuncture, have taken a financial toll on the employee's out-of-pocket health care expenses. The interviewee's mold-related concerns now not only encompass health issues, but financial and job-related issues as well.

**CASE STUDY #5**

Kim Shipley is an administrative staff member who works in the School of Public and Environmental Affairs (SPEA). Ms. Shipley began to notice allergy and asthma-like symptoms three years ago, about a year after she began working at SPEA. She did not experience allergy or asthma symptoms prior to her employment at SPEA. Her symptoms include asthma, sneezing, runny nose, eye irritation, and chronic sinus drainage. She has been diagnosed with allergies to mold through skin tests, and she is allergic to some foods, dust, grass, and some animals.

After associating her symptoms as allergic reactions to mold, two years ago Ms. Shipley, along with other SPEA faculty and staff, contacted EHS about the problem of mold and indoor air quality. She reported numerous water leaks around SPEA, especially near the windows and staircases, and she noted that the faculty and staff lounge specifically smells of mildew. It is also important to note that EHS did not request or require Ms. Shipley to fill out any forms to document her complaint or request for inspection. EHS responded by testing the indoor air quality. However, EHS reported that the results of the tests indicated that that air quality was within building standards. Nevertheless, Ms. Shipley has continued to experience allergy and asthmatic symptoms on a daily basis, which tend to worsen throughout the workday. Similar to the other case study interviewees, her symptoms tend to subside once she leaves the building.

# IV. Administrative Hierarchy and Process at Indiana University

As discussed, mold affects not only the health and well being of faculty, staff, and students, but also severely impairs the building integrity of University structures. The widespread implications of mold require numerous administrative departments' involvement in mold policy and remediation. The Physical Plant, in addition to the Office of Environmental Health and Safety and Building Managers/Representatives, is one of the most active departments involved with mold issues and therefore, it is important to remember the Physical Plant's unique relationship with both the Chancellor's Office and the Office of the Vice President and Chief Administrative Officer.

## IV.A. Description of Relevant Offices

Provided below is a description of the administrative roles and responsibilities of offices whose decisions impact mold policies and administrative procedures at IUB. This description includes: 1) the Chancellor's Office, and two offices reporting to the Chancellor, the Office of Space Management and Residential Programs and Services; and 2) the Vice President/Chief Administrative Office, and three departments reporting to the Vice President, Environmental Health and Safety, Risk Management, and Physical Plant.

### *IV.A.1. Chancellor's Office*

The Chancellor's Office is responsible for the administration of IUB expenses and revenues, totaling roughly $616 million in FY 2004-05. Of this budget, roughly one-third was revenue appropriated by the Indiana General Assembly. The remainder was raised through student fees generated by each academic unit[71] (see Appendix D, Table 1).

Vice Chancellor for Budgetary Affairs, Neil Theobald, is responsible for IUB financial planning and budget administration. He is supported by Associate Vice Chancellor, James Donges. Vice Chancellor Theobald was interviewed and provided a tour of campus buildings in order to assist this class in its information gathering. Associate Vice Chancellor, Jim Donges, provided our class with IUB budgetary information. Vice Chancellor Theobald chairs the Budgetary Affairs committee, which plays a major role in determining priorities and recommending budget allocations. Along with other budget and finance committees, the Budgetary Affairs Committee works with campus leadership to achieve agreed upon goals.[72] An additionally important Chancellor's Office finance committee is the Capital Priorities Committee; this committee sets the IUB's priorities for capital improvement projects and makes recommendations to the Budgetary Affairs Committee. Robert Kravchuk, Ph.D., faculty member of the Budgetary Affairs Committee and Capital Affairs Committee, was additionally interviewed in regard to these committees' roles. The implications of budgetary decision-making for mold growth on campus are more thoroughly discussed in Section V, Financial Analysis.

[71] Interview with Mr. Neil Theobald, Vice Chancellor for Budgetary Affairs, on 22 February 2005.
[72] Office of the Chancellor, Indiana University Bloomington, *Budget Goals for the Coming Year*, Sept. 30, 2004 [on-line]; available from http://www.iub-chancellor.indiana.edu/speeches/bfc2004.shtml; Internet; accessed 30 March 2005.

### *IV.A.1.i. Office of Space Management*

The Office of Space Management assists academic and administrative departments with their space, remodeling, and renovation needs in order to support the academic mission of the IU Bloomington campus. In addition, this office oversees the IU Warehouse and Mail Services Department. The Office of Space Management is staffed by two professional staff, the Director, and the Associate Director. The IUB Campus general fund supports this Office's budget, with the exception of a portion of the Associate Director's salary, which is supported by the IU warehouse account.

Effective response to academic and administrative units' remodeling and renovation needs is an important aspect of mold prevention, and at times, mold remediation. Coordinating this response is a primary function of the Office of Space Management. The academic and administrative units' remodeling needs range from simple to complex.

The Office of Space Management represents academic and administrative units in remodeling activities and insures that space change and use resulting from remodeling projects adheres to the "campus master plan". In order to effectively accomplish this task, the office receives units' remodeling and renovation requests, consults with users, determines priorities, oversees cost estimates, and identifies funding sources. This office additionally coordinates University Architect and Physical Plant project activities, while serving as a liaison to the administrative or academic units. The Office of Space Management often serves as a financial intermediary and administrator for remodeling and renovation projects.

### *IV.A.1.ii. Residential Programs and Services (RPS)*

Vice Chancellor for Auxiliary Services, Bruce Jacobs is responsible for auxiliary service units, including RPS. Patrick Conner is the executive director of the Residential Programs and Services (RPS) department. RPS employs about 150 professional staff, excluding custodians and other staff. Residential Programs and Services (RPS) is responsible for housing approximately 11,500 students in its eleven residential centers, not including its single-student and traditional apartment housing complexes. Each facility has its own unique design and setup making them attractive to meeting student needs.

The residence halls and on-campus apartments are strategically arranged into four geographic locations, called Neighborhoods. Because each hall and apartment complex is designed differently (i.e., numbers, floors, buildings), each has their own unique facility concerns. In addition, RPS is responsible for all dining services and custodial staff. The mission of RPS is to bring the academic life of the University into the student's living environment by providing a residential experience which best meets the educational and developmental goals of our residents outside the classroom, enabling them to succeed inside the classroom.[73] RPS believes that their buildings are the students' homes, so if students are concerned about building issues, RPS attempts to mitigate those problems or concerns immediately. The Residential Operations staff track all work orders to be sure they have been completed. In addition, Residence Managers perform monthly audits to ensure work requests are completed and charged properly.[74]

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[73] Residential Program Services, Indiana University, Bloomington [on-line]; available from http://www.rps.indiana.edu/default.htm; Internet; accessed 29 March 2005.

[74] Interview with Mr. Larry Isom, RPS Facilities Management Director.

During the information gathering process, Steve Akers, Associate Director of Environmental Operations / Design, was formally interviewed in regards to water and mold related issues within RPS. Steve Akers oversees all custodial operations in the single housing centers.[75] Environmental Operations has an average of 10-15 staff (i.e. custodians) per center and all are trained in proper cleaning procedures by EHS. The staff is responsible for the cleaning of all center areas. The average size of IUB residence halls is approximately 600 rooms, accommodating about 1000 residents.[76] Custodians at residence halls are trained in proper cleaning procedures by EHS.

According to Larry Isom, Facilities Management Director, each residence hall has one person responsible for all local maintenance within the center. Larger maintenance tasks are performed by outside skilled laborers (e.g. Physical Plant staff). In addition, a sole RPS technician is responsible for the inspection and replacement of all filters in the dorms two to three times per year. Old filters can accumulate dust and become a source for mold growth.

Currently mold issues are not a major concern within RPS. It was estimated that less than 1% of the department's budget is associated with mold-related problems.[77] However, Larry Isom and Steve Akers have stated that mold-related problems experienced by RPS are related to air ventilation systems or the lack of air ventilation. All the dormitories are linked to, or retrofitted to, the Energy Management System[78] which reduces the likelihood of moisture problems. However, the EMS is sometimes combated by those individuals who promote conditions suitable for mold growth. For instance, students may promote mold growth by inadvertently leaving the A/C on a low temperature during long spans of absence, thus, creating a condensation affect along aluminum window seals. The condensate along the window is a prime location for mold growth.

Most recently, a center experienced minor mold problems in rooms when cool room air mixed with more humid hallway air. As a result, mold was found growing around nearby window frames. By ensuring that hallway ventilation systems operate at all times, problems such as these can be mitigated.[79]

Another source of information was a class presentation by John Bruce, RPS Health and Safety Manager, during which he explained his job function and what mold related issues are common in his field of work at IUB.[80] Mr. Bruce is involved in all mold related problems, which entail addressing proper clean up and solutions. Mr. Bruce also currently provides all of the health and safety training for RPS employees, who include, but are not limited to residence managers, residence assistants, and student leaders that deal with cleaning.

The major source of mold, Mr. Bruce explained, is from moisture, which may be a result of roof leaks and plumbing leaks; the former being the most prevalent. In addition, dead air or poor ventilation is another factor that creates a suitable environment for mold growth. Mr. Bruce also mentioned that fixing roof leaks expediently is a high priority and the most cost-effective way to prevent further mold growth and damage to buildings. An example of a key location for mold growth would be high storage areas in dorms, damp ceiling tiles and drywall, and in and around window seals. Ceiling tiles are a recurring problem because they are composed of

[75] Interview with Mr. Steve Akers, RPS Associate Director of Environmental Operations/Design.
[76] Interview with Isom.
[77] Interview with Akers.
[78] See *infra*, IV.B.3.iv.
[79] Interview with Isom.
[80] Presentation by Mr. John Bruce, Health and Safety Manager, RPS, on 1 February 2005.

cellulose, which is a primary nutrient utilized by mold to support growth. Also the ceiling tiles are almost always being saturated with water form leaking pipes. Note that mold on porous materials (e.g. ceiling tiles, drywall) cannot be remediated; instead, those materials must be removed and replaced.

### *IV.A.2. Office of the Vice President and Chief Administrative Officer*

The Office of the Vice President and Chief Administrative Officer works to advance and support academic excellence throughout the entire Indiana University System by providing quality services through leadership and stewardship to the University community.[81] The Office of the Vice President and Chief Administrative Officer oversees all six IU campuses, but has a unique relationship with the IUB campus. Unlike any of the other IU campuses, the Office of the Vice President and Chief Administrative Officer administers services to the IUB campus, in addition to its general oversight function.[82]

### *IV.A.2.i. University Office of Environmental, Health, and Safety Management (EHS)*

Mr. Dan Derheimer is the Environmental Manager at EHS, and among other responsibilities, he is in charge of Indoor Air Quality (IAQ) at IUB. Mr. Derheimer reports to Ted Alexander, the University Environmental Health and Safety Department Director. This department then reports to Vice President and Chief Administrative Officer, Mr. Terry Clapacs. (see Appendix B, Chart 4)

The mission of EHS is to augment the University academic mission by promoting and supporting a safe and healthy workplace and natural environment for Indiana University.[83] The goals of the IAQ program are *i*) to diagnose problems and solve them as efficiently and quickly as possible and *ii*) to prevent future problems by maintaining systems properly.[84] The main work done at EHS is investigative; no remediation work is involved. EHS recommends the level of remediation necessary to the Physical Plant or outside contractors.

There is a lack of information for the Indoor Air Quality budget and expenditures at Department of Environmental Health and Safety Management (EHS). According to an interview conducted with Mr. Derheimer, it is costly and inefficient to do periodic air quality sampling to detect mold. Mr. Derheimer reported that he has observed Physical Plant's decreased ability to maintain buildings, particularly air handling systems. This makes it difficult to proactively prevent mold issues on campus. He attributes this lack of maintenance to lack of state appropriated R & R funding.[85]

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[81] The Office of the Vice President and Chief Administrative Officer, *Mission Statement* [on-line]; available from http://www.indiana.edu/~vpa/html/vp___cao_mission_statement.html; Internet; accessed 23 April 2005.
[82] Presentation by Dr. Edwardo Rhodes, Interim Associate Vice President for Student Development and Diversity and Professor of Public and Environmental Affairs at SPEA, on 20 January 2005.
[83] Indiana University Office of Environmental Health and Safety Management, *Mission Statement* [on-line]; available from http://www.ehs.indiana.edu/missionstatement.html; Internet; accessed 24 April 2005.
[84] Indiana University Office of Environmental Health and Safety Management, *Indoor Air Quality at IU-Bloomington* [on-line]; available from http://www.ehs.indiana.edu/indoor_air.html; Internet; accessed 24 April 2005.
[85] Interview with Mr. Dan Derheimer, Environmental Manager, Office of Environmental Health and Safety Management, on 10 February 2005.

### *IV.A.2.iii. Office of Risk Management*

Mr. Larry Stephens is the Director of the Office of Risk Management, which employs about 25 staff members, whose primary responsibilities include investigating and addressing insurance claims. This department reports to the Vice President and Chief Administrative Officer, Mr. Clapacs. Its operating budget is allocated by the IU President's Office.

The Office of Risk Management is responsible for purchasing Indiana University's insurance (self-insurance fund), excluding life and health insurance.[86] This office is also responsible for loss prevention and loss control, related safety, emergency disaster planning, and adjustment of all related claims. The following classify as related claims: property and liability claims, workers compensation, auto claims, etc. Loss prevention is defined as preventing a loss before it actually happens. An example of a loss prevention measure would be proper health and sanitary conditions in and around the food facilities. On the other hand, loss control is the ability to control the amount of loss which occurs from a given situation. For example, designing and building roofs with longer life spans may prevent water damage related losses.

### *IV.A.3. Physical Plant*

"The mission of the IUB Physical Plant is to operate and maintain a high-quality physical environment to enhance student learning, faculty teaching and research. [They] serve other non-academic departments, and [they] support the University's service to the community and citizens of Indiana."[87] The Physical Plant strives to create the most productive and pleasant working environment and maintains the quality of the working spaces on campus. Mr. Hank Hewetson, the Director of the Physical Plant, works extremely hard to achieve the mission and goals of the Physical Plant and to provide the best quality service.[88]

The Physical Plant provides numerous behind-the-scenes services to the University, including[89]:

Classroom and office lighting maintenance
Trash pickup
Outdoor lighting maintenance
Office furniture rearrangement and transfer
Sign fabrication and installation
Restroom plumbing maintenance*
Carpet care*
Hard floor care
Leaf removal*
Room temperature controls adjustment*
Roof repair and maintenance*
Snow removal from walks and parking lots
Swimming pool maintenance*
Building door-lock and window repair*
Pest control
Window washing
Routine custodial care*
Flower bed planting

[86] Office of Risk Management, Indiana University [on-line]; available from http://www.indiana.edu/~riskmgmt; Internet; accessed 24 April 2005.
[87] The Department of Physical Plant, Indiana University, Bloomington [on-line]; available from http://www.indiana.edu/~phyplant/html; Internet; accessed 23 April 2005.
[88] Most of the information pertaining to the Physical Plant was obtained from Mr. Hank Hewetson's class presentation on 8 February 2005, a follow-up interview with Mr. Hewetson on 24 February 2005, and through email correspondence.
[89] Department of Physical Plant, *Examples of Services We Provide* [on-line]; available from http://www.indiana.edu/~phyplant/html/body_examples_of_services.html; Internet; accessed 23 April 2005.

Tree trimming
Street sweeping
Lecture room PA system maintenance
Sidewalk maintenance and construction
Fire alarm and maintenance

* Indicates services that may implicate mold issues

Some of the Physical Plant's main responsibilities are maintenance, repair and minor renovation of buildings and facilities; grounds care; utility distribution (water, heat, electricity, etc.); and custodial care.[90]

The Physical Plant has approximately 750 full-time clerical, technical, service, and administrative employees. The custodial staff in the Building Services Division maintains nearly seven million square feet of space, the craft-workers service more than 250 buildings, the utilities staff maintains more than 180 miles of utility distribution systems, and the staff in the Campus Division is responsible for nearly 2000 acres of IUB landscaping, lawns, sidewalks, parking lots, and streets.

The Physical Plant is housed in sixteen different buildings and has six Campus Division zones and six Building Maintenance zones located throughout the campus.[91] Each of the work zones operates fairly autonomously and does not interact or discuss problems specific to each zone very often.

### *IV.A.3.i. Physical Plant Budget*

The Physical Plant General Fund is used primarily for maintenance and the general upkeep of existing non-auxiliary facilities, which includes cleaning and maintenance of academic buildings, campus grounds keeping and landscaping, facility operation, exterior campus lighting and all utility distribution systems except telephone and data. The Physical Plant is responsible for financing the upkeep and maintenance of building services, including: building structures and envelopes (e.g. permanent walls, roofs, floors, ceilings, windows); basic daily cleaning (e.g. public areas); weekly cleaning (e.g. private offices); bi-annual and annual cleaning; HVAC systems; plumbing; and building-wide distribution systems in support of research labs in addition to others.

Individual departments are responsible for funding major renovation and remodeling project completed by the Physical Plant. This type of work is not covered under the Physical Plant's general budget and "are funded through charge-backs to departmental accounts, based on hourly labor rates, for non-academic facility maintenance and other services." Some examples of services billed to departmental account numbers include: departmental equipment (i.e. installation, modification, replacement or maintenance of furnishings and equipment which purpose is to serve a specific office) and renovation (e.g. architectural, mechanical, and electrical systems; abatement) (see Appendix E, Physical Plant Funding Responsibilities, Indiana University, Bloomington).

The Chancellor's Office controls the Physical Plant's budget; in FY 2004 it was allocated approximately $52 million, 5.6% of IUB's total operating expenses. The Physical Plant's

[90] Department of Physical Plant, *About Physical Plant* [on-line]; available from http://www.indiana.edu/~phyplant/html/body_about_physical_plant.html; Internet; accessed 23 April 2005.
[91] Department of Physical Plant, *About Physical Plant* [on-line]; available from http://www.indiana.edu/~phyplant/html/body_about_physical_plant.html; Internet; accessed 23 April 2005.

expenditures include approximately $21 million for utilities and purchased fuel, $9 million for cleaning, $8 million for maintenance, $4 million for utility operations, and $2.4 million for ground care[92] (see Appendix E, Table 1). In the past, Physical Plant received additional funding from state Repair and Rehabilitation (R & R), but in FY 2003, IUB received less than 1% of expected R & R and in FY 2004, IUB received 0% of the expected R & R (see Appendix E, Table 2).

The Campus Care Program provided the Physical Plant with approximately $750,000 additional funding this year, which is a separate source of funding that goes into the Physical Plant's base budget. About $250,000 of this funding was earmarked for custodial work and the remainder is allocated to painting offices and classrooms. The Campus Care Program funding is not used to fund projects no longer receiving state R & R funding, but instead is targeted at projects such as classroom work. [93]

### *IV.A.3.ii. Physical Plant Training*

New Physical Plant employees must attend an orientation that covers all regulatory requirements, but nothing in this training addresses mold identification or associated health problems. They do receive some remediation training that is catered toward emphasizing that mold can not just be bleached, but that other adequate remediation steps must be taken. In general, however, the training is primarily focused on knowing whom to contact for different problems and for protective personal equipment.

### *IV.A.3.iii. Physical Plant Mold Protocols*

When the Physical Plant began addressing mold growth, the generally accepted procedure was to scrape up the mold, wipe down the surface, and repaint the area with three times the amount of fungicidal paint. The Physical Plant, as well as other departments, has learned over the years through trial and error how to best attack mold problems. Although there are no strictly enforced mold procedures similar to those followed for asbestos clean up, there exists more loosely followed "best practices" for mold remediation.[94] Extremely large mold problems, extremely large water problems, or those problems that are much more detrimental to a person's health are contracted out to an abatement team.

The Physical Plant encounters mold in the air handling units throughout the University. Older air handling units were insulated with organic matter, which encouraged mold growth throughout the unit. These air handling units have been replaced with double panel stainless steel air handling units, which are much less susceptible to mold growth, in approximately four to six new buildings, but most buildings still contain the old systems. The large air handling units are thoroughly cleaned about once a year during routine maintenance check-ups for motors, belts, etc. The air filters are changed twice a year and are checked quarterly.[95]

[92] Interview with Mr. Hank Hewetson, Director of Physical Plant, at Physical Plant, on 24 February 2005.
[93] Interview with Hewetson, 24 February 2005.
[94] Presentation by Hewetson, 8 February 2005.
[95] Interview with Hewetson, 24 February 2005.

### *IV.A.3.iii. Working Relationships with Other Offices*

As explained by Mr. Hewetson, the Physical Plant will interact on a day-to-day basis with the Office of Environmental Health and Safety, the Architect's Office, Building Managers, and the Chancellor's Office. Mr. Hewetson meets with a representative from EHS, Risk Management, and the Deputy Vice President from Terry Clapac's office every other week to discuss general problems.[96]

**Office of Environmental Health and Safety**: Many of the Physical Plant's responsibilities are fulfilled during the course of maintenance and therefore are not typically reported to the Office of Environmental Health and Safety. If the cause of mold is identifiable, then Physical Plant staff will remediate it without notifying EHS. If someone complains about flu-like symptoms then Mr. Derheimer, the Director of Indoor Air Quality at EHS, will become involved in the remediation process. The Physical Plant and EHS have a very good working relationship and are willing to take each other's recommendations into consideration when determining the best course of action to remediate the problem.

**Architect's Office**: Mr. Hewetson works with Mr. Meadows, the IU Architect, to develop building standards that are designed to reduce recurring maintenance repairs. Compromises exist within many architectural designs, but initial design decisions can significantly impact the prevalence of mold growth in a building. Mr. Hewetson discovered that mold growth frequently occurred in the organic matter contained in air handling units and worked with the IU Architects to determine how best to address this problem. It is now a building standard that double panel stainless steel air handling units are installed in all new buildings. These new air handling units have proven to be less conducive to mold growth and indicate how problem solving strategies can be developed between different departments working together. The Physical Plant is working to better understand design implications and make recommendations to the Architect's Office for specific materials or design decisions (e.g. decreasing the amount of bends in air handling units to decrease mold growth).

**Building Managers**: The Physical Plant's relationship with building managers and building representatives generally includes communication about maintenance and construction projects and procedures.[97] Building managers report water leaks, mold growth, maintenance requests, and other activities directly to the Physical Plant. It is important that these problems be reported to the Physical Plant in a timely fashion so that repairs and/or remediation can begin as soon as practicable. The building managers provide a vital link because they have the responsibility for reporting any mold problems to the Physical Plant.

### *IV.A.3.v. Remediation*

Mr. Hewetson estimates that about 61% of the current buildings on campus need some sort of building repair or renovation (see Appendix E, Table 3). There is a continuum of severity for mold problems and this requires the Physical Plant to have a number of different response tactics. If mold growth is located in a small and confined area then the Physical Plant may simply clean the area by washing with detergent or they may choose to cut out a section of the building material (e.g. drywall, ceiling tiles, carpet, insulation, etc.) that contains mold and replace it. The Physical Plant must respond within forty-eight hours of a water leak to ensure the

[96] Presentation by Hewetson, 8 February 2005; Interview with Hewetson, 24 February 2005.
[97] E-mail correspondence with Mr. Bruce Williams, Service Center Manager, Physical Plant, April 2005.

prevention of mold growth. Many of the Physical Plant's remediation actions also entail patching roof leaks, sealing leaking windows or pipes, and cleaning out air handling units and vents.

If severe mold problems implicate health issues, an abatement team or a contractor may be called upon to address the situation. Currently, IU has an asbestos abatement group that has been trained on the proper health precautions and removal processes and may be called upon for extremely contaminated mold projects. In another instance, a pipe burst, an area became completely flooded, and the University decided to call in an outside contractor to assess and mitigate the problem.

Historical buildings and new architectural design innovations pose a unique dilemma for Physical Plant remediation and renovation work. Historical buildings are governed by regulations that dictate the types of renovation work that can be performed. The Physical Plant is limited regarding the types of systems they can install because of these strict standards. New building designs pose difficulties for the Physical Plant because no precedent exists to illuminate what types of problems could potentially occur. Newer buildings are very different from traditional buildings on campus, and it therefore requires additional time to understand the implications and potential problems associated with these buildings. For example, there are more steel frame buildings being constructed on campus while the Physical Plant does not have any: ultimately, it is a learning process.[98]

### *IV.A.3.vi. Preventative Maintenance*

The Physical Plant is working hard to develop more preventative maintenance strategies to address mold. The most visible improvement is with the new building standards for air handling units.[99] They are also working to specify air handling units that are more serviceable, which will result in earlier detection of water leak and mold accumulation. In addition, the Physical Plant is experimenting with a black-light system in one air handling unit in an attempt to cut down on the amount of dirt that accumulates and in return spawns mold growth. Mr. Hewetson believes that the new air handling units contain significant improvements for the control of mold growth, temperature, and humidity.[100]

The building automation system for heating and cooling also works to prevent moisture build up problems. Mr. Hewetson believes that the building automation system for heating and cooling is very effective and reliable. The Energy Management System (EMS) is a regulating system that monitors and controls all heating and cooling systems in order to use energy more efficiently and to monitor proper temperature and humidity. Large buildings communicate continuously with the system, and the staff operating the system can identify the temperature and humidity at a specific zone level supplied. This system is in excellent working condition and is well run by a very knowledgeable staff. They are quick to respond to situations that involve high humidity levels and are able to help prevent mold growth. Although the temperature of buildings and rooms is well managed, there have been some malfunctions which resulted in increased humidity levels. Mr. Hewetson is of the opinion that the heating and cooling system does not

[98] Presentation by Hewetson, 8 February 2005; Interview with Hewetson, 24 February 2005.
[99] See *supra*, Section IV.B.3.iii Architect's Office.
[100] Presentation by Hewetson, 8 February 2005.

cause a large number of mold problems, but that mold growth is created primarily as a response to other factors. [101]

Although the Physical Plant is working to practice more preventative maintenance procedures, the focus has not yet been on the prevention of future mold problems when fixing small projects.[102] For large renovation projects, on the other hand, the Physical Plant has a greater tendency to address mold-growth conditions and preventative maintenance.

## IV.B. Initial Mold Complaint and Response Protocol

Mold related complaints can be filed in four different ways at IUB, which has the potential to cause ineffective response actions. Individuals can contact the Physical Plant directly for water leaks and general maintenance repairs and cleaning. After approval by numerous administrative offices, the Physical Plant also responds to academic and non-academic departments' service requests for large-scale renovation and remodeling projects.

Mold complaints may also be submitted directly to EHS. The Office of Environment, Health and Safety Management typically receives mold complaints from faculty of staff experiencing health effects they believe to be associated with their building environment. Building managers may also receive mold complaints from faculty and staff that they then forward to the Physical Plant. Lastly, students, residence hall staff, or RPS maintenance staff can file mold complaints directly to Residential Programs Services. Although these individual departments attempt to work together on mold related projects, in general each department addresses mold complaints autonomously, causing a breakdown in effective mold response actions.

### *IV.B.1. Physical Plant*

A discussion with Mr. Bill Haines, the Physical Plant's Manager of Building Maintenance, revealed that procedures to remediate mold are as follows: if "smaller" cases of mold are identified, the Physical Plant staff are to utilize the guidelines established by New York City Health Department to remediate the area. If "larger" cases of mold are identified, maintenance staff is advised to contact EHS to either remediate the problem or secure a contractor for the remediation work. However, it is apparent that compliance with these guidelines and procedures is difficult to monitor or ensure.[103]

The Physical Plant typically becomes involved in mold remediation or response actions through either in-house maintenance service requests or academic/non-academic departmental service requests for renovation and remodeling projects (see Appendix F, Request for Service Form). The Physical Plant receives service requests from building managers and representatives, typically for services such as remodeling, moving and set-ups, special event services, department equipment repair, laboratory equipment repair, key and lock changes, and fabrication or installation of special items. The Physical Plant recommends that such routine services be conveyed to Building Representatives/Managers, the liaison between the department(s) and

[101] Presentation by Hewetson, 8 February 2005; Interview with Hewetson, 24 February 2005.
[102] Presentation by Hewetson, 8 February 2005.
[103] Interview with Mr. Bill Haines, Manager of Building Maintenance, IUB Physical Plant, 1 April 2005; See Figure 1. IAQ Flowchart below.

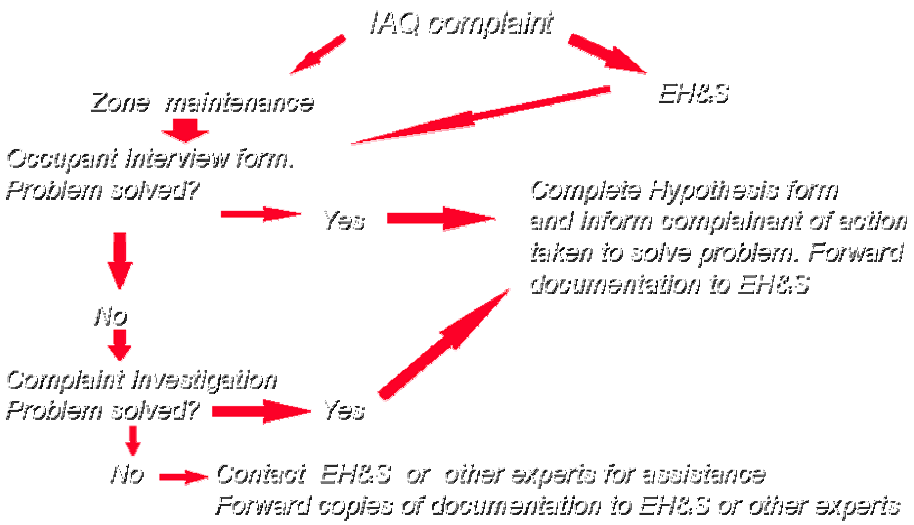
Physical Plant.[104] The Physical Plant responds to and funds these maintenance-specific and general service requests.

Mr. Hewetson also receives service requests from the Architect's Office, detailing major renovation and remodeling projects for specific departments. Each department is responsible for initiating a service request and obtaining approval from the Campus Administrative Officer in the Chancellor's Office. Once the Chancellor's Office approves the project, it is forwarded to the Vice President and Chief Administrative Officer. Finally, after it has been approved by the Vice President and Chief Administrative Officer, the service request is assigned a project number and sent to the Architect's Office. The Architect's Office details the renovation and remodeling work to be completed by the Physical Plant.[105] These projects are fully funded by the individual department requesting the service.

### *IV.B.2. EHS*

EHS addresses mold issues based on complaints primarily from the faculty and staff. Consequently, issues are investigated only when there are indoor air quality complaints. When the complaint is made, based on the occupant interview form, EHS inquires about the person's symptoms and the correlation of symptoms to the amount of time spent in a building (see Appendix F, Occupant Interview Form).[106] The process for addressing mold complaints is shown in Figure 1. EHS attempts to take action to remediate the problem in a timely manner. When significant capital expenditures are needed, the problem will be prioritized by its risk and remediated as funds become available. Risk is based on the number of people reporting complaints and the severity of their symptoms.

**Figure 1. IAQ Flow Chart**




[104]Department of Physical Plant, *How to Request Service* [on-line]; available from http://www.indiana.edu/~phyplant/html/body_how_to_request_services.html; Internet; accessed 23 April 2005.
[105]E-mail correspondence with Mr. Tom Swafford, Director of Space Management, Chancellor's Office, 19 April 2005.
[106] U.S. Environmental Protection Agency, *Occupant Interview Form* [on-line]; Internet; available from http://www.epa.gov/iaq/largebldgs/graphics/occint.pdf; Internet; accessed 23 April 24, 2005.

Once the complaint reaches EHS and is verified to be a health issue, an EHS staff person will check for mold by conducting air sampling in the building. If mold is found, the Physical Plant will be contacted and asked to investigate the HVAC system of the building. After the investigation, EHS proposes options for remediation. The Physical Plant normally accepts the proposed remediation strategies suggested, but ultimately it is the Physical Plant's decision as to how to address the situation.

### *IV.B.3. RPS*

The mold complaint process can be initiated in three distinct ways at RPS: (1) students can report the complaint to a resident assistant (RA), (2) the student can fill out a maintenance request form at the central desk in the hall or online via e-mail, or (3) the student or RA can bring the complaint to the attention of the custodial staff in the dorm. Visiting parents have also identified mold problems and reported them to the proper authority.

Once the mold complaint is reported, the problem is ameliorated in one of two ways depending on the scale of the mold problem. In-house RPS maintenance workers can remediate small-scale mold problems. RPS officials stated that the standard response to mold is for Environmental Operations staff to clean the mold surfaces with High-Efficiency Particulate Air (HEPA) filtered vacuums and cleaning chemicals to destroy the mold spores. For example, mold growth on aluminum window seals can be remediated using household cleaning products to eliminate the mold.

On the other hand, large-scale mold problems require the additional support of other departments at IUB, including the Physical Plant and EHS. The Office of Environment, Health, and Safety Management inspects the area to determine the cause of the mold and suggest solutions. During these procedures, residents are informed of the problem and are moved to other accommodations if necessary. For instance, mold growth on porous material or large-scale mold contamination caused by water damage requires assessment by Dan Derheimer for health-related consequences.

Following the EHS assessment, the Physical Plant can remediate the problem with its trained workers. While the trained workers are usually familiar with asbestos abatement, New York City and the Environmental Protection Agency (EPA) guidelines are used as a primary reference for mold remediation.[107] These include guidelines regarding the size of mold contamination and the use of personal protective equipment (PPE). Following remediation, RPS maintenance staff follows up to ensure the problem has been resolved. Monitoring inspections are regularly conducted during extended breaks. If a mold problem persists following remediation, an engineer from the IU engineering services department is called in to assess the situation and solve the problem by identifying the source of mold growth (e.g., source of moisture). The engineer is also responsible for inspecting any structural damage that may have occurred from excess water damage. Moisture can deteriorate construction materials to a point where the structural integrity of the building is compromised. If continued remediation attempts fail, a private contractor is called in to assess and solve the problem.

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[107] U.S. Environmental Protection Agency, *A Brief Guide to Mold, Moisture, and Your Home* [on-line]; available from http://www.epa.gov/iaq/molds/moldguide.html; Internet; accessed 2 February 2005; New York City Department of Health, *Guidelines on Assessment and Remediation of Fungi in Indoor Environments* [on-line]; http://www.lchd.org/environhealth/aq/pdfs/NYC%20DOH%20Guidelines.pdf; Internet; accessed 2 February 2005.

### *IV.B.4. Building Managers*

Mold can be reported by any person within academic or non-academic buildings. As noted above, when mold problems are encountered, the Physical Plant or EHS are notified. Occasionally, building managers will follow-up on maintenance-related problems. While building managers do not have any scheduled monitoring inspections, but will inspect from time to time.

Most academic and non-academic buildings lack mold-related protocols with the exception of a few buildings, such as Morrison Hall, which has established its own procedure for handling mold because of their archive storage.

In contrast to RPS, the other academic and non-academic buildings do not have their own environmental operations and maintenance units and therefore must depend on Physical Plant for maintenance and EHS for mold-prevention. Since these two departments operate with such autonomy, this segmented structure makes it very difficult to establish consistent and integrated mold-prevention guidelines for the IU-Bloomington campus.

# V. Financial Analysis

Resource commitment is essential to effective implementation of IUB policy and procedures to address and prevent mold on IUB campus. The following describes the key players impacted by revenue shortfalls traditionally relied upon to address the major repairs and renovations needed to prevent building deterioration and mold growth on campus. This section describes these key players' budget limitations, responses to this revenue shortfall, and the budgetary incentives which exist for current decision-making practices. When appropriate, alternate financing options are discussed.

## V.A. Repair and Rehabilitation Funding (R & R)

Indiana University has traditionally relied upon Repair and Rehabilitation (R & R) funding, appropriated by the Indiana General Assembly, as a significant source of revenue for remodeling and repair of buildings on its seven campuses. State Repair and Rehabilitation funding includes "Building R & R" and "Infrastructure R & R". Building R & R is determined using a formula which includes in part, the current age of buildings and square footage of space. Infrastructure R & R is determined based on 2% annual replacement cost value. R & R is appropriated by the Indiana General Assembly bi-annually and funding is allocated annually. The Indiana Commission for Higher Education is the agency responsible for making recommendations to the Indiana General Assembly for R & R funding appropriation levels. These recommendations are based on the condition, utilization, and value of physical facilities on campuses. This information is summarized in the Commission's "Facilities Inventory and Space Utilization Study.[108] According to Mr. Baumgarten, the IU Vice President's Department of Facilities maintains and provides this information to the Commission for Higher Education.[109]

R & R funding has not been provided to IU at levels expected in the past two biennium's (2001-2005). Table 7 "R & R Funding History" summarizes the history of R & R funding appropriated and allocated to Bloomington campus over the last decade (see Appendix G). Figure 1 in Appendix G, "IUB Repair and Rehabilitation Funding" demonstrates the trend of an increasing difference between the amounts of R & R due based on funding formulas and appropriated amounts. Since budgets years 1999-2001, R & R funding has declined precipitously. In the 2003-2005 period, R & R was appropriated at 25% of its expected level, but due to Governor O'Bannan-Kernan's "Deficit Management Plan" introduced in June 2003, the Bloomington Chancellor's office reports that only 0.34% of the R & R due to IUB (based on formula calculations) was actually received in FY 2003. No R & R funding has thus far been received for FY 2004.[110]

As a result of IU President Adam Herbert's budget request to the Indiana House Ways and Means Committee in January 2005, 2005-2007 R & R funding is optimistic. In a recent presentation by President Herbert, he listed "resumption of full funding for campus repair and

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[108] Indiana Commission for Higher Education, *Physical Facilities of Indiana Public Higher Education: Their Location, Value, Condition and Utilization, Fall2003* (May 3, 2004). Provided by Michael Baumgartner, Associate Commissioner for Facilities and Financial Affairs.

[109] Interview with Mr. Michael Baumgarten, Associate Commissioner for Facilities and Financial Affairs, 30 March 2005.

[110] *Bloomington Interest Income FY 2003-04 Sources and Uses*, Document was drafted for class use. Provided by Associate Vice Chancellor Donges, 30 March 2005.

rehabilitation projects" as one of his two top priorities.[111] As of the writing of this report, the Indiana Budget Committee had not reconciled the Indiana House and Senate versions of the higher education funding bills.[112]

The result of this R & R appropriation legislation primarily impacts the IUB campus, relative to the other IU campuses. In the 2005-2007 period, approximately 66% of the approximately $47 million due should have been allocated to IUB. Much of the remainder was due to IUPUI (25% of the total). These percentages are not unlike past years; between 1999 and 2003, IUB's share of expected R & R was 60-70% of the IU total. IUB has the greatest amount of building square footage of greatest age, each significant components of R & R funding formula (see Appendix E, Table 3; Appendix G, Table 1).[113]

## V.B. Missing R&R Funding: Impact and Strategic Responses

### *V.B.1. Chancellor's Office*

Once R & R funds are allocated to the IUB campus, these funds are accessed through a process of negotiated decision-making. R & R funds have traditionally been allocated by the Chancellor's Office, which acts on the recommendations of the Budgetary Affairs Committee. These funds have traditionally been allocated to the Office of Space Management and the Physical Plant to administer. The Office of Space Management used these funds to provide supplemental funding to academic and non-academic units undertaking remodeling and major repair projects. According to Tom Swafford, Director of Space Management, without R & R funding, remodeling projects of less than $100,000 are generally 100% funded by the academic or non-academic unit directly benefiting from the remodeling/ rehabilitation project.[114] However, it is important to note that according to interviews with the fiscal officers for two IUB schools, no expenses for repair and renovation are planned for in these schools' operating budgets.[115]

In a meeting with Vice Chancellor Theobald, he explained that investment in rehabilitation and repair by the Chancellor's Office has been severely constrained due to the lack of R & R funding. Therefore, the costs and benefits of each major repair and rehabilitation project are thoroughly considered. Highest prioritized repairs are those that are deemed critical or emergency situations. Emergency repairs are generally defined as life threatening. An example of a life threatening necessary repair is a unsecured shingle. Vice Chancellor Theobald additionally explained that when considering how to use very limited IUB campus funds, an additional criterion for evaluating major renovation and repair projects is the degree to which it furthers the academic mission of the University. The example provided was the planned renovations to Kirkwood Hall, beginning in summer of 2006. Its total expected cost is $4 million. The goal of this project is to condense IUB's 82 language departments into one central location. This project presents advantages over other projects because it is expected to create

[111] Indiana University, Media Relations, *IU President Adam W. Herbert presents budget request to House Ways and Means Committee* (Jan. 11, 2005) [on-line]; available from http://newsinfo.iu.edu/news/page/normal/1809.html; Internet; accessed 30 March 2005.
[112] Interview with Mr. John Grew, IU Legislative Affairs, on 20 March 2005.
[113] Indiana Commission for Higher Education, *Physical Facilities of Indiana Public Higher Education: Their Location, Value, Condition and Utilization, Fall2003* (May 3, 2004), p. 7, 13.
[114] Interview with Mr. Tom Swafford, Director of Space Management: on 16 March 2005 and 30 March 2005; Presentation by Swafford on 17 February 2005.
[115] Interview with Mr. Brad Thomas, SPEA and Mr. Chris Pucket, College of Arts and Sciences.

significant value to the entire IUB campus. This value includes showcasing an area of major academic strength and the creation of significantly more classroom space. The project's cost-effectiveness in regard to addressing critical building repairs is a final criterion. For example, Kirkwood Hall renovations will include its roof. This repair is high priority because of its extremely deteriorated state, but it alone will cost $850,000. This repair would very likely need to be made regardless of the plans for major renovation to the whole building. Therefore, the benefits of this project significantly outweigh its costs.[116]

Between 2003 and 2004, the IUB Chancellor's Office was able to provide funding for remodeling and repair projects by using accumulated interest income on campus investments.[117] These funds provided academic units with about $2.3 million and academic (administrative) units with $700,000 in renovated space. Accumulated interest income is now exhausted, and Assoc. Vice Chancellor Donges estimates that 2005-06 interest income might provide $1.5 million for similar types of remodeling projects.[118] According to Vice Chancellor Theobald, the campus has also accumulated $16 million in debt due to funding provided for repairs and rehabilitation.

Tom Swafford proposed that an alternative option for the Chancellor's Office is to ask the IU trustees for authority to sell bonds in order to fund major R & R projects. Currently, under IC 20-12-6-1, it is the duty of the trustees of Indiana University to maintain buildings. Pursuant to the above law and IC 20-12-6-6, several Indiana universities have requested the authority to issue bonds to pay for new construction.[119] IC 20-12-6-6 gives Indiana Universities the authority to issue and sell such bonds (see Appendix G, IC 20-12-6-1.). To date, Purdue West Lafayette, Purdue Fort Wayne, Indiana State, Ivy Tech, Indiana University Indianapolis, University of Southern Indiana, Indiana University East Campus, IUPUI, Indiana University Bloomington, Vincennes, and Ball State have all used this bonding authority for various projects. If the Remodeling and Renovation budget continues to encounter a shortfall, a request to issue and sell bonds may be a viable option to complete necessary repairs.

### *V.B.2. Physical Plant*

According to interviews with Mr. Hewetson, budget constraints are significantly impinging the Physical Plant's ability to effectively and efficiently fulfill its mission. Mr. Hewetson estimated that deferred maintenance, due to lack of R & R funding, could potentially implicate future mold problems for the University. Mr. Hewetson is not yet able to predict if deferred maintenance is currently having a direct impact on mold problems, but he believes that inadequate funding has caused the overall quality of IUB buildings to decrease. According to Mr. Hewetson, decreased building quality has caused an increase in moisture related problems. He is additionally concerned about the future expense of addressing building integrity due to currently deferred maintenance.[120]

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[116] Interview Theobald, 22 February 2005.
[117] Interview Theobald, 22 February 2005; Associate Vice Chancellor Donges, *Bloomington Interest Income FY 2003-04 Sources and Uses*, 30 March 2005.
[118] Interview Donges, 30 March 2005.
[119] For example, in 1997, the trustees of Indiana University were authorized to issue and sell bonds under IC 20-12-6, subject to the approvals required by IC 20-12-5.5, for the purpose of constructing, remodeling, renovating, furnishing, and equipping the law school-Herron art school project at Indianapolis, if the sum of the principal costs of the bonds issued is not more than $19 million.
[120] Interview Hewetson, 24 February 2005.

Mr. Hewetson reports that he has seen a "shift in [Physical Plant] effort from permanent repairs to expedient repairs due to a lack of funding".[121] Mr. Hewetson estimated that the Physical Plant's mold-related expenses between 2000-2004 were as follows:[122]

- Approximately $80,400 on miscellaneous mold related expenses. These expenses include, for example, cleaning associated with mold remediation.
- Large-scale remediation projects cost $248,800 between 2000 and 2004.
- Average annual preventive maintenance cost $150,000. These maintenance costs include, for example, regularly scheduled air-handler cleaning and filter replacement. In addition, $100,000 was spent on average annual exterior wall repair (i.e. tuck pointing).[123]

Projects likely to implicate future moisture problems, and consequently mold growth, and which remain un-repaired include, but are not limited to:[124]

- Exterior: tuck pointing, window replacement, exterior caulking, planter membrane repair.
- Mechanical: air conditioning renovation, HVAC replacement, replace air handlers.
- Roof repair & replacement: new roofs, repair of damaged roofs.
- Steam: replace condensate piping.

These repairs are included in the Physical Plant's running "wish list" of projects. Projects on this list are considered pressing needs, but have not been addressed due to budget constraints. This "wish list" totals $25 million.[125] Of the projects described on this list, more than half pertain to building envelope maintenance.

Building envelope maintenance includes the following types of necessary repairs and totals the following amounts: approximately $7 million in roof repair/replacement, $14 million in widow repair/replacement, and $3.7 million in exterior wall repairs for a total of approximately $25 million.[126] Mr. Hewetson has submitted this list to the IUB Capital Affairs and Budgetary Affairs Committees for their consideration in determining IUB's priorities for capital investments.

### *V.B.3. Academic/Non-academic Units*

According to the Physical Plant's expenditure responsibility guidelines, academic and non-academic units are responsible for expenditures related to the renovation of architectural, mechanical and electrical systems, and associated abatement. Additionally, the Physical Plant is responsible for maintenance and general upkeep of the "basic building system"[127] (see Appendix E, Physical Plant Funding Responsibilities Indiana University Bloomington).

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[121] E-mail correspondence with Mr. Hank Hewetson , 18 April 2005.
[122] *Bloomington Academic Buildings Mold Remediation and Building Integrity Costs*, Document provided by Hank Hewetson.
[123] This does not include R & R funded repairs.
[124] Interview Hewetson 24 February 2005; *2003-2005 R & R Working List*, document provided by Mr. Hewetson.
[125] Ibid.
[126] Deferred over a ten-year period. *Mold and Building Integrity Cost table*, document provided by Hank Hewetson.
[127] Building Maintenance, *Physical Plant Funding Responsibilities Indiana University - Bloomington Campus*, (Updated Oct. 2004) [on-line]; available from http://www.indiana.edu/~phyplant/html/building_maintenance.html; Internet; accessed 31 March 2005; Interview Hewetson 24 February 2005.

Without the R & R funding provided through the Chancellor's Office or Physical Plant, incentive exists for academic and non-academic units to delay major projects. The logical result of delaying renovation that addresses moisture related damage is increased need for minor repairs to academic/ non academic buildings across the IUB campus. Thus, the immediate direct expense of delayed repairs is largely incurred by the Physical Plant.

A primary reason for this delay strategy may be the school Dean's and non-academic unit Director's hope that R & R funding will be provided in the future. The Physical Plant's current guidelines regarding their responsibility for renovation appears to conflict with past practices. In fact, the continued existence of a "wish list" maintained by the Physical Plant implies that the Physical Plant will eventually fund major repairs and necessary renovations. A secondary reason may be that academic and non-academic unit administrators are unaware of their expenditure responsibilities. SPEA Dean, Kurt Zorn, Ph.D. was unaware such a policy regarding renovation responsibility existed.[128] In an interview with the SPEA Fiscal Officer, Brad Thomas, he indicated that SPEA's approach to addressing repairs and rehabilitation has been to request that repairs be added to Physical Plant's "wish list".[129] As previously noted, there are no planned repair and renovation expenses shown in the College of Arts and Sciences and School of Public and Environmental Affairs FY 2004-05 budgets.[130] Dean Kurt Zorn noted that a renovation completed in summer 2004, which addressed SPEA's space needs more than major necessary repairs, utilized funds generated through an earned income source. It is not known how common it is for other schools to rely upon alternate types of funding sources, not shown in operating budgets.

As demonstrated previously in this study, delayed investment in major repair and renovation has the potential to increase health problems and property damage, and therefore liability. In addition to the reasons provided for renovation and repair delays provided thus far, increased liability, property insurance, and workers compensation expenses are not directly or immediately incurred by academic and non-academic units. IU insurance schemes do not relate units' building investments, or lack there of, to potentially increased insurance expenses.[131]

The IU insurance coverage structure, pools increased health, property or liability risk across the IU system. Any potential increase in expenses related to increased liability, workers compensation, and property insurance is thus shared by all system campuses.[132] These pooled expenses are "passed-on" to each IU campus by the Vice President through the University Tax assessment. The University Tax funds much of the VP departmental services, including IU's property, liability and workers compensation insurance. The University Tax assessment is determined based upon units' income (such as student fees) and expenses (such as faculty and staff salaries); unlike the other IUB assessment on academic units, the University Tax excludes square footage of space occupied.[133]

This analysis additionally demonstrates that if increased risk occurs as a result of unit's delayed investment in major repairs and renovation, the associated expense is "subsidized" by

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[128] Interview Dr. Kurt Zorn, SPEA Associate Dean for Academic Affairs, on 13 April 2005.
[129] See s*upra*, section V.B.2
[130] Interview Thomas, and Pucket.
[131] E-mail correspondence with Mr. Jim Donges 20 April 2005; 4/5/05 Interview with Mr. Lynn Sinn, Risk Management on 5 April 2005; Interview with Mr. Brad Thomas, Fiscal Affairs Officer, SPEA, on 5 April 2005; Interview Zorn 28 March 2005; Interview Donges, 30 March 2005.
[132] Interview with Mr. Daryl Brawthen, Director of Financial Affairs, Risk Management on 5 April 2005.
[133] E-mail from Donges, 20 April 2005.

the entire Indiana University system. This is deemed a subsidy because risk associated with delayed repair and renovation is not shared equally in the IU system. Increased risk is disproportionately attributable to older campuses, such as IUB, where building deterioration is greatest (see Appendix G, Table 1).

Student health care costs are borne entirely by students, either through their use of the IUB Health Center or other health care services. Additionally, the IUB Health Center is a self-supporting auxiliary unit, which relies upon student fees and charges for service for their revenue generation.[134] Therefore, an additional incentive exists for delayed renovation and repair investments, since expenses related to decreased student health due not accrue to any academic or non-academic unit.

An alternative strategy is to use private donor funding (maintained in IU Foundation account) for renovation and repair projects. Private donor fundraising might be enhanced by undertaking a campaign to raise funds from other private sources, such as corporations or alumni donors. The School of Heath, Physical Education and Recreation (HPER) has undertaken such a campaign in order to renovate its courtyard. This may a preferred option for IUB schools and colleges with higher alumni donor revenue potential.[135]

## V.C. Responsibility Centered Management

In 1990, Indiana University implemented a budgeting system termed Responsibility Centered Management (RCM). RCM was initiated by President Thomas Ehrlich in order to decentralize the budgeting system at IU. "President Ehrlich's goal was to develop a system guided by three basic principles: all costs and income attributable to each school and other academic unit should be assigned to that unit; appropriate incentives should exist for each academic unit to increase income and reduce costs to further a clear set of academic priorities; and all costs of other units [non-academic] should be allocated to the academic units."[136] The core philosophy of this approach is that expenditures are attributed to the same unit responsible for generating the expense.

This report demonstrates that the basic RCM accounting principle is not fully applied to the direct and indirect expenses of maintaining building integrity.

[134] *FY 2004 IU Health Center Consolidated Budget Report* provided by Assoc. Vice Chancellor, Jim Donges
[135] Interview Theobald 22 February 2005.
[136] Budgetary Administration and Planning, Office of the Chancellor, Indiana University Bloomington, *Report of the RCM Review Committee Responsibility Centered Management at Indiana University Bloomington 1990-2000* (May, 2000) p. 2. [on-line]; available from http://www.indiana.edu/~obap/; Internet; accessed 30 March 2005. (Second Assessment of RCM in 10 year period)

# VI. Estimating the Costs of Health Care and Lost Productivity Due to Mold

IU Bloomington does not currently monitor and compile all mold-related costs. Beyond remediation and prevention expenses, there are other costs associated with mold in buildings including lost productivity, and health care expenses. In the absence of specific data, we developed a model that utilizes IUB demographic data and information from applicable literature to assign probability distributions to each relevant variable. The model gives the total present value of the costs over 25 years. The results reveal the hidden costs of mold in buildings that should be considered in the building repairs and maintenance budgeting process. Note that this cost analysis only incorporates costs associated with health care and lost productivity; it does not include costs associated with the remediation process itself, building materials, etc.

## VI.A. Methods

We used SAS statistical software to develop a Monte Carlo simulation model. Variables are assigned probability distributions and then the simulation runs thousands of times to produce a frequency distribution for predicted outcomes. The predictive power of the Monte Carlo simulation depends on the robustness of the assumptions, which are summarized in Table 1 and described in Appendix H.

**Table 1: Summary of Model Assumptions and Information Sources**

| Variable | Value | Distribution | Information Source |
|---|---|---|---|
| **Discount Rate** | Mean: 7.24%<br>St. Dev.: 2.24% | Normal | Office of Management and Budget |
| **IUB population** | Res. Student: 22,544<br>Non-Res. Student: 15,277<br>Faculty: 1,877<br>Staff: 5,199 | NA | Indiana University Fact Book<br>http://factbook.indiana.edu/fbook04/index.shtml |
| **Population Growth Rate** | Mean: .727% per year<br>St. Dev: 1.57% | Normal | Indiana University Fact Book |
| **Exposure Duration (Time in IUB buildings, hrs/yr)** | Res. Student: 4760<br>Non-Res. Student: 510<br>Faculty: 2000<br>Staff: 2000 | NA | Assumption – see description below |
| **Opportunity Costs ($/hr)** | Res. Student: $4-5<br>Non-Res. Student: $4-5<br>Faculty: $48.65<br>Staff: $15.65 | NA | Assumption<br>Assumption<br>Indiana University Fact Book<br>IU Bloomington Human Resource Services |
| **Health Costs** | $\xi$: 7<br>$\varphi$: 1.13 | Log Normal | Case Studies |
| **Days Lost** | $\xi$: .5<br>$\varphi$: 1 | Log Normal | Milton, DK, Glencross, P, Walters, MD. 2000 |
| **Sensitivity to Mold** | Mean: 10.65%<br>St Dev: 2.29% | Normal | American Lung Association |
| **Chance of Exposure** | 10-30% | Uniform | Assumption |

## VI.B. Results

The total estimated present value over 25 years of health care costs and days lost to mold-related illness at IUB is $9.9 million. Annualized over the 25 years at a 7% rate, the total mold-related health care and lost productivity costs are $851,521 per year. Table 2 summarizes the results of the model. This estimate shows the extent of the costs of mold at IUB, beyond mold remediation and regular building maintenance. IU administration officials should take these costs into account when considering preventative maintenance or new building construction. For the full details of the model, refer to Appendix H.

**Table 2: Summary of Model Results**

| | |
|---|---|
| **Mean (PV from 25 years)** | $9,923,274 |
| **Annualized Costs (for 25 years at 7%)** | $851,521 |
| **Standard Deviation** | $3,332,186 |
| **Upper Bound (95%)** | $15.728,804 |
| **Lower Bound (5%)** | $6,011,126 |

# VII. Policy Analysis

## VII.A. Mold Policy

Problems with indoor air quality (IAQ) in residences, offices, schools and other buildings are becoming increasingly recognized as a serious environmental risk to human health. Although mold is gaining more attention as a potential threat to human health, much uncertainty exists about the direct causal link between IAQ and health problems such as upper respiratory infections, asthma attacks, headaches, nausea, dizziness, coughing, mood changes, depression, anxiety, and fatigue. Many of these symptoms can also be caused by a variety of factors other than IAQ. Additionally, quantifying these potential health effects into enforceable standards is a critical prerequisite for developing IAQ regulations. However, characterizing the health effects and establishing clear causal links is complicated by the existence of multiple pollutants, sources, building environments, exposure scenarios, endpoints and other varying compounding factors. Mold is one specific aspect of IAQ that has received recent attention and has been targeted for potential regulation.

Mold is ubiquitous in the natural environment, both indoors and out, and it is not practical to entirely avoid exposure. Numerous reports in the press about the health effects of mold have highlighted the general public's concern about the risks of exposure to mold growth in office buildings and homes. The available science addressing these issues is incomplete and sometimes controversial. Communicating risks associated with mold becomes complicated without clearly established consensus for scientific evaluation.

Even without federal and state regulations, most experts agree that the prevention of active mold growth is necessary to prevent potential negative health effects. Also, as mentioned previously, mold related litigation is on the rise. In recent years, reports regarding health problems attributed to mold on college and University campuses across the country have been on the arise. These cases focus not only on students, but faculty and staff. The threat of potential legal liability and the need to ensure the health and safety of students and staff have compelled colleges and universities to respond with guidelines for mold remediation and suggestions for prevention. For example, in early 2004 the University of Virginia adopted a mold policy.[137] However, the policy only acknowledges the potential health problems associated with mold. It also notes that the available science addressing these issues is incomplete and sometimes controversial. It then suggests a system for notification and remediation. The policy is rather incomplete, but reflects much of what exists on campuses across the country.

The University of North Carolina at Pembroke (UNCP) also addresses mold. UNCP has a facilities planning and construction policy that seeks to prevent the formation of mold, outlines measures to attempt detection of mold early in its growth stages and specific remediation guidelines. Specifically, the policy requires the UNCP Physical Plant to conduct:

- Preventative maintenance on air-handling units, including monthly filter changes, application of biocide tablets in condensation pans, ensuring chilled water temperatures to coils of 45 degrees or less, and monitoring handling units for proper air flow.
- Preventative roof maintenance and requiring periodic building inspections.

[137] University of Virginia Office of Environmental Health and Safety; *University of Virginia Mold Management Policy* [on-line]; available from: http://keats.admin.virginia.edu/polproc/XIVT1.html; Internet; accessed 24 March 2005.

- Preventative maintenance on toilets, water fountains, and laundry rooms.
- Monthly building mold inspections.[138]

The UNCP plan also requires Physical Plant, UNCP Safety Officer, and Building Coordinators to conduct monthly visual inspections of buildings. Also, it requires that Physical Plant annually contract an industrial hygienist to test the mold spore counts in each air conditioning zone and communicating the results to the occupants of each area. Remediation practices are also suggested for a variety of mold situations ranging by area from less than 10 feet to more than 100 feet. The UNCP guidelines list clean-up steps, types of professional personal equipment to protect workers, and approaches to containment for affected areas. The tasks charged to the UNCP Physical Plant may be realistic on a campus of less than 6,000 students faculty and staff and maintaining less than 50 buildings. Larger campuses on the other hand have adopted similar guidelines, but do not require monthly inspections. Most policies merely reference the remediation guidelines suggested by the EPA and New York City Department of Health.

Many colleges and universities have adopted guidelines for addressing mold problems, but there is little evidence of a comprehensive policy that adequately addresses mold prevention through using greener building materials, stressing the importance of funding preventative building maintenance, and outreach education for students, faculty and staff.

## VII.B. Administrative Policy Analysis

Mr. Hewetson commented that "never before have there been so many people having a problem being in a space".[139] Originally, people were skeptical about indoor air quality complaints, but now people understand the health implications of mold. Mr. Hewetson knows that water in buildings is directly correlated to mold growth and he knows that there is more water in buildings, but he is not able to definitively say that the lack of water repair projects will directly cause an increase in mold related problems. The Physical Plant is not yet to the point where they question if "they are preventing future mold problems" when they address small repair projects.[140]

The Physical Plant currently faces two major difficulties, 1) adequately addressing current problems and 2) implementing preventative maintenance procedures. Both of these problems are primarily caused by a lack of funding[141] although communication, training, and documentation also have significant impacts.

Under the current situation, many large-scale water and mold-related problems are not being addressed and those that are, are being remediated inadequately. Small water leaks and easy, cheap mold clean-ups are performed by the Physical Plant consistently. Major problems such as leaking roofs and windows and exterior building envelope integrity issues have long term cost and health implications and are currently receiving "band-aid" approaches as opposed to adequate repair.

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[138] The University of North Carolina at Pembroke, Office for Business Affairs; *UNC Pembroke Mold Prevention, Assessment, and Remediation Plan* [on-line]; available from: http://www.uncp.edu/ba/policies/fpc/fp1103.htm; Internet; accessed 24 March 2005.
[139] Interview Hewetson 24 February 2005.
[140] Ibid.
[141] See *Missing R & R Funding, Administrative Response, Physical Plant*, *supra* section V.B.2.

### *VII.B.1. Communication*

Internally, the Physical Plant needs to work to keep up communication, specifically on water and mold related problems across different work areas on campus. Physical Plant staff are divided by zone areas across campus and do not communicate among each other or within the Physical Plant. Increased communication within the Physical Plant's zones needs to occur on a regular basis to ensure consistent actions across campus. Increased communication would also facilitate sharing information regarding the most effective and efficient remediation techniques.

Although Mr. Hewetson agrees that the key players who address mold problems at IUB need to do a better job of communicating, he does not necessarily believe that creating a board of representatives from each department will more effectively address the communication problems. Environmental Health and Safety has one person specifically designated for Indoor Air Quality, Mr. Dan Derheimer, but the Physical Plant staff is broken down by specific work areas.

Mr. Hewetson values the separation of EHS from the Physical Plant because EHS is responsible for the health of the University and too much overlap between the two departments could bias EHS's decision making. EHS and Physical Plant need to bridge the gap between water and mold related service requests and EHS health related complaints. It is imperative that these two departments continue to communicate when new problems are discovered and older problems are remediated so that the issues are most effectively and efficiently resolved.

Mr. Derheimer expects to see more communication with Physical Plant. In the past, he informally proposed that different departments, particularly EHS and Physical Plant, share copies of complaint forms, but the proposal was not supported or implemented. In addition, Mr. Derheimer also feels that central tracking system would be beneficial to check which buildings have been visited most often due to complaints. At the moment, EHS has to search the entire system on a regular basis to find this kind of information, but once the new Maintenance Management System (MMS) system is in place, a central tracking system could be possible. This system would make compiling the number of annual complaints for mold and other concerns much easier. Currently, EHS is the only department utilizing this system, but the Physical Plant and the Architect's Office could use this system as well. Such a system would clarify how much was spent on what, how often recurring problems occur, and what improvements were made in which buildings.

The University needs to facilitate a more formal building manager system that is fully integrated with the Physical Plant. Currently, increased communication is difficult because there is no structured system in place for building managers, and many designated informal building managers do not have the incentive to coordinate and communicate with the Physical Plant on a regular basis. It is imperative that building managers inform the Physical Plant of water damages and mold growth immediately, which requires a structured communication system.

The Architect's Office also needs to keep the Physical Plant in the loop when determining design decisions. The Physical Plant has the most hands-on experience when it comes to understanding the effectiveness of building materials and systems and this knowledge needs to be utilized. The Architect's Office should increase the level of consulting with the Physical Plant to better understand how materials and systems are currently functioning and to inquire about the potential for better systems. The Architect's Office worked with the Physical Plant to develop building standards for double panel stainless steel air handling units and this

resulted in a reduction of mold growth within air handling units. This type of teamwork and communication needs to be increased.

### *VII.B.2. Training*

Currently, a select number of Physical Plant staff are trained annually by Mr. Derheimer, EHS Environmental Manager, on the procedures of mold remediation. Some of the Physical Plant staff have the attitude that mold growth is not a serious problem because they have been working in mold infested environments for thirty years, perhaps without any health affects. To them it is difficult to understand how some people have severe sensitivities to mold. The Physical Plant staff needs to receive training on: the proper way to protect themselves when dealing with mold; the proper way to remediate/eliminate mold; how to identify mold and the potential for future mold growth; and the serious health implications of mold growth.

Mr. Hewetson acknowledges that they may not be doing the best they can in terms of training and that it would be beneficial to talk to the Physical Plant staff about Indoor Air Quality, with an emphasis on the causes of mold, particularly water leaks. He feels that mold problems are not from a malfunction of the HVAC system, but that typically something else is occurring in the system that causes mold growth, perhaps a small leak that does not affect the operating system, but creates an environment for mold growth. "Knowing that something is not functioning properly is very good, but it does not always tell you the whole story."[142] Currently, there is a large possibility that the Physical Plant staff is overlooking potential problems because they are only looking for dirt and therefore they do not notice the little pool of water that should not be there. These types of problems are not currently flagged for follow up.

### *VII.B.3. Documentation*

In order to learn about the intricacies of the current information management system for work order and service requests, IUB Physical Plant's Associate Director of Administrative Services, Linda Michael, and Scott Knapp, the Maintenance Management System (MMS) Administrator were consulted. Since 1999, IUB's Physical Plant has used the Maximus Facility Focus database system to record work orders and service requests. In addition, this database is a statewide system utilized or accessible to the Bureau of Facilities, Programming, and Utilization (which oversees property computer-aided design (CAD) blueprints), Architect's Office, RPS, the Vice President of Administrative Contracts, EHS, and Building Representatives. However, it is important to note that EHS just started using this database within the past six months; it does not appear to be used to track *all* work orders. The use of different information systems has hindered communication among departments.[143]

Mold related expenditures are not currently documented as such and there is no problem code specific to mold projects within the Physical Plant's software system. The Physical Plant does not actively monitor the recurrence of mold that has been cleaned up and remediated and this kind of monitoring is not within the Physical Plant's standard protocol. Mr. Hewetson wants to be able to track mold related remediation and abatement projects. The documentation of these projects and their financial costs would provide a significant source of bargaining power with the

[142] Interview Hewetson 24 February 2005.
[143] Interview with Michael and Knapp, 1 April 2005.

state and the University, as well as provide key evidence of the cost implications of postponing replacement projects, specifically roof replacement.

The Physical Plant and EHS need to be able to easily share information regarding mold complaints and remediation to get an overall understanding of the entire problem. Each time that EHS or Physical Plant addresses a mold complaint or water leak, the other department should be notified. Access to this information would allow Mr. Derheimer to tract persistent problems that may cause health effects for some people. Easy access to mold related complaints and water related damage repairs between the Physical Plant and EHS will allow these two departments to work together more cohesively and eliminate mold problems more effectively.

Another shortcoming of the current building manager role at the University is the absence of a uniform system for documenting both mold-specific remediation projects and maintenance responses to mold-related concerns (i.e. water leak repair). The absence of a consistent documentation system hinders accountability, but more importantly, forces newly assigned building managers to begin their duties without a formal mechanism for learning about the history of their building and its problems. The learning curve for new building managers could dramatically improve if a documentation system for maintenance and remediation responses was available and readily accessible.

## VII.C Building Management Policy Analysis

Through the analysis of building management at the ground level it is evident that the prevalence of full-time building managers across campus is sporadic at best. It is first important to note that when initial contact was made with 28 different buildings on campus, the work focused on contacting individuals most likely to be either a building manager or best able to direct us to the building manager if one existed. As a result, there can be only speculation regarding the existence and role of building managers at buildings for which there was no response. That said, information was obtained directly from 10 individuals retaining some level of responsibility for the building in which they work. From this information, several observations emerged:

- The term "building manager" has numerous interpretations ranging from "the individual that people bring complaints to," to a full-time employee that serves as a knowledgeable first responder to concerns with building operations.
- More than half of the individuals that responded to our information requests were full-time employees of the University in a position other than building manager (i.e. Informal building manager).
- Building managers are hired or assigned by the school/department residing within the facility.
- For those individuals not explicitly employed as building managers, their building management role generally consists of simply contacting the University's Physical Plant when someone identifies a building problem.
- Knowledge of individual building histories, their problems, and standard responses to their problems is greatly limited in buildings without full-time building managers.
- Buildings that contain multiple academic departments tend to have the least formal form of building manager or no manager at all.

- Regardless of employment status, building managers do not receive formal training on mold awareness.
- There is no formal communication network among building managers, Physical Plant and EHS.
- There is no feedback system by which the building managers are informed about building maintenance practices (i.e. ventilation filter changes, responses to called-in problems).

These observations represent broad problems that exist under the current conditions at the University and are meant to demonstrate the disconnect between building occupants and those individuals in charge of responding to the needs of building occupants. A consequence of the University having no uniform policy requiring full-time building managers is the existing lag in both problem identification and response time, which ultimately exacerbates the University's struggle to meet its basic spatial demands. The current practice of relying on Physical Plant and the on EH&S to maintain safe, healthy and efficient working environments for 488 buildings without trained building managers onsite to assess problems is unrealistic and inefficient. Furthermore, with the University nearing breaking points with the viability of using some buildings in their current conditions, it appears even more advantageous to have individuals on location to continuously monitor the facilities. This may allow the University to avoid having what could have been a minor problem become a major one only because the problem was identified too late.

# VIII. Recommendations

## VIII.A. Policy and Administrative Protocols

In general, the administration as a whole needs to devise a more effective working relationship through open and frequent communication. Without the full support and cooperation of the entire University administration, the Physical Plant and the Office of Environmental Health and Safety will not be able to adequately and effectively combat mold.

### *VIII.A.1. Physical Plant*

The air-handling units need to be inspected and cleaned at least twice a year, with more focus on older air handling units that still contain organic insulation. These old systems need to be replaced as soon as possible or brought up to the same standards as the new double panel stainless steel air handling units that are installed during new construction.

When the air-handling units are inspected, the Physical Plant staff needs to be trained to identify potential mold environments. This includes knowing to look for water leaks, even small ones, when inspecting the units and not just going in to clean them without thinking about mold implications. Mr. Hewetson suggests that this type of education should allow the staff to "look a little farther into the problem with a little different eye."[144] The Physical Plant should train their staff how to correctly prevent, abate, and mitigate mold growth, with an emphasis on preventing moisture build up and eliminating environments for mold to grow.

The Physical Plant needs to continue working with the Architect's Office and the Engineering Department to inform them of current building materials and systems problem with regards to mold growth. The Architect's Office needs to seriously consider Mr. Hewetson's recommendations during the design phase. Mr. Hewetson has the most hands on knowledge regarding the types of systems and materials that promote or encourage mold growth and the Architect's Office should take advantage of that expertise.

The University needs to create a structured communication procedure between building managers and Physical Plant. In addition, it is recommended that the Physical Plant institute monthly meetings to discuss current practices, projects, and difficulties experienced within the different zone areas.

A mold project identification code should also be established in the Physical Plant's software system so that mold can be appropriately tracked in terms of repairs completed and their expenditures. A code specific to mold remediation will allow the Physical Plant and the University to get a holistic and realistic picture of mold problems.

Lastly, the Physical Plant needs to focus more on preventative maintenance. The current budget constraints make this very difficult, particularly with such a long list of necessary repairs, but a preventative view point will save time and money in the future. Fixing the problem now will alleviate more future problems.

### *VIII.A.2. IAQ & Mold Reporting*

It is critical that IUB provide a consistent reporting system regarding IAQ and mold problems. Faculty, staff, and students need to be aware of this system and have easy access to it

[144] Interview Hewetson 24 February 2005.

through online sources or via telephone. IUPUI has a thorough IAQ questionnaire that is used for user-friendly reporting of mold problems.[145]

In addition, IUPUI provides the following reporting procedures for faculty, students, and staff (see "Mold Reporting Procedures" Box below[146]). This increases awareness about the issue and provides people within the University an easy and efficient means of communicating problems with the appropriate departments. It is our recommendation that these reports be received by both EHS and by the Physical Plant.

**Mold Reporting Procedures**

When water leaks, overflows, or condenses on building materials, it can damage the building or lead to mold growth. Mold can cause allergic reactions in sensitive individuals and lead to costly, disruptive clean-up. To prevent building damage and mold growth, prompt clean-up is necessary. As a building occupant, you can help minimize interruptions by contacting Campus Facility Services as soon as possible. During regular hours (Monday-Friday 7:30 a.m. to 4:00 p.m.) call your Zone Operations trouble line. If you don't know the zone you're in, please check our Facility Operations Map. For all emergencies after 4:00 p.m. M-F or on weekends call 278-1900.

| | |
|---|---|
| Zone One 278-1420 | Zone Four 278-1800 |
| Zone Two 278-1620 | Zone Five 278-3900 |
| Zone Three 278-1940 | Grounds 274-3816 |

If mold or any suspected mold-like material is discovered in a University building, call IUPUI Environmental Health & Safety (EHS) at 274-2005 as soon as possible to report the problem. DO NOT handle materials or attempt to clean up the area. If the mold infestation appears extensive, isolate the area and keep people out until EHS staff can make an assessment.

### *VIII.A.3. Communication with Staff, Students and the Public*

Communication with building occupants is essential for successful mold remediation. Some occupants will understandably be concerned about mold growth in their building and the potential health impacts. Occupants' perceptions of the health risk may increase if they perceive that information is being withheld from them. The status of the building investigation and remediation should be openly communicated and include information on any known or suspected health risks.

Because indoor air problems can jeopardize the health of students and staff, the public may react strongly to reports of poor indoor air quality. Therefore, it is recommended that an IAQ Coordinator establish uniform communication guidelines, so that the public will not become alarmed by conflicting or wrong information and will have a consistent and complete source of information regarding the quality of the indoor air at IUB.

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[145] IUPUI, Environmental Health & Safety Services & Fire Protection Services, *Programs > Indoor Air Quality Questionnaire* [on-line]; available from http://www.ehs.iupui.edu/ehs/prog_IAQQuestionnaire.asp; Internet; 31 March 2005.

[146] IUPUI, Environmental Health & Safety Services & Fire Protection Services, *Programs > Mold Information* [on-line]; available from http://www.ehs.iupui.edu/ehs/prog_molinfo.asp; Internet; accessed 31 March 2005.

In addition, IUPUI provides information specific to mold on their Environmental Health and Safety Website.[147] The website provides faculty, staff, and students with background information on mold, health effects of mold exposure, regulations and legislation regarding mold, preventing mold, and mold reporting procedure. We recommend that IUB's EHS department use this as a template to provide similar online and pamphlet resources to all University building occupants.

#### *VIII.A.4. Database Management*

Currently, IUB's Physical Plant and EHS departments have different database systems to track work orders and maintenance requests. At present, the IUB Physical Plant utilizes an Oracle database called Facility Focus and produced by Maximus. Physical Plant and a few other IUB departments are in the process of transitioning software to a web-based Maximus database.[148] It is recommended that this web-based database be adopted by all IUB maintenance departments, utilizing the same work and problem coding systems, so as to better promote communication and tracking of mold-related problems and maintenance.

Physical Plant staff is optimistic that the transition to the web-based system will promote a more integrated maintenance system among IUB departments. The current system is not a live system; it is updated on a daily basis and is inquiry-based. One area of significant concern is that within Physical Plant and other departments, work and problem codes are not being regularly utilized. (For clarification, problem codes are a means to break down work codes.) When running reports to track the frequency of specific problems, such as mold, many maintenance requests are not accounted for and room locations cannot be tracked.[149]
In addition, all departments are utilizing different work and problem codes, none of them contain codes specific for work requests related to mold complaints. Although EHS does have a work code, there needs to be a distinction between the departments handling a service request. It is recommended that all departments begin utilizing the same work and coding and that there be work and problem codes established for mold complaints.[150]

Despite these recommendations, Physical Plant is to be commended for its preventative maintenance efforts, especially at a time when budgets are extremely tight. These efforts include specialized inventory maintenance records on over 2000 pieces of significant equipment such as cooling towers, air handlers, backflow preventors, elevators, and escalators. In addition, there are also set daily, weekly, and monthly inspections of specific equipment such as HVAC filters, belts, and bearings.[151]

### VIII.B. Building Management Policy Recommendations

An integral part in the prevention and remediation of mold at the IU Bloomington campus is the integration of the building manager position into the administrative hierarchy. The following points describe possibilities by which this may be achieved:

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[147] IUPUI, Environmental Health & Safety Services & Fire Protection Services, *Programs* > *Mold Information* [on-line]; available from http://www.ehs.iupui.edu/ehs/prog_molinfo.asp; Internet; accessed 31 March 2005.
[148] Interview with Ms. Linda Michael, Associate Director of Administrative Services, IUB Physical Plant, and Mr. Scott Knapp, Maintenance Management System Administrator, 1 April 2005.
[149] Interview with Michael and Knapp, 1 April 2005.
[150] Interview with Michael and Knapp, 1 April 2005.
[151] Interview with Michael and Knapp, 1 April 2005.

- Increase the campus-wide awareness of building managers—even if some are unofficial building managers—in order to facilitate communication between faculty, staff, and the building manager.
- Establish a single, permanent contact through which all maintenance requests are routed to improve efficiency and establish responsibility. Building managers should be established as the primary contact for maintenance requests from faculty and staff. Building managers also need a consistent contact within either EHS or Physical Plant to whom they will direct their concerns.
- Create an inclusive system for recordkeeping. A system that cross-references related topics like "mold" and "IAQ" is necessary to avoid misrepresenting the causes of a problem or the numbers of that type of problems. Additionally, a method that permits any interested party easy access to the records should be utilized to allow easier dissemination of information. Building managers need to be informed—or have the ability to inform themselves at their own discretion—when maintenance is being performed on their buildings.
- Develop a full-time, official building manager position. For some of the larger buildings, and for those buildings housing more than one department, an official University-sponsored building manager position should be implemented to handle the increased concerns of a large building or to eliminate possible interdepartmental inefficiencies.
- Whether or not an official position is created, training should be provided to educate current building managers about mold and its causal factors. The goal is not to enable building managers to remediate mold; the goal is to raise their awareness so issues do not worsen while unnoticed. While training could be extended to all faculty and staff to increase the overall observation possibilities, it would be more efficient to train one dedicated individual, an official building manager for example, to be responsible for observing the causal factors of mold.

Following one or more of the above suggestions should improve the effectiveness and responsibility of building managers not only in dealing with mold issues, but through the creation of a solid foundation for handling all building-related problems.

## VIII.C. Training Programs & Materials

Education of the IUB community regarding mold and IAQ is critical. If people are provided information about the sources and effects of contaminants to which they could be exposed (i.e. proper functioning of ventilation systems or allergy-like symptoms), they will better understand their indoor environment. Increased awareness can assist individuals to identify ways to reduce their personal exposure. The following sections include recommendations regarding education and training for IUB Physical Plant employees, building managers, RPS staff, the student community and IUB faculty and staff.

### *VIII.C.1. Physical Plant & Maintenance Staff*

EPA has created detailed mold remediation guidelines that could be used as a training resource for IUB Physical Plant and building maintenance staff. The document, "Mold

Remediation in Schools and Commercial Buildings" describes how to investigate and evaluate moisture and mold problems in educational facilities. It also presents key steps for implementing a remediation plan and provides a checklist for conducting mold remediation efforts along with a resource list of helpful organizations and governmental agencies. Appendices of the EPA documents contain a glossary, an educational section on molds, and an explanation of how communication with building occupants aids in mold eradication efforts.[152] Regular use of such materials can assist in the long-term education of staff who combat these problems.

### *VIII.C.2. Building Managers*

Training for full-time building mangers should parallel the recommendations for Physical Plant and maintenance staff training. Building managers perform similar roles, and these training programs would benefit building managers and the IUB campus immensely. Additionally, this recommendation eliminates the cost of designing and implementing a new training program.

Part-time building managers would benefit from the same training as their full-time counterparts. Therefore, another recommendation is for part-time building managers to receive additional periodic training. As professionals outside the field of building management, staff with limited time and resources tend to focus on primary duties. While this is reasonable, one fear is that it may detract from important building manager obligations. This report recommends that brief, periodic trainings which focus on single issues be administered quarterly. A brief training on mold identification and remediation should be administered at least annually. A monthly training offers both an opportunity to revisit various skills and an opportunity to gather with colleagues. This gathering reinforces the fact that there are others on campus responsible for the same building manager duties on top of their already heavy workload. The camaraderie built by these interactions will further reinforce the importance of the building manager position.

### *VIII.C.3. RPS Staff*

John Bruce, Health and Safety Manager for RPS, currently provides all of the health and safety training for RPS employees (which include, but are not limited residence managers, residence assistants, and student leaders that deal with cleaning). Training of resident assistants and managers on the detection of mold and mold-growth conditions will be beneficial to the buildings' long-term indoor air quality. Quicker detection of problems will often lead to more efficient remediation. To incorporate mold awareness into existing training, the following measures should be implemented:

- Include links to mold resources on the RPS website, http://www.rps.indiana.edu.
- Include a mold awareness section in the student housing guide, "Residence Living 2005: Your Neighborhood from A to Z".
- Develop informational pamphlets to be exhibited at the Student Health Center and available through resident managers.

[152] U.S. Environmental Protection Agency, *Mold Remediation in Schools and Commercial Buildings* [on-line]; available from http://www.epa.gov/iaq/molds/images/moldremediation.pdf; Internet; accessed 31 March 2005.

### *VIII.C.4. Students*

In Section VI, it is estimated that resident students spend an average of 20 hours per day in buildings on campus. As such, students are a critical group of individuals whose increased knowledge of mold awareness and education is essential to the health of the campus community. Certainly, the extent of training recommended above for those University personnel involved in mold-related issues is unnecessary for students. However, some awareness and education is necessary and would be relatively simple to implement under the auspices of the current training and educational materials to which students are regularly exposed.

The orientation session facilitated by RPS staff at the beginning of the school year is a perfect opportunity to reach out to students regarding mold awareness. It is important for the student "training" that materials be kept informational, straightforward and brief. Under the coordination of John Bruce, resident managers could develop an under five-minute presentation which addresses what mold is, how to spot it in buildings, what conditions lead to mold growth, how mold can affect health, and who to contact with concerns. Role-playing could be used to further engage students to listen to the information presented.

As mentioned above, students live in RPS "Neighborhoods," and are provided with guidebooks that contain relevant information regarding neighborhood policies and procedures. At the orientation session, the neighborhood guide would be referenced as a source of additional information on mold topics. Students seeking more heath-related information would be directed to the resident managers or the student health center where a newly developed pamphlet on mold and IAQ would be available.

Given the amount of time students spend in their residence halls, classrooms, and public buildings, teaching them how leaky pipes and poor ventilation systems can lead to mold growth and ultimately health effects is very important. Through this lens, IUB could have over 25,000 inspectors at their disposal to assist in the mold identification and remediation on campus.

### *VIII.C.5. IUB Faculty and Staff*

Training for IUB faculty and staff is critical to improving the awareness of mold-related issues on campus. Especially in buildings prone to water leaks and poor ventilation, personnel must be educated on the conditions favorable to mold growth for better reporting and remediation of the problems. Similarly, better awareness will allow for those individuals prone to allergic reactions to mold to more quickly identify plausible causes for their symptoms. Indoor air quality has a direct effect on working conditions and should therefore be taken seriously by those spending a majority of their working day indoors.

However, serving the training needs of a campus community as large as IUB's can be a daunting task. For example, The University of Michigan's Office of Occupational Safety and Environmental Health has nine different programmatic areas and a staff of over sixty.[153] To broaden the scope of training for IUB faculty and staff, a further recommendation is that EHS incorporate mold awareness and education into existing training programs. These items should include:

[153] University of Michigan Office of Occupational Safety and Environmental Health, *OSEH Staff* [on-line]; available from http://www.oseh.umich.edu/osehstaff.html; Internet; accessed 31 March 2005.

- The addition of a hyperlink entitled "Indoor Air Quality Awareness" to the Occupational Safety Section of the Publications and Policies Page.[154] This document could be formatted around information found at the OSHA Indoor Air Quality website.[155]
- The addition of an "Indoor Air Quality" section to the "Safety Initiatives Program Training Needs Survey" administered by the Training Coordinator to gauge employee interest and needs.[156]
- The organization of informational seminars on indoor air quality and mold-related topics to be held once per semester.

Not only will it be necessary to educate individuals on mold-growth conditions and health effects, it is necessary to inform them of the chain of reporting and communication. (The codification of reporting and communication is discussed elsewhere in this report.) For example, on the EHS website, visitors are instructed to direct questions relating to such problems as humidity, air "stuffiness," and visible mold growth to the Physical Plant, but questions about symptoms or noxious odors should be directed to EHS.[157] The revised flowchart of communications will help to guide the formation of this contact and informational sheet. Additional recommendations include:

- The addition of an informational page on indoor air quality to the faculty and staff handbook as a way to make reporting more efficient and effective.
- The support of the IU Workers Union to initiate training requests and track IAQ complaints by employees to ensure their resolution.

### VIII.D. Building Materials

The following materials are believed to be useful in preventing mold problems inside buildings: protective fungicidal coating, Ultraviolet lighting systems, high efficiency air filters, dehumidifiers, concrete board, green board, drain pans, anti-mold paint, latex paint, and mold-resistant ceiling panels. Using such materials in the construction of new buildings or in the maintenance of old buildings on-campus may help prevent future mold problems and reduce long-term maintenance and repair costs for University buildings. For example, installing more efficient air filters would improve indoor air quality at minimal cost to the University. However, the University's level of funding received from the State of Indiana for Repair and Rehabilitation will significantly impact the University's ability to thoroughly address future mold problems that may arise in campus buildings.

Listed below is a more in-depth description of building materials useful to the prevention of mold growth:

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[154] IU Office of Environment, Health, and Safety Management, *Publications and Policies* [on-line]; available from http://www.ehs.indiana.edu/publications.html; Internet; accessed 31 March 2005.
[155] U.S. Department of Labor, Occupational Safety and Health Administration, *Health and Safety Topics: Indoor Air Quality* [on-line]; available from http://www.osha.gov/SLTC/indoorairquality/; Internet; accessed 31 March 2005.
[156] IU Office of Environment, Health, and Safety Management, *Safety Initiatives Program Training Needs Survey* [on-line]; available from http://www.ehs.indiana.edu/training/Survey%20form.doc; Internet; accessed 31 March 2005.
[157] IU Office of Environment, Health, and Safety Management, *Indoor Air Quality at IU-Bloomington* [on-line]; available from http://www.ehs.indiana.edu/indoor_air.html; Internet; accessed 31 March 2005.

- **Protective fungicidal coating**
  - EPA-registered fungicides should be sprayed on all cellulose-based building materials, such as drywall, plasterboard and plywood substitutes.[158]
  - Should apply at least two wet sprayings and one coating of an EPA-registered protective fungicide.
  - Coatings can protect materials from moisture and related mold damage.

- **Ultraviolet (UV) lighting systems (air purifier)**[159]
  - Install in return air ducts.
  - UV light possesses just the right amount of energy to break organic molecular bonds (i.e. micro mold particles) in the HVAC systems.
  - As micro mold particles in the air handling units pass by the light, the UV rays break up the molecules and destroy the mold.

- **High-quality rubber water barrier**
  - A high-quality rubber water barrier beneath the roof shingles or tiles can keep rain from entering the building.

- **High Efficiency Particulate Air (HEPA) filters in the HVAC system**
  - A replaceable HEPA filter or a top-rated electronic air cleaner removes airborne mold spores from the circulating air.
  - HEPA filters inhibit the passage of large mold spores into the HVAC unit.
  - Filters should be made of synthetic materials instead of cardboard, cotton or other organic elements in order to eliminate a potential food source for the mold.
  - Recommend 3M filters™ 3 Month Allergen Reduction Filter that contains electrostatic fibers that can capture micro mold particles in the HVAC system[160]

- **Programmable dehumidifier in the HVAC system**
  - A programmable dehumidifier in the HVAC systems can reduce indoor humidity and discourage mold growth by 30 to 40%.
  - A humidistat-controlled exhaust fan in any crawl space area is required to keep the humidity level low in the area.
  - Exhaust fans should be installed in bathrooms and kitchens and vent directly outdoors.

- **Concrete floor (or ceramic tile)**
  - Carpeting is a great place for mold to multiply especially after it has had water damage.
  - Concrete floors or ceramic tiles contain a waterproofing compound that does not easily allow mold to grow.

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[158] Health & Energy, *DangerBusters Describes How To Build A Mold-Safe Home Or Commercial Building* [on-line]; available from http://healthandenergy.com/mold-safe_construction.htm; Internet; accessed 27 March 2005.
[159] Division of Indoor Purification Systems, Inc., *About UV Light Air Purification*, [on-line]; available from http://www.surroundair.com/uv-light.htm; Internet; accessed 4 April 2005.
[160] Presentation by Mr. Dan Derheimer, Environmental Manager, Office of Environmental Health and Safety, in SPEA 272 on 3 February 2005.

- For wood floors, vinyl tile or linoleum should be installed.
- Concrete floors may contain a three-inch lip at the border that effectively creates a boundary to prevent water movement

- **Green board**[161]
  - Most drywall installed at IUB campus is made with gypsum-based drywall that is very strong when dry. Typically, the drywall panels have a thick paper wrapping that protects the gypsum core from impact and abrasion damage.
  - When the paper absorbs water and transmits it to the gypsum inside the panel, the panel loses its rigidity and either falls apart or becomes very mushy.
  - Water-resistant drywall, also called green board, is a great product when used as designed, but its use is not appropriate for areas that are exposed to constant moisture.
  - The water-resistant green board is also sensitive to stud spacing. In areas of rooms that will get heavy concentrations of water, a waterproof wall material is recommended.
  - The green board drywall is water-resistant, not waterproof.

- **Waterproof wall panel with hot-dipped galvanized fasteners and SS nails and screws**
  - Waterproof wall panels should be used behind tile and in any location where water is expected to be regularly splashed onto a wall surface.
  - Hot-dipped galvanized fasteners or even stainless steel (SS) nails and screws to fasten the wall panels to the wall studs and ceiling supports are recommended.

- **Anti-mold paint**
  - Several coats of high-quality paint will keep moisture from penetrating drywall, but this is not always the best strategy. If water gets behind the paint where the paint stops and a sink top or cabinet edge begins, damage to the drywall may start.

- **Closed Cell Foam insulation**[162]
  - It is an elastomeric material that provides for low water vapor permeability and will not support moisture absorption. It should be used exclusively in the HVAC equipment.
  - The surface of which is smooth, durable to impact, and resistant against damage does not allow potential for nutrients for mold, such as dust, to adhere on the surface.
  - Acts as its own vapor barrier
  - The lining meets the requirements for ASTM G-21, which is the most widely adopted standard test method to evaluate a product's resistance to mold growth.[163]

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[161] Tim Carter, '*Green board' drywall is resistant to moisture* [on-line]; available from *Indy Star Online*, http://www2.indystar.com/articles/4/230197-8214-053.html; Internet; accessed 27 March 2005.
[162] David Lingrey. *White Paper: Reducing Mold Growth in HVAC Equipment* [on-line]; available from *Environmental Technologies, Inc.,* http://www.enviro-tec.com; Internet; accessed March 2005.
[163] Today's Facility Manager, *Reducing Mold Concerns* [on-line]; available from http://www.facilitycity.com/tfm/tfm_04_02_news1.asp; Internet; accessed March 2005.

- **IAQ Drain Pan**[164]
  - The drain pan should be sloped toward the drain connection to allow for positive drainage.
  - The drain pan should be made from stainless steel for corrosion protection and cleanliness.
  - The pan must be externally lined with closed cell insulation to prevent surface condensation.
  - The drain connection should be located on the bottom of the pan to facilitate drainage of condensation.
  - To prevent drain line blockage and condensate standing water or overflow, a drain connection comprised of an easily removable, large diameter P-trap for cleaning and service should be used.
  - To prevent overflow, a low-energy heating coil may be attached to facilitate evaporation.
  - Fungicidal tablets can be placed in the drain pan to prevent mold growth.

- **Flat latex paint instead of vinyl wallpaper**
  - Use latex paint as a bare minimum on walls or a permeable wallpaper
  - Non-permeable vinyl wallpaper is not recommended because it can trap moisture, whether coming from outdoors or a water leak, and lead to outbreaks of mold beneath the wall covering on the surface of the gypsum wallboard[165]

- **EuroFoam Ceiling Panels**[166]
  - Mold and mildew resistant
  - Free from off-gassing and do not shed fiber as they age
  - 87% light reflectance to optimize lighting efficiency

This list of 13 building material suggestions does not represent a comprehensive list of materials that can be utilized by the University to improve the mold-resistance capabilities of buildings on campus. However, these suggestions are intended to provide the University with clear examples for how some minor upgrades in materials used to construct as well as repair and maintain University buildings can produce greater long-term benefits in respect to combating environments within buildings that foster mold growth. In short, by investing a little more in the materials used to construct new buildings or repair old ones, the University can heighten the ability of these buildings to maintain a safe and healthy environment for the staff, students and visitors that occupy them each day.

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[164] David Lingrey. *White Paper: Reducing Mold Growth in HVAC Equipment* [on-line]; available from *Environmental Technologies, Inc.*, http://www.enviro-tec.com; Internet; accessed March 2005.
[165] Philip Fairey, Subrato Chandra and Neil Moyer. *Managing Mold in Your Florida Home: A Consumer Guide* [on-line]; available from http://www.fsec.ucf.edu/bldg/science/mold/; Internet; accessed March 2005.
[166] Building Design & Construction. *Green Products: A sneak peak at the Top 10 Green Products* [on-line]; available from *Dow Jones & Reuters*, http://global.factiva.com; Internet; accessed 1 Marsh 2005.

## VIII.E. Administrative Structure and Budgeting

A very real scenario on the horizon is that Repair and Remediation (R & R) state appropriated funding continues to be an unstable source of funding for IUB's major repairs and renovation. As it is, there is a strong incentive for academic units to continue to delay investment in repairs and renovation, and an increase demand for "expedient" repairs to result. Without R & R funding, Physical Plant and the Chancellor's Office of Space Management will continue to be hampered in their ability to address the need for investment in renovation and repair. IUB must respond to this shortfall by developing short and long-term strategies to fund R & R. Regardless of whether R & R funding is appropriated by the Generally Assembly in for the 2005-07 Biennium strategizing must be led by the IUB Chancellor's Office. This strategizing must plan for continued instability.

The first recommendation is for the Chancellor's Office to clarify and publicize guidelines regarding expenditure responsibility for renovation and major repairs, addressing whether academic units are responsible for this expense. The second recommendation is to strengthen the practices of responsibility centered management by asking the IU President to require that the Risk Management Department assess the risk associated with specific renovation and repairs currently delayed, and then communicate results of this assessment to the IUB Budgetary Affairs Committee, Capital Priorities Committee, and most importantly, academic and non-academic units, in order to provide them with information on how their actions influence assessment expenditures.

The issues identified and addressed in this report regarding communication and training reflect a lack of Physical Plant accountability to the academic units who pay for these services. Increasing Physical Plant's accountability to the academic units through the Chancellor's Office administrative structure is the most effective way to assure that these training and communication issues are addresses. Therefore, a third recommendation is to change the current system of administrative accountability, so that the Physical Plant reports to the IUB Chancellor's Office.

Short term and long term strategies for the IUB Chancellor's Office to consider include:

- Issuing Bonds. Currently new construction is financed through the sale of bonds. It is a viable option to finance major repair and renovation expenses through a similar process.
- Increase private donor fundraising though IU Foundation.
- Require a portion of assessments on academic units set-aside for renovation and repair.
- Conduct an audit of physical plant operations in order to determine the feasibility of undertaking many of the recommendations proposed in this report, intended to increase responsiveness to academic and non-academic maintenance needs.

## IX. Overview of Primary Recommendations

- Increase Professional and Awareness Training
- Promote Use of Mold-Resistant Materials and Design
- Create Full-time Official BM Position for Buildings
- Improve Data Management System
- Increase Communication & Cooperation among VP's Departments (EHS & Physical Plant), and Academic Units (building managers)
- Improve Communication with Faculty, Staff, Students & Public
- Increase University Tax Transparency, Improve Implementation of RCM Principles
- Restructure Physical Plant under IUB Administration

## X. Next Steps

Given that this project was constrained to one semester, a full cost-effectiveness analysis was not feasible. The next steps in this project would include a full cost-effectiveness analysis that would detail the effects of the suggested recommendations, if implemented. This analysis would enable a clear comparison between our suggestions and the current administrative mold policy to determine the most beneficial solution.

# Appendices

APPENDIX A

## Guidelines for Moisture Prevention

US Environmental Protection Agency.
Indoor air—mold/moisture.
*Mold Resources: A Brief Guide on Mold, Moisture and Your Home: Mold Remediation in Schools and Commercial Buildings.*

Occupational Safety and Health Administration, US Department of Labor.
Indoor air quality investigation.
*OSHA Technical Manual*. Section III, chap 2.

American Conference of Governmental Industrial Hygienists Inc.
Janet Macher, editor. *Bioaerosols: Assessment and Control*. ISBN: 1-882417–29-1. 1999, 322 pages.

Canadian Construction Association.
Mold Guidelines for the Canadian Construction Industry. Standard Construction Document CCA 82. 2004.

USACHPPM
Army Facilities Management Information Document on Mold Remediation Issues. TG 277. 2002.

APPENDIX A

# IAQA Guidelines for Indoor Environments

**Quick Reference Guide to IAQA 01-2000**
**Recommended Guidelines for Indoor Environments**

| IAQA 01 Section# | Parameter | Limit/Range | References |
|---|---|---|---|
| **Physical Parameters** | | | |
| 1.1 | Temperature | Summer 73-79 F; Winter 68-74.5 F | ASHRAE 55 |
| 1.2 | Relative Humidity | 30%-65% | Florida Dept. Man. Ser. |
| 1.3 | Air Movement | 0.8 ft/s or 0.25 m/s | WHO |
| 2.0 | Ventilation (Carbon Dioxide) | 650 over ambient | ASHRAE 62 |
| 3.0 | Filtration | 25%-30% Dust Spot Efficiency | ASHRAE 52.1 |
| 4.0 | Pressurization | 1-5 Pascals &/or + Press | Florida Solar Energy Center; Lstiburek |
| 5.1 | Respirable Particulate | 50 mg/m3 | State of California, Air Resources Board |
| 5.2 | Particulate in Cleaned HVAC Systems | 1.0 mg/100 cm2 | NADCA 1992-01 |
| **Chemical Parameters** | | | |
| 6.1 | Carbon Monoxide | 9 ppm | EPA - National Ambient Air Quality Standard |
| 6.2 | Radon | 4 picoCuries/liter | EPA |
| 6.3 | Ozone | 0.05 ppm | WHO |
| 7.1 | Total Volatile Organic Compounds | 3 mg/m3 (0.64 ppm) | Molhave, 1990 |
| 7.2 | Formaldehyde | 0.06 mg/m3 (0.05 ppm) | Health & Welfare Canada |
| **Biological Parameters** | | | |
| 8.1 | Fungal Bioaerosols (culturable) | 300 CFU/m3 total; 50 CFU/m3 individual (excepting Cladosporium) | Robertson, 1997 |
| 8.2 | Bacterial Bioaerosols (culturable) | 500 CFU/m3 total; dominated by gram + organisms | WHO |

APPENDIX A

## NYC Remediation Guidelines

In all situations, the underlying cause of water accumulation must be rectified or fungal growth will recur. Any initial water infiltration should be stopped and cleaned immediately. An immediate response (within 24 to 48 hours) and thorough clean up, drying, and/or removal of water damaged materials will prevent or limit mold growth. If the source of water is elevated humidity, relative humidity should be maintained at levels below 60% to inhibit mold growth.[31] Emphasis should be on ensuring proper repairs of the building infrastructure, so that water damage and moisture buildup does not recur.

Five different levels of abatement are described below. The size of the area impacted by fungal contamination primarily determines the type of remediation. The sizing levels below are based on professional judgment and practicality; currently there is not adequate data to relate the extent of contamination to frequency or severity of health effects. The goal of remediation is to remove or clean contaminated materials in a way that prevents the emission of fungi and dust contaminated with fungi from leaving a work area and entering an occupied or non-abatement area, while protecting the health of workers performing the abatement. The listed remediation methods were designed to achieve this goal, however, due to the general nature of these methods it is the responsibility of the people conducting remediation to ensure the methods enacted are adequate. The listed remediation methods are not meant to exclude other similarly effective methods. Any changes to the remediation methods listed in these guidelines, however, should be carefully considered prior to implementation.

Non-porous (e.g., metals, glass, and hard plastics) and semi-porous (e.g., wood, and concrete) materials that are structurally sound and are visibly moldy can be cleaned and reused. Cleaning should be done using a detergent solution. Porous materials such as ceiling tiles and insulation, and wallboards with more than a small area of contamination should be removed and discarded. Porous materials (e.g., wallboard, and fabrics) that can be cleaned, can be reused, but should be discarded if possible. A professional restoration consultant should be contacted when restoring porous materials with more than a small area of fungal contamination. All materials to be reused should be dry and visibly free from mold. Routine inspections should be conducted to confirm the effectiveness of remediation work.

The use of gaseous ozone or chlorine dioxide for remedial purposes is not recommended. Both compounds are highly toxic and contamination of occupied space may pose a health threat. Furthermore, the effectiveness of these treatments is unproven. For additional information on the use of biocides for remedial purposes, refer to the American Conference of Governmental Industrial Hygienists' document, "Bioaerosols: Assessment and Control."

3.1 *Level I*: Small Isolated Areas (10 sq. ft or less) - e.g., ceiling tiles, small areas on walls

a. Remediation can be conducted by regular building maintenance staff. Such persons should receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program

to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).

b. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should be worn.

c. The work area should be unoccupied. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons recovering from recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).

d. Containment of the work area is not necessary. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.

e. Contaminated materials that cannot be cleaned should be removed from the building in a sealed plastic bag. There are no special requirements for the disposal of moldy materials.

f. The work area and areas used by remedial workers for egress should be cleaned with a damp cloth and/or mop and a detergent solution.

g. All areas should be left dry and visibly free from contamination and debris.

3.2 *Level II*: Mid-Sized Isolated Areas (10 - 30 sq. ft.) - e.g., individual wallboard panels.

h. Remediation can be conducted by regular building maintenance staff. Such persons should receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).

i. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should be worn.

j. The work area should be unoccupied. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).

k. The work area should be covered with a plastic sheet(s) and sealed with tape before remediation, to contain dust/debris.

l. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.

m. Contaminated materials that cannot be cleaned should be removed from the building in sealed plastic bags. There are no special requirements for the disposal of moldy materials.

n. The work area and areas used by remedial workers for egress should be HEPA vacuumed (a vacuum equipped with a High-Efficiency Particulate Air filter) and cleaned with a damp cloth and/or mop and a detergent solution.

o. All areas should be left dry and visibly free from contamination and debris.

3.3 *Level III*: Large Isolated Areas (30 - 100 square feet) - e.g., several wallboard panels.

A health and safety professional with experience performing microbial investigations should be consulted prior to remediation activities to provide oversight for the project.

The following procedures *at a minimum* are recommended:

p. Personnel trained in the handling of hazardous materials and equipped with respiratory protection, (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should be worn.

q. The work area and areas directly adjacent should be covered with a plastic sheet(s) and taped before remediation, to contain dust/debris.

r. Seal ventilation ducts/grills in the work area and areas directly adjacent with plastic sheeting.

s. The work area and areas directly adjacent should be unoccupied. Further vacating of people from spaces near the work area is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).

t. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.

u. Contaminated materials that cannot be cleaned should be removed from the building in sealed plastic bags. There are no special requirements for the disposal of moldy materials.

v. The work area and surrounding areas should be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution.

w. All areas should be left dry and visibly free from contamination and debris.

If abatement procedures are expected to generate a lot of dust (e.g., abrasive cleaning of contaminated surfaces, demolition of plaster walls) or the visible concentration of the

fungi is heavy (blanket coverage as opposed to patchy), then it is recommended that the remediation procedures for Level IV are followed.

3.4 *Level IV*: Extensive Contamination (greater than 100 contiguous square feet in an area)

A health and safety professional with experience performing microbial investigations should be consulted prior to remediation activities to provide oversight for the project. The following procedures are recommended:

x. Personnel trained in the handling of hazardous materials equipped with:

   i. Full-face respirators with high efficiency particulate air (HEPA) cartridges
   ii. Disposable protective clothing covering both head and shoes
   iii. Gloves

y. Containment of the affected area:

   i. Complete isolation of work area from occupied spaces using plastic sheeting sealed with duct tape (including ventilation ducts/grills, fixtures, and any other openings)
   ii. The use of an exhaust fan with a HEPA filter to generate negative pressurization
   iii. Airlocks and decontamination room

z. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).

aa. Contaminated materials that cannot be cleaned should be removed from the building in sealed plastic bags. The outside of the bags should be cleaned with a damp cloth and a detergent solution or HEPA vacuumed in the decontamination chamber prior to their transport to uncontaminated areas of the building. There are no special requirements for the disposal of moldy materials.

bb. The contained area and decontamination room should be HEPA vacuumed and cleaned with a damp cloth and/or mop with a detergent solution and be visibly clean prior to the removal of isolation barriers.

cc. Air monitoring should be conducted prior to occupancy to determine if the area is fit to reoccupy.

3.5 *Level V*: Remediation of HVAC Systems

3.5.1 A Small Isolated Area of Contamination (<10 square feet) in the HVAC System

dd. Remediation can be conducted by regular building maintenance staff. Such persons should receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).

ee. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should be worn.

ff. The HVAC system should be shut down prior to any remedial activities.

gg. The work area should be covered with a plastic sheet(s) and sealed with tape before remediation, to contain dust/debris.

hh. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.

ii. Growth supporting materials that are contaminated, such as the paper on the insulation of interior lined ducts and filters, should be removed. Other contaminated materials that cannot be cleaned should be removed in sealed plastic bags. There are no special requirements for the disposal of moldy materials.

jj. The work area and areas immediately surrounding the work area should be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution.

kk. All areas should be left dry and visibly free from contamination and debris.

ll. A variety of biocides are recommended by HVAC manufacturers for use with HVAC components, such as, cooling coils and condensation pans. HVAC manufacturers should be consulted for the products they recommend for use in their systems.

3.5.2 Areas of Contamination (>10 square feet) in the HVAC System

A health and safety professional with experience performing microbial investigations should be consulted prior to remediation activities to provide oversight for remediation projects involving more than a small isolated area in an HVAC system. The following procedures are recommended:

mm. Personnel trained in the handling of hazardous materials equipped with:

i. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended.
ii. Gloves and eye protection

iii. Full-face respirators with HEPA cartridges and disposable protective clothing covering both head and shoes should be worn if contamination is greater than 30 square feet.

nn. The HVAC system should be shut down prior to any remedial activities.

oo. Containment of the affected area:

i. Complete isolation of work area from the other areas of the HVAC system using plastic sheeting sealed with duct tape.
ii. The use of an exhaust fan with a HEPA filter to generate negative pressurization.
iii. Airlocks and decontamination room if contamination is greater than 30 square feet.

pp. Growth supporting materials that are contaminated, such as the paper on the insulation of interior lined ducts and filters, should be removed. Other contaminated materials that cannot be cleaned should be removed in sealed plastic bags. When a decontamination chamber is present, the outside of the bags should be cleaned with a damp cloth and a detergent solution or HEPA vacuumed prior to their transport to uncontaminated areas of the building. There are no special requirements for the disposal of moldy materials.

qq. The contained area and decontamination room should be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution prior to the removal of isolation barriers.

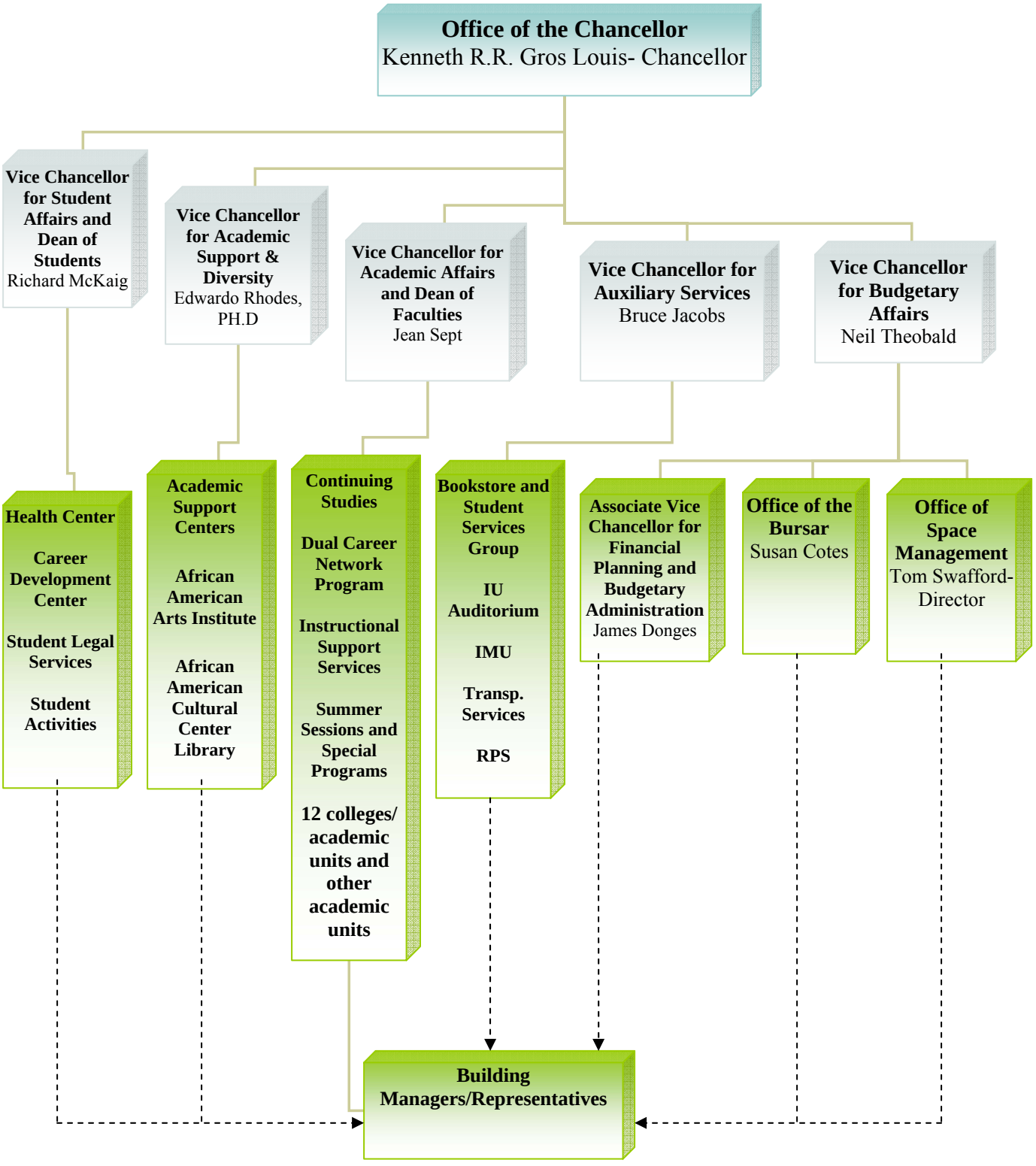
rr. All areas should be left dry and visibly free from contamination and debris.

ss. Air monitoring should be conducted prior to re-occupancy with the HVAC system in operation to determine if the area(s) served by the system are fit to reoccupy.

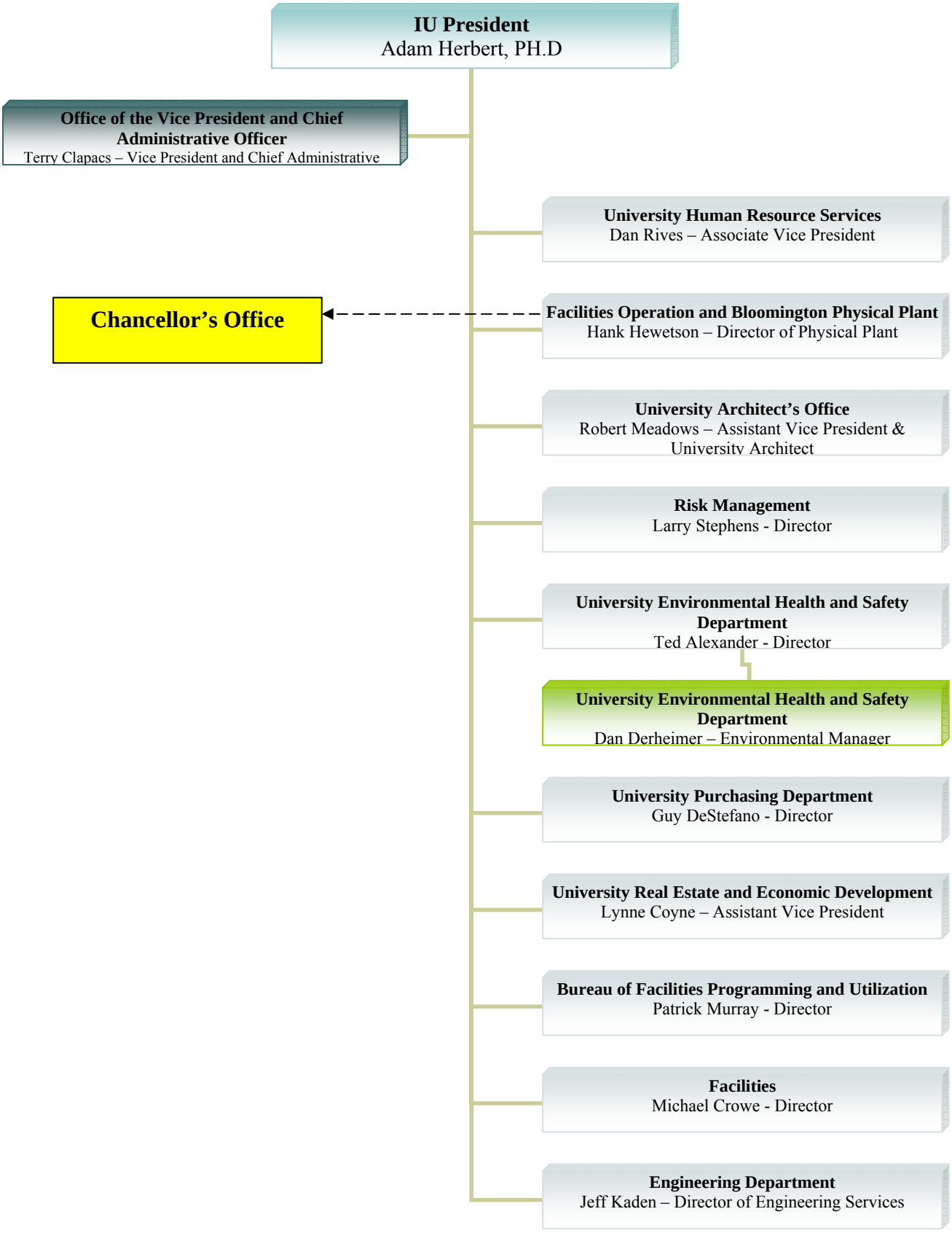
tt. A variety of biocides are recommended by HVAC manufacturers for use with HVAC components, such as, cooling coils and condensation pans. HVAC manufacturers should be consulted for the products they recommend for use in their systems.

APPENDIX B

## Chart 1. Office of the Chancellor – Organizational Chart



## Chart 2. Office of the President – Organizational Chart



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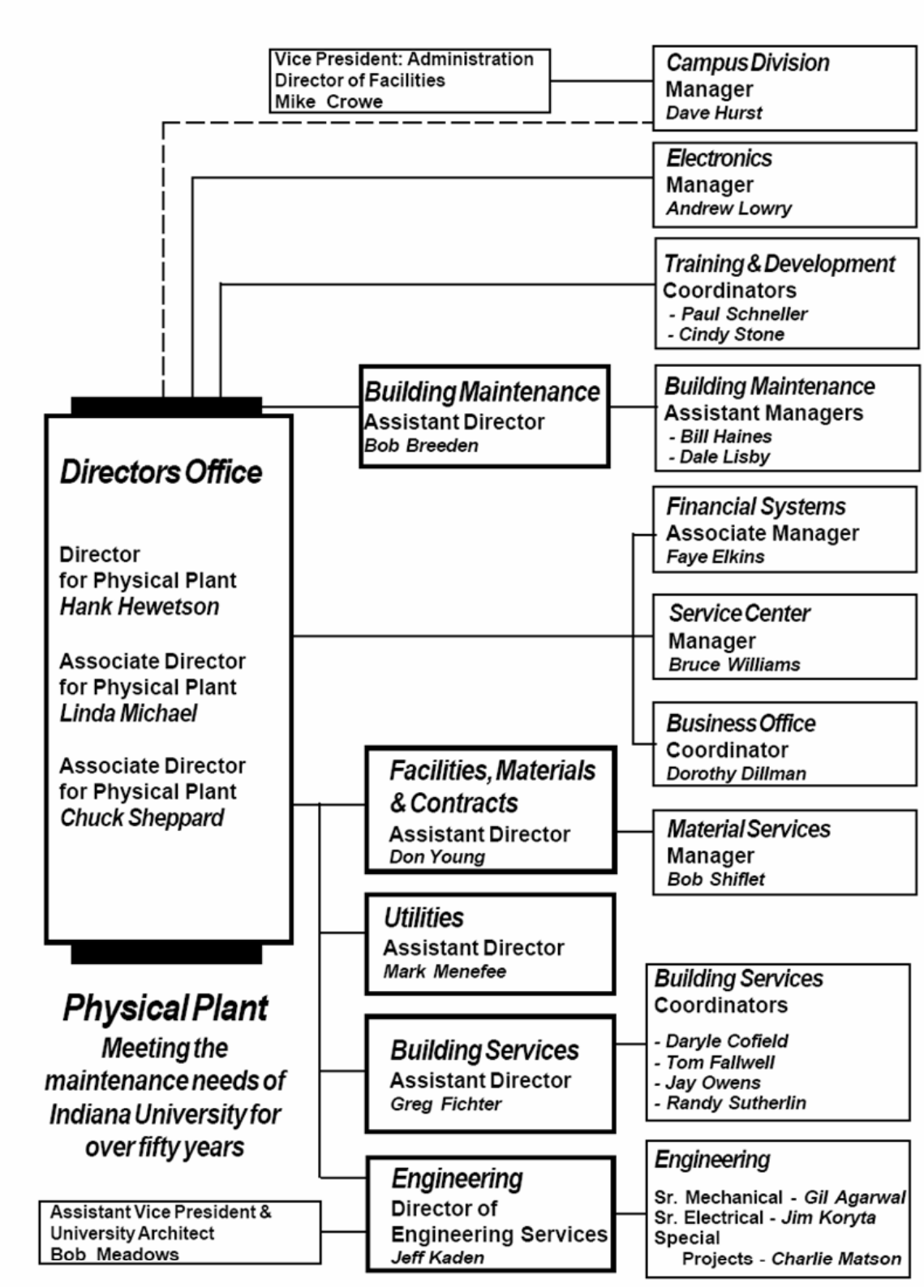
## Chart 3. Physical Plant – Organizational Chart




Available at: http://www.indiana.edu/~phyplant/html/body_organization_chart.html

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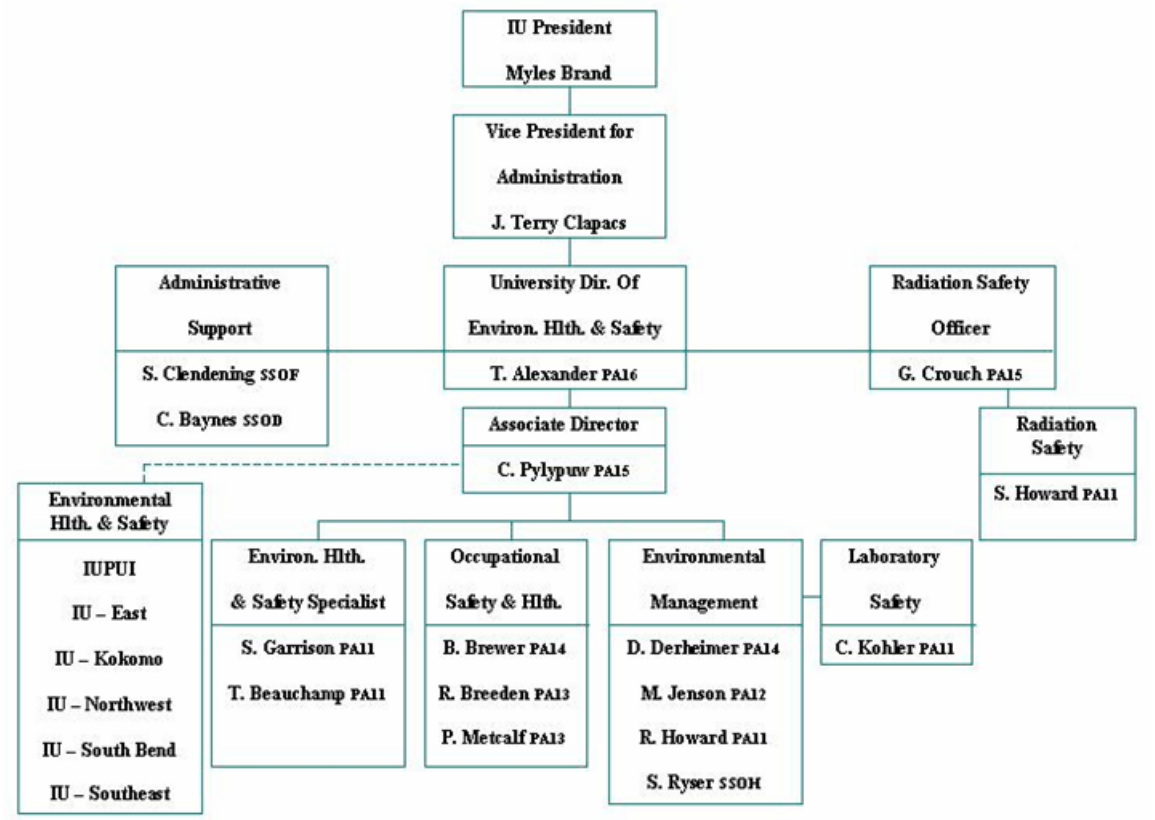
## Chart 4. Office of Environmental Health and Safety Management Organization Chart



APPENDIX C

## Building Manager Questionnaire

1. How long have you been the building manager?
2. Are you the building manager for any other buildings?
3. How many people take care of this building, how many people are on your maintenance staff for this building?
4. Who comes to you with building complaints & concerns (faculty, staff, students, custodians)? To whom do you relay those complaints and concerns?
5. When was this building built?
6. Have there been any renovations since this building was built?
7. What kind of problems do you have regarding water leaks?
   Condensation?
   Floods?
   Any other water damage?
   (sprinkler system being set off, emergency showers in labs, pipe bursts)
8. How do you and your staff respond to the above mentioned issues?
9. Are there large planters either inside or outside the building?
10. Do any parts of the building have vinyl wallpaper?
11. Do you know when the last time carpet was replaced in this building?
12. Have there been any problems with the ventilation system?
13. Do you know how often air filters are changed?
14. What type of heating and cooling system does this building have?
15. How is the roof constructed and does it have any problems with leaking?
16. Have there been any significant mold problems in this building? (requiring more than just wiping it up with solvent)?
17. If there has been mold problems in the past, do you or your staff periodically monitor the area that was affected to make sure the problem isn't re-emerging?
18. Have you or your staff ever clean mold up yourselves?
19. How quickly does the physical plant respond to notices of leaks and or mold?
20. Have you notice anything staff or students do that could possibly lead to mold growth (i.e. leaving a window cracked allowing moisture in the building for extended periods?
21. Does faculty, staff, students, or custodians ever come to you complaining of health issues regarding indoor air quality (i.e. troubled breathing)? How do you address such complaints?
22. Have you done anything special for certain individuals, such as set up an air purifier that has not been done for the whole building?
23. When a work order is placed with the physical plant regarding a building maintenance issue, do you or your staff have a system set up to keep track of all your work orders?
24. Do you follow-up on the work orders to make sure they were completed?
25. Do you receive any training from IU in regards to mold identification?
26. Do you think mold identification training would be helpful to you and your staff?
27. If you could fix any part of this building, regarding water leaks and moisture) what would be your number one priority?

APPENDIX C

## Building Manager Questionnaire Contact List

**IU Bloomington Academic and Non-Academic Buildings**

1. Alumni Center
2. Ballantine Hall
3. Bryan Hall*
4. Business-Undergraduate*
5. Ernie Pyle Hall
6. Franklin Hall*
7. HPER
8. Indiana Memorial Union
9. Informatics Building
10. Jordan Hall
11. Kirkwood Hall*
12. Law
13. Lindley Hall*
14. Main Library*
15. Morrison Hall*
16. Myers Hall
17. Neal-Marshall
18. Poplars Building
19. Psychology
20. Rawles Hall*
21. School of Optometry
22. Simon Center
23. SPEA*
24. SRSC
25. Student Building
26. Swain Hall Library
27. Sycamore Hall
28. Woodburn Hall*

**IU Bloomington Residence Halls**

1. Ashton
2. Briscoe
3. Campus View
4. Collins
5. Eigenmman
6. Everman
7. Forest
8. Foster
9. Hillcrest
10. McNutt
11. Read
12. Redbud
13. Teter*
14. Tulip Tree
15. University East & West
16. Wilkie
17. Wright

**RPS Facilities Management***

* Responded to Building Manager Questionnaire

APPENDIX C

# Building Manager Questionnaire Responses

| Building Manager Questionnaire | Lindley Hall | Kelley Business School |
|---|---|---|
| 1. How long have you been the bldg mgr? | | 10 years |
| 2. Are you the building manager for any other buildings? | | Kelley school of business buildings only |
| 3. How many people take care of this building, how many people are on your maintenance staff for this building? | | I have 2 hourly students that help me directly. The custodial staff and physical plant are not under my direct control. Hank Hewetson could answer these questions. |
| 4. Who comes to you with building complaints & concerns (faculty, staff, custodians, students)? To whom do you relay those complaints & concerns? | | All of the above. Maintenance-physical plant. Custodial-bldg services. Outdoor facilities-grounds crew. Parking-parking operations. |
| 5. When was the building built? | 1902 | undergrad: 1966, graduate: 2002 |
| 6. Have there been any renovations since this building was built? | yes, major renovation in 1991 | Largest renovation was in 1982 for the 1966 bldg. Individual classroom renovations, especially for technology began in 1988 & continued through about 2000. BU 200, 202, 425, 219, & 223 have had air handling improvements as well as new carpeting, tables and chairs. |
| 7. What kind of problems do you have regarding water leaks? Condensation? Floods? Any other water damage? | since 1993: broken water main & flood of basement, ice dam in gutters causing water to back up into building a couple of times, clogged drain in chilled water units a couple of times. | Condensation-yes. No natural flooding. Roof leaks, plumbing leaks. Sprinkler system has been set off & there have been pipe bursts. |
| 8. How do you and your staff respond to the above mentioned issues? | | Call physical plant, call bldg services, do what we can do to contain the damage until one of them arrives. |
| 9. Are there large planters either inside or outside the building? | Not that I know of. | |
| 10. Do any parts of the building have vinyl wallpaper? | Yes, there is quite a bit of wallpaper and I suspect it is all vinyl. | yes |
| 11. Do you know when the last time carpet was replaced in this building? | 1991 | In the undergrad bldg 1982 with the exception of the above mentioned rooms that received classroom renovations. |
| 12. Have there been any problems with the ventilation system? | Yes, there have been mold problems. | yes |
| 13. Do you know how often the air filters are changed? | no, don't know | contact physical plant |
| 14. What type of heating and cooling system does this building have? | don't know | contact physical plant |

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| | Lindley Hall | Kelley Business School |
|---|---|---|
| 15. How is the roof constructed and does it have any problems with leaking? | Slate roof and I'm not aware of any leaks since the renovation in 1991. | Rubber sheet with rock ballast, yes. |
| 16. Have there been any significant mold problems in this building? (requiring more than just wiping it up with solvent) | Yes. I don't know all the details but there has been significant work recently to remove mold. | P101K East wall |
| 17. If there has been mold problems in the past, do you or your staff periodically monitor the area that was affected to make sure the problem isn't re-emerging? | don't know | the source of moisture was removed so, no, we don't check it |
| 18. Have you or your staff ever cleaned up mold yourselves? | There are times when little pieces of mold will come out of the ventilation system and we have cleaned that off of tables and computers. | no |
| 19. How quickly does the physical plant respond to notices of leaks and mold? | Don't know about the mold, but they seem quick to respond to leaks.\ | Depends on how severe the leak. Generally in a timely fashion unless a severe leak, which requires immediate response, which we generally get when needed. |
| 20. Have you noticed anything staff or students do that could possibly lead to mold growth (i.e. leaving window cracked allowing moisture in the building for extended periods)? | I have seen people leaving windows open. I don't know how widespread the practice is. | no |
| 21. Do faculty, staff, students or custodians ever come to you complaining of health issues regarding indoor air quality (i.e. trouble breathing)? How do you address such complaints? | I know at least one person has. Don't know all the details but they were working from home for a while. | Yes, with a doctor's statement concerning allergies, the school provides room HEPA filters that we maintain. Also, risk mgmt has a dept. that can measure air quality; they can work w/ the physical plant to work on problems. |
| 22. Have you done anything special for certain individuals, such as set up an air purifier that has not been done for the whole building? | As noted above, one person worked from home for a while. | see above |
| 23. When a work order is placed with the physical plant regarding a building maintenance issue, do you or your staff have system set up to keep track of all of your work orders? | | yes |
| 24. Do you follow-up on the work orders to make sure they were completed? | | yes |
| 25. Do you receive any training from IU in regards to mold identification? | | no |
| 26. Do you think mold identification training would be helpful to you and your staff? | | Perhaps where mold would be obvious, however the physical plant personnel are in places that we generally don't go that are more likely to have these problems, i.e. mechanical rooms, bathroom chase areas & other areas hidden from view. |
| 27. If you could fix any part of this building, regarding water leaks and moisture, what would be your #1 priority? | | Where ever there is water, leaks do & will occur without warning. They seldom happen when you are expecting them or seldom do you see the problem coming. However, in the 1966 bldg, I am concerned about the 39 year old pipes that are no doubt corroding form the inside out. We were hoping to have a major renovation in the near future. With the current state budget problems, we are probably not going to see that in the near future. the physical plant will continue to be called upon to do more with less, to maintain an aging bldg. even the 1966 bldg. is newer than a vast majority of the buildings on campus, so the job is a big one. |

APPENDIX C

| **Building Manager Questionnaire** | **SPEA** | **Morrison Hall** |
|---|---|---|
| 1. How long have you been the building manager? | 3 years as bldg manager, but have worked here 17years | nearly one year |
| 2. Are you the building manager for any other buildings? | no | no |
| 3. How many people take care of this building, how many people are on your maintenance staff for this building? | IU Bldg Services has assigned 1 day person and 3 custodians at night to service our bldg. Many other IU employees work on bldg issues from time to time. | I have no idea, it is not *my* maintenance staff; I deal only with the supervisor when I submit my requests |
| 4. Who comes to you with building complaints & concerns (faculty, staff, custodians, students)? To whom do you relay those complaints & concerns? | I field complaints from all of the above. Depending upon the situation I may take care of the issue myself, report it to the Physical plant for service, or seek guidance from the Dean's office | Typically I just handle requests from my own dept. the Kinsey institute is upstairs and they tend to handle their own concerns and operate fairly independently. I have twice received requests from faculty who teach in one or 2 of the classrooms. I usually pass this information on to the physical plant through email and someone there passes the request on to the appropriate dept. If I know the particular dept and supervisor, I would go directly to him/her. |
| 5. When was the building built? | 1982 | 1906, but I'm not 100% sure |
| 6. Have there been any renovations since this building was built? | yes, a few areas have | yes, at several points; it was originally a dorm |
| 7. What kind of problems do you have regarding water leaks? Condensation? Floods? Any other water damage? | Yes, in the open plenums around limestone edge. Planter leaks, water or steam lines bursting, leaking interior gutters or windows and overflowing catch pans in penthouse machine room. Concrete/Limestone damage from freezing and thawing of moisture. Folks in labs defrosting freezers. | Most of our problems are with leaks. It is an old bldg & has trouble w/ pipes, leaky terraces & even the walls seep moisture. There has been at least 1 major flood in the last 5 years that was very dangerous to our collection. At this point, 1 of the 2 public restrooms in the bldg has been permanently closed b/c of the plumbing. Also, there is a terrace that perpetually leaks. I've been told by some that it has leaked for over 20 years. The outside walls also seep, bubbling & crumbling the plaster molding in our museum space. |
| 8. How do you and your staff respond to the above mentioned issues? | Look at the situation first hand and report the problems to the physical plant for them to fix. After reporting the problem, I concentrate on how I can help those affected by the problem. | I'm sure it depends on the severity. We keep our own emergency supplies to handle water leaks before someone from physical plant can get here. If it is a water leak, I always call the physical plant's emergency line, which operates 24 hours/day. |
| 9. Are there large planters either inside or outside the building? | yes, we also have folks that grow their own plants inside the bldg. | There are not any planters on the ground floor. The Kinsey institute has some planters on a terrace on the 3rd floor. |
| 10. Do any parts of the building have vinyl wallpaper? | yes | Yes, there is some very dreadful wallpaper in the women's restroom. It is mostly peeling off the wall |
| 11. Do you know when the last time carpet was replaced in this building? | Some areas have been replaced: 80% is original. | I did speak w/ someone about our carpet a few months ago. He said he'd been the one to originally lay the carpet and it'd been 20 or so years. Again, I don't know anything about the carpet in the Kinsey institute. |
| 12. Have there been any problems with the ventilation system? | yes | not since I've been here |
| 13. Do you know how often the air filters are changed? | I think they are on a 6 month cycle. Physical plant is in charge of schedule and performing maintenance. | I don't, and this has been one of my failed missions. I've continually asked to have them changed and to be updated on it, but I usually don't hear anything back and never know if they were changed or not. I've been told that the physical plant does not routinely change the filters, but only does so when it is requested. |

APPENDIX C

| | SPEA | Morrison Hall |
|---|---|---|
| 14. What type of heating and cooling system does this building have? | Steam heat/chilled water from IU utilities. | we have radiator sand ceiling units |
| 15. How is the roof constructed and does it have any problems with leaking? | Roof is the original membrane type and it leaks from time to time. | I don't know. The Kinsey institute takes up the top portion of the bldg and I don't have any information about roof leaks |
| 16. Have there been any significant mold problems in this building? (requiring more than just wiping it up with solvent) | some would say yes | we do have a history of mold problems, mostly associated with the leaky overhead forced water cooling systems, and also in the ceiling tiles when there have been slow leaks in the ;plumbing and cooling systems that have slowly saturated the porous tiles. About 3 years ago we had a staff member experiencing symptoms from this and had some of the mold tested by a local biologist. We aren't supposed to touch the mold ourselves, but have before, before we knew we shouldn't, and other times when it seemed urgent to take immediate action. In addition to this, we have several archival storage spaces in the bldg, both in the archives and upstairs in Kinsey. Mold is a major concern with us so we have our own procedures for handling mold in our collections. This is separate from the normal bldg services. |
| 17. If there has been mold problems in the past, do you or your staff periodically monitor the area that was affected to make sure the problem isn't re-emerging? | not often as some areas are not easily accessible | I believe we are always on the look out for mold. The frequent leaks & danger of having mold in an archive makes it important to monitor |
| 18. Have you or your staff ever cleaned up mold yourselves? | I'm sure we have at times | Yes, I'm sure we have. Occasionally we have mold problems on materials in the archives and that is handled according to archival standards. If it was on the bldg generally, I would call physical plant to handle it. |
| 19. How quickly does the physical plant respond to notices of leaks and mold? | It depends on many factors. As for bldg leaks they respond pretty well to anything but leaks from the planters. Mold issues are more difficult as EH&S has to identify a problem first, prior to them implementing a solution | They are very good about coming out if you indicate that it is a serious problem. |
| 20. Have you noticed anything staff or students do that could possibly lead to mold growth (i.e. leaving a window cracked allowing moisture in the building for extended periods)? | Folks do quite often leave windows open and leave food items in lockers for extended periods. | occasionally there is a window open in one of the classrooms, but that hardly compares to frequent leaks in the bldg |
| 21. Do faculty/staff/students/custodians ever complain to you of health issues regarding indoor air quality? How do you address such complaints? | Yes, I forward them to EH&S and make our own personnel office aware of the situation. | We've had some complain of breathing problems, but that was prior to my coming here. |
| 22. Have you done anything special for certain individuals, such as set up an air purifier that has not been done for the whole building? | I have | no |
| 23. When a work order is placed with the physical plant regarding a building maintenance issue, do you or your staff have system set up to keep track of all of your work orders? | there is the MMS system in place that I can track orders | absolutely |
| 24. Do you follow-up on the work orders to make sure they were completed? | Most of the time they are completed but need some follow up. | Yes, sometimes the physical plant will inform you of the status, but other times you have to be persistent and call for answers and updates. |
| 25. Do you receive any training from IU in regards to mold identification? | no, but I defer to scientists in the bldg when help is needed | no |

APPENDIX C

| | SPEA | Morrison Hall |
|---|---|---|
| 26. Do you think mold identification training would be helpful to you and your staff? | no | I'm not sure |
| 27. If you could fix any part of this building, regarding water leaks and moisture, what would be your #1 priority? | a new bldg, planter leaks | For me, it would definitely be the leaking terrace that drips into our downstairs work area. It seems unbelievable that this leak has persisted for 20 years without a known cure & that our staff sometimes has to work in an environment w/ plastic on the floor and 1/2 a dozen garbage cans catching drips. There must be a way of sealing off the problem. Having water in a sound archives is very dangerous to the collections. |

APPENDIX C

| Building Manager Questionnaire | Franklin Hall | Kirkwood Hall |
|---|---|---|
| 1. How long have you been the building manager? | I've been the Associate Bursar for 13 years, located in the Bursar Office (basement of Franklin Hall) | just this past year |
| 2. Are you the building manager for any other buildings? | | no |
| 3. How many people take care of this building, how many people are on your maintenance staff for this building? | | Building maintenance is handled by bldg services, physical plant. |
| 4. Who comes to you with building complaints & concerns (faculty, staff, custodians, students)? To whom do you relay those complaints & concerns? | Relay complaints to physical plant, Dale Lisby, EH&S | complaints/concerns from Kirkwood college staff comes to Lynn Keller and she contacts physical plant |
| 5. When was the building built? | | 1894 |
| 6. Have there been any renovations since this building was built? | Renovation over the last year; perpetual construction, 8 years ago construction on the south side of building to shore up moisture in planters. Still having moisture problems; although it has been better since the renovation. | I don't know the history of renovations on the bldg. Sewer pipes had to be replaced perhaps 10 years ago when sewage was backing up in the restrooms. I remember some kind of chemical treatment that was used was making staff sick in the basement. It was a real inconvenience since we couldn't use the restrooms while they were replacing the pipes. The fire escape was rusting for years & was finally treated about a year ago. Several offices have been remodeled over the years. |
| 7. What kind of problems do you have regarding water leaks? Condensation? Floods? Any other water damage? | East side of building: windows collect water | I know of 1 instance in either the late 80's or early 90's when a pipe burst on the 3rd floor during Christmas break & water flooded down into the 2nd & 1st floor, including the dean's office, damaging walls, ceilings, carpet and wallpaper. |
| 8. How do you and your staff respond to the above mentioned issues? | Contact Physical Plant for moisture problems; go directly to Dale Lisby for problems to speed up the process. They don't bother with zone managers; it is the physical plant's responsibility. Takes a lot of brow beating to get something done. The biggest problem in handling these problems is people continually handing the problem off and the lack of budget money for remediation. Who do we go to with this problem and how is it paid for? | we would immediately call bldg services |
| 9. Are there large planters either inside or outside the building? | yes | a couple on the west entrance, I think |
| 10. Do any parts of the building have vinyl wallpaper? | | yes, KH104 definitely has it |
| 11. Do you know when the last time carpet was replaced in this building? | There was mold in the carpet, replaced in the past few years in the bursar's office | Don't know about the whole bldg. Some offices have been re-carpeted |
| 12. Have there been any problems with the ventilation system? | Yes, in the past they call when problems with the air system are suspected | For years the 2 mens' bathrooms had no ventilation. It's only been in the last year or so that an air conditioner was installed in 1 and I believe a ceiling fan in the other. |
| 13. Do you know how often the air filters are changed? | Not sure of filter changing schedule. | no |

APPENDIX C

| | Franklin Hall | Kirkwood Hall |
|---|---|---|
| 14. What type of heating and cooling system does this building have? | | Very old system: no central air & steam heat, which sometimes causes clanky, noisy radiators. We have window air conditioners only in offices & some bathrooms. Hallways are quite hot & stuffy in the summer. |
| 15. How is the roof constructed and does it have any problems with leaking? | | don't know |
| 16. Have there been any significant mold problems in this building? (requiring more than just wiping it up with solvent) | Yes, in the bursar's office; In room 230A, there was mold in the air diffuser→ windows didn't close all the way | yes, several rooms have needed extensive cleaning/painting/re-flooring to eliminate the mold problem- 202 &207 to mention 2 |
| 17. If there has been mold problems in the past, do you or your staff periodically monitor the area that was affected to make sure the problem isn't re-emerging? | No, we just keep calling and complaining, there are no scheduled inspections now that mold history has been established. | no, we rely on staff members to report any problems |
| 18. Have you or your staff ever cleaned up mold yourselves? | | not me |
| 19. How quickly does the physical plant respond to notices of leaks and mold? | | quickly with an assessment, not so quick with the fix |
| 20. Have you noticed anything staff or students do that could possibly lead to mold growth (i.e. leaving a window cracked allowing moisture in the building for extended periods)? | Windows are sealed in the basement and cannot be opened, vents are ceiling vents; Don't know if there have been problems upstairs | Water has been left on in a sink in a custodial closet within 207. Windows leaking in 001 causing flooding down the walls & floors. |
| 21. Do faculty, staff, students or custodians ever come to you complaining of health issues regarding indoor air quality (i.e. trouble breathing)? How do you address such complaints? | Yes. | Yes, several staff have reported chronic respiratory problems attributed to mold. |
| 22. Have you done anything special for certain individuals, such as set up an air purifier that has not been done for the whole building? | One person with severe respiratory problems was moved to a different part of the building, not much of a solution. | not beyond completely re-doing the paint and carpeting in rooms, no. |
| 23. When a work order is placed with the physical plant regarding a building maintenance issue, do you or your staff have system set up to keep track of all of your work orders? | | I print off a copy of the work order and keep it in a pending file until it's completed. |
| 24. Do you follow-up on the work orders to make sure they were completed? | yes | yes |
| 25. Do you receive any training from IU in regards to mold identification? | | none |
| 26. Do you think mold identification training would be helpful to you and your staff? | | No, don't we have physical plant people who already know this stuff? |
| 27. If you could fix any part of this building, regarding water leaks and moisture, what would be your #1 priority? | Would like to see more preventative measures regarding moisture. | Re-seal windows, or open them up but make them tight when they are closed. Also, some of the air vents have let in rodents- those could/should be secured. |

APPENDIX C

| Building Manager Questionnaire | Woodburn Hall | Bryan Hall | Main Library | Rawles Hall |
|---|---|---|---|---|
| 1. How long have you been the building manager? | 5 years | 20+ years | 21 months | Only informally "building manager", no date assigned duty. |
| 2. Are you the building manager for any other buildings? | no | no | no | no |
| 3. How many people take care of this building, how many people are on your maintenance staff for this building? | Unknown; maintenance staff works through the physical plant. | Physical plant provides maintenance to this bldg. We have 1 day janitor who also takes care of 2 other buildings at night. Offices are cleaned once a week. | No maintenance staff reports to me. All maintenance work is conducted by the physical plant. | physical plant does maintenance |
| 4. Who comes to you with building complaints & concerns (faculty, staff, custodians, students)? To whom do you relay those complaints & concerns? | Anyone who is in the bldg. And sees problems; they are forwarded to physical plant operations or bldg. Services. | Most are faculty & staff who works in the bldg. Issues are reported to physical plant. | physical plant | If there are concerns, then Dr. Hoff would contact Physical plant. |
| 5. When was the building built? | don't know | 1936 | 1969 | |
| 6. Have there been any renovations since this building was built? | yes, but not sure when | yes, but mostly a room by room as needs change, nothing major for the bldg. | only minor renovations | crescent renovations in early 1990's |
| 7. What kind of problems do you have regarding water leaks? Condensation? Floods? Any other water damage? | we've had some roof leaks | a few roof leaks | Some condensation around uninsulated vents during high humidity levels in the summer. No flooding from natural elements. Minor damage during a pipe break in the sub basement | Major problem with the flat portions of the roof above the buildings stairwells. When it rains, water leaks behind the walls & has caused the plaster to weaken & crumble numerous times. Physical plant has responded to this problem by fixing the plaster & repainting the damaged areas. As far as I know, there has been no inspection of the damage w/n the walls caused by these water leaks. Dr. Hoff also noted that because the roof is slate tile, it is extremely expensive to fix, so the plaster fix is an extremely cheap alternative. |
| 8. How do you and your staff respond to the above mentioned issues? | report them to physical plant | all issues are reported to the physical plant | we contact physical plant | Physical plant is called in to fix it. |
| 9. Are there large planters either inside or outside the building? | not as I recall | no | outside | |
| 10. Do any parts of the building have vinyl wallpaper? | not sure what the wall coverings are made of | Yes, nothing new for several years. Most have been painted over | yes | |
| 11. Do you know when the last time carpet was replaced in this building? | some in 1999 perhaps | Last year carpet in room 103 was replaced. Carpet is replaced as needed; nothing for the entire bldg. | some areas are brand new, others are original to the bldg | |

APPENDIX C

| | Woodburn Hall | Bryan Hall | Main Library | Rawles Hall |
|---|---|---|---|---|
| 12. Have there been any problems with the ventilation system? | No that I'm aware of. | Nothing major; old bldg/old system. | no | not that he is aware of |
| 13. Do you know how often the air filters are changed? | no, that's physical plant again | Not sure as physical plant maintenance staff takes care of this; a guess would be twice/year. | quarterly | |
| 14. What type of heating and cooling system does this building have? | Unknown. | Heat is from IU power plant, steam & cooling is from the central chilled water plant. | not water and chilled water | |
| 15. How is the roof constructed and does it have any problems with leaking? | unknown, some leaks (though few of late) | no major problems with leaks | Rubber membrane with ballast. No active leaks. | slate tile roof, mostly slanted, but flat above stairwells- leaks are a problem (see Q#7) |
| 16. Have there been any significant mold problems in this building? (requiring more than just wiping it up with solvent) | not that I know of | no | Some mold from past roof problems, mostly isolated to 5 west. | Not aware of any significant problems, but suspects mold issues behind walls in stairwells because of excessive water damage. |
| 17. If there has been mold problems in the past, do you or your staff periodically monitor the area that was affected to make sure the problem isn't re-emerging? | | no | only visual monitoring for roof leaks | |
| 18. Have you or your staff ever cleaned up mold yourselves? | not the POLS staff, but that wouldn't be our responsibility | no | no | |
| 19. How quickly does the physical plant respond to notices of leaks and mold? | don't know | most time within hours | Physical plant responds in a reasonable time. In my limited amount of time here, I've not used them to clean up mold. | |
| 20. Have you noticed anything staff or students do that could possibly lead to mold growth (i.e. leaving a window cracked allowing moisture in the building for extended periods)? | no | no | no | |
| 21. Do faculty, staff, students or custodians ever come to you complaining of health issues regarding indoor air quality (i.e. trouble breathing)? How do you address such complaints? | 1 complaint when fumes from solvent were brought through ventilation system; reported it and it was addressed by physical plant and EH&S. | very few | Only minor issues, especially if a strange odor appears. I usually go directly to the areas to evaluate the complaint. | No- and Dr. Hoff stated that if there were concerns, people would come to him to address the concern. |
| 22. Have you done anything special for certain individuals, such as set up an air purifier that has not been done for the whole building? | no | Yes, we have recommended an air purifier for a few people. Their dept. purchased them working w/ EH&S. | no | no |

APPENDIX C

| | Woodburn Hall | Bryan Hall | Main Library | Rawles Hall |
|---|---|---|---|---|
| 23. When a work order is placed with the physical plant regarding a building maintenance issue, do you or your staff have system set up to keep track of all of your work orders? | No | Yes, as a building manager. Physical plant will check w/ us, most of the time. | I track work orders I submit and monitor their progress | |
| 24. Do you follow-up on the work orders to make sure they were completed? | Only if complaints are received or problem is urgent. | yes | yes, by inspecting the site to determine if the work is done | |
| 25. Do you receive any training from IU in regards to mold identification? | no | no | no | |
| 26. Do you think mold identification training would be helpful to you and your staff? | given that we don't patrol/monitor the bldg, probably not; any problems are reported to physical plant, who have the responsibility & training to address such problems | no | yes | |
| 27. If you could fix any part of this building, regarding water leaks/moisture, what would be your #1 priority? | Our concerns in that regard have been addressed through roof repair and tuck pointing. | I would install new windows. | At this time, we have no leaks and moisture is not my biggest problem. | The stairwells- roof issues |
| N.B. | | | | Dr. Hoff thinks there definitely should be someone that serves exclusively as the building manager for Rawles Hall. He noted that the physical maintenance and general implementation of IU guidelines for items such as commercial advertisement and solicitation as well as other aspects largely goes uncontrolled because there is no one assigned explicitly to perform these duties. |

APPENDIX C

| **Building Manager Questionnaire** | **RPS Facilities Management** |
|---|---|
| 1. How many people take care of each residence hall, how many people are on your maintenance staff for each building? (Please give us a sense of average sizes by building types: dorms and apartments) | Each residence hall has one maintenance person who is responsible for all local maintenance within the center. This would be maintenance that can be performed by one person locally. "larger" maintenance items are performed by outside skilled craft staff. Environmental Operations staff (Custodians) has an average of 10-15 staff per center. These staff is responsible for cleaning of all center areas. The average size of our residence halls: accommodates 1000 residents, approximately 600 rooms. |
| 2. What kind of mold-related maintenance problems have you had? What is the most common problem/cause in residence halls? | Mold related problems that we have had have been related to air ventilation system or the lack of air ventilation. Most recently, a center experienced some minor mold problems in rooms when cool room air mixed with more humid hallway air. The result was mold around window frames. The solution was to insure hallway ventilation was operating at all times. |
| 3. How do you and your staff respond to the above-mentioned issues? | The standard response when mold is discovered is for Environmental Operations to clean the mold surfaces with heap filtered vacuums and cleaning chemicals to destroy the mold spores. At the same time as cleaning occurs, maintenance staff and staff from Environmental Health and Safety inspect the area to determine the cause of the mold and to determine solutions. During these procedures, residents are informed of the problem and are moved to other accommodations if necessary. Later on, maintenance staff follows up to insure the solution to the problem has been successful. |
| 4. Are there large planters either inside or outside residence halls? | None inside. We have periodically had some planters installed seasonally outside our halls. One example would be around Wright Quad during orientation housing. Any planters inside our buildings hold artificial plants |
| 5. Do any parts of buildings have vinyl wallpaper? | Yes, we have some vinyl wallpaper in some of our dining areas and some large public spaces. There is no vinyl wallpaper in residential rooms. |
| 6. Do you know any (potential) mold problems caused by old carpets? Do you know how often carpets are replaced in residence halls? | We have not had any mold problems occur with "old" carpeting. The hall way carpeting in our centers is on a seven year rotation. So, at least every seven years, hallway carpeting is totally replaced as a general rule. When we have carpeting in student rooms get wet from broken plumbing, the sectional piece is replaced or if is wall to wall carpet, the carpet is dried, cleaned and all water is extracted. |
| 7. Have there been any problems with the ventilation system? | Our ventilation systems have been virtually problem free. In the past few years we have added on some mechanical parts to some hall ventilation systems that warm the air so the air is dried out before it mixes with room air conditioned air. The drier the air, the less chance for mold spores to form and grow. |
| 8. Do you know how often air filters are changed? | Air filters for public areas are changed 2 – 3 times per year. Air filters for room air conditioning units in our centers where air conditioning is available are changed 2 – 3 times per year. |
| 9. What type of heating and cooling system do residence halls have? | The heating systems in our centers are primarily steam heat. The cooling systems are chilled water systems. |
| 10. How is the roof constructed and does it have any problems with leaking? | The majority of the center roofs are a rubber membranes type with Styrofoam insulation. We have had occasional leaks as a result of roof damage and the leaks are promptly repaired. This was one of the prime reasons why we have closed our sundeck areas in centers. Traffic on the sundecks caused damage to our roof areas which in some cases caused leaks. |

APPENDIX C

| | **RPS Facilities Management** |
|---|---|
| 11. Do you or your staff periodically monitor the area that was affected by mold problems to make sure the problem isn't re-emerging? | Yes, as mentioned in #3 above, follow up is a priority to insure problems do not re-occur. |
| 12. Have you or your staff ever cleaned mold up by yourselves? | Yes, our Environmental Operations staff cleans up mold when it is encountered and is trained in proper cleaning procedures by Environmental Health and Safety |
| 13. How quickly does the physical plant respond to notices of leaks and or mold? | When we encounter leaks or mold, our expectation for Physical Plant staff is to address the area the day it is discovered. Our halls are the homes of residents and so keeping their environment clean and safe is our top priority. |
| 14. Have you noticed anything staff or students do that could possibly lead to mold growth (i.e. leaving window cracked allowing moisture in the building for extended periods?) | In some cases when residents have windows open in a room with air conditioned air and it mixes with warm humid air, the potential for mold growth is greater. This only occurs in the early fall if the humidity is high. So our center staff communicate to residents, when the ac is on, your windows are to be closed. We have had some students set up dryer racks in their rooms to dry towels or wet clothing. This can be a source of excessive moisture introduced to a room. Also, some students have placed humidifiers in rooms, also introducing in some cases excessive moisture. |
| 15. Have you done anything special for certain individuals, such as set up an air purifier that has not been done for the whole building? | No. Many residents purchase their own air purification systems locally. We have occasionally installed dehumidification units in hallways where mold problems have occurred. The solution in these cases have been that the building ventilation system was not operating consistently, i.e. system was off due to a power failure, etc. |
| 16. When a work order is placed with the physical plant regarding a building maintenance issue, do you or your staff have a system set up to keep track of all your work orders? | Yes. Our center Residential Operations staff track all work orders to be sure they have been completed. In addition, Residence Managers perform monthly audits to insure work requests are completed and charged properly. |
| 17. Do you follow-up on the work orders to make sure they were completed? | As stated above, being sure that all work requests are completed is essential. |
| 18. What kind of mold prevention options has been considered during the past building renovations? | In the design or renovation of centers, being sure the most current HVAC systems are installed by the builder. Part of these HVAC system would be dehumidification systems built into the system. |
| Is there a plan to consider the following mold-prevention options? Or were they already implemented? | the ceiling tile installed is mold resistant.<br>b. Use of green boards – green boards have been used in new construction like Willkie as a method to cover walls and will not absorb moisture and retain moisture.<br>c. No wall paper – we are getting away from wallpaper as we renovate.<br>d. Mold resistant paint – all paint being used currently is mold resistant.<br>e. Use of catch pans under water pipes – there are catch pans within room air conditioning units and these pans are cleaned on the same schedule as air filter replacement.<br>f. Positive pressure of the building (if the building has negative pressure) – with all new construction like Willkie and soon Ashton, tempered air is introduced into public spaces. This air is conditioned to be cool and dry so when it mixes with other air from rooms, the possibility of mold occurring is reduced from excessive moisture.<br>g. Etc.? |

APPENDIX D

# Table 1. 2004-05 General Fund Budget by Responsibility Center

| Campus and Center | Student Fee Income | Indirect Cost Recovery | Other Income | Subtotal | State Appropriations | Assessment | Total |
|---|---|---|---|---|---|---|---|
| BLOOMINGTON | | | | | | | |
| Arts & Sciences | $181,226,454 | $8,000,000 | $529,000 | $189,755,454 | $80,277,654 | ($109,906,270) | $160,126,838 |
| Health Sciences | $2,668,707 | $0 | $0 | $2,668,707 | $691,915 | ($1,758,828) | $1,601,794 |
| Journalism | $3,918,133 | $0 | $71,800 | $3,989,933 | $2,476,116 | ($2,268,430) | $4,197,619 |
| School of Business | $55,350,953 | $32,500 | $88,000 | $55,471,453 | $16,081,288 | ($24,248,119) | $47,304,622 |
| School of Education | $24,209,964 | $612,500 | $22,400 | $24,844,864 | $11,013,119 | ($13,340,992) | $22,516,991 |
| School of HPER | $23,777,177 | $190,000 | $62,000 | $24,029,177 | $13,627,275 | ($19,420,258) | $18,236,194 |
| School of Law | $12,197,014 | $0 | $4,000 | $12,201,014 | $9,584,188 | ($6,502,880) | $15,282,322 |
| Library and Info Science | $3,413,791 | $38,000 | $7,300 | $3,459,091 | $1,619,786 | ($1,473,268) | $3,605,609 |
| School of Music | $22,316,213 | $0 | $73,300 | $22,389,513 | $22,543,042 | ($15,782,533) | $29,150,022 |
| School of Optometry | $6,485,976 | $333,125 | $3,317,020 | $10,136,121 | $2,676,046 | ($3,505,001) | $9,307,166 |
| Other Academic Programs | $19,421,476 | $0 | $0 | $19,421,476 | $1,413,391 | ($2,282,075) | $18,552,792 |
| Public and Environ Affairs | $13,986,658 | $750,000 | $141,912 | $14,878,570 | $5,708,638 | ($7,078,689) | $13,508,519 |
| Informatics | $1,839,141 | $5,000 | $15,100 | $1,859,241 | $8,688,950 | ($1,568,610) | $8,979,581 |
| Subtotal, Academic | $370,811,657 | $9,961,125 | $4,331,832 | $385,104,614 | $176,401,408 | ($209,135,953) | $352,370,069 |
| Dean of Faculties | $744,188 | $0 | $15,000 | $759,188 | $0 | $15,394,813 | $16,154,001 |
| Research & Univ Grad Sch | $584,584 | $2,000,000 | $500 | $2,585,084 | $0 | $16,125,304 | $18,710,388 |
| Academic Computing | $7,084,604 | $0 | $237,000 | $7,321,604 | $0 | $9,317,908 | $16,639,512 |
| Library | $0 | $2,910 | $407,585 | $410,495 | $2,157,328 | $24,444,774 | $27,012,597 |
| Student Support | $0 | $0 | $0 | $0 | $0 | $2,475,913 | $2,475,913 |
| Vice Pres-General Admin | $0 | $0 | $3,000 | $3,000 | $0 | $2,888,378 | $2,891,378 |
| Vice Pres-Acad Affairs | $0 | $0 | $362,000 | $362,000 | $8,325,115 | $8,357,949 | $17,045,064 |
| Enrollment Services | $1,391,706 | $0 | $1,223,544 | $2,615,250 | $0 | $28,904,754 | $31,520,004 |
| Diversity & Acad. Sppt. | $0 | $36,000 | $90,618 | $126,618 | $0 | $6,555,046 | $6,681,664 |
| Dean of Budget-Stdnt Sup | $1,490,100 | $0 | $1,801,500 | $3,291,600 | $0 | $8,375,230 | $11,666,830 |
| Dean of Budget-Gen Admin | $0 | $0 | $1,831,460 | $1,831,460 | $0 | $6,724,251 | $8,555,711 |
| Physical Plant | $0 | $0 | $437,050 | $437,050 | $0 | $50,665,498 | $51,102,548 |
| Intercampus Transfers | $0 | $0 | $0 | $0 | $3,432,696 | $28,906,135 | $32,338,831 |
| Subtotal, Support | $11,295,182 | $2,038,910 | $6,409,257 | $19,743,349 | $13,915,139 | $209,135,953 | $242,794,441 |
| Facilities Debt Service | $0 | $0 | $0 | $0 | $21,237,515 | $0 | $21,237,515 |
| Total | $382,106,839 | $12,000,035 | $10,741,089 | $404,847,963 | $211,554,062 | $0 | $616,402,025 |

# Physical Plant Funding Responsibilities
# Indiana University Bloomington

*Physical Plant's mission is to operate and maintain a high-quality physical environment to enhance student learning, faculty teaching and research.*

We provide facilities maintenance, operation and improvements and other types of services.

Physical Plant currently employs a staff of 660 who provide facilities maintenance, renovation and other services for over 14 million square feet of building space in 300 buildings located on 2000 acres of land.

PHYSICAL PLANT FUNDING RESPONSIBILITY

The Physical Plant General Fund is used for maintenance and general upkeep of existing non-auxiliary facilities. This includes cleaning and maintenance of academic buildings, campus grounds keeping and landscaping, facility operation, exterior campus lighting and all utility distribution systems except telephone and data. Physical Plant generates steam and chilled water and manages campus utility usage (electric, gas, water and sewer). Also provided are Engineering services, energy management and equipment monitoring.

Basic building systems include:

- *Building Structures and Envelopes* (permanent fixed walls, roofs, floors, ceilings, windows, doors, locks, paint, basic daily cleaning (public areas), weekly cleaning (private offices), bi-annual and annual cleaning, recycling and trash removal, pest control…)
- *HVAC* (heat, ventilation and air conditionings systems…)
- *Plumbing* (restrooms, drinking fountains, fire safety, utilities to laboratories…)
- *Electric and Natural Gas Distribution Systems* (general building power systems, lights, elevators, building safety and security systems, fire alarms, central clocks, emergency generators…)
- *Classrooms and Teaching Labs* (furniture, audio visual screens, chalkboards, whiteboards…)
- *Building-wide Distribution Systems In Support Of Research Labs* (compressed air, distilled water, gas and nitrogen piping up to, and including, shut off valves supporting departmental equipment; exhaust fans and ductwork down to, but not including departmental exhaust hoods…)
- *Basic Signage* (standard exterior building identification signs, standard room location signs.)

DEPARTMENT FUNDING RESPONSIBILITY

All other services are funded through charge-back to departmental accounts, based on hourly labor rates, for non-academic facility maintenance and other services.

Examples of services billed to departmental account numbers:

- *Departmental Equipment* (installation, modification, replacement or maintenance of furnishings and equipment which purpose is to serve a specific office, research or program activity or to meet special environments or unique departmental requirements. Examples are: office furnishings and partitions, computers and peripherals, electronic classroom technology, and research lab equipment such as autoclaves, freezers, cage washers, dish washers, ice machines, dust collection systems, lab chillers, lab air compressors, exhaust hoods, lab benches and fixtures, built-in or free-standing walk-in environmental chambers, nitrogen generators, specialized electronic equipment…)
- *Renovation* (architectural, mechanical and electrical systems, associated abatement, new environmental systems, key and lock changes, special signs, special equipment and technology…)
- *Moving and Setups* (moving departmental furnishings and equipment, event setup…)
- *Special Services* (excess refuse removal, special custodial services, special event support services, after-hours call-outs for non-maintenance requests…)
- *Other Services* in support of program revenue funded operations (Auxiliaries)

These are general guidelines. There may be some variation for individual facilities. Please contact your Building Representative or the Physical Plant Service Center at 855-8728 or phypltbl@indiana.edu for questions or comments.

Updated October 2004

# Table 1. Physical Plant's Mold Remediation & Building Integrity Costs Updated October 2004

**Actual Expenditures, 2000-2004**

| | |
|---|---|
| Misc. Mold related service requests | $80,400 |
| service requests identifying cleaning repair and remediation related to mold problems | |
| Large scale remediation projects | $248,800 |

**Annual Expenditures, 2000-2004**

| | |
|---|---|
| Average Annual Preventative Maintenance | $150,000 |
| regular scheduled PM of air handling equipment. Includes airhandler cleaning/filter replacement | |
| Average Annual Exterior Wall Repair | $100,000 |
| e.g., Tuck pointing. Does not include R&R funded repairs | |

**Building Envelope Deferred Maintenance (estimated backlog of repairs eligible for R&R funding)**

| | |
|---|---|
| Roof repair/replacement | $6,983,000 |
| Includes 6-8 roofs | |
| Window repair/replacement | $14,009,000 |
| Exterior wall repair | $3,670,000 |

## Table 2. Physical Plant Functional Expenses

| | 2004-05 | 2003-04 | 2002-03 | 1996-97 |
|---|---|---|---|---|
| Instruction | | $298,643,679 | $273,165,537 | |
| Research | | $81,713,388 | $67,880,426 | |
| Public Service | | $57,895,699 | $55,184,765 | |
| Academic Support | | $59,131,657 | $49,040,151 | |
| Student Services | | $38,294,310 | $32,623,332 | |
| Institutional Support | | $94,584,055 | $72,726,243 | |
| Physical Plant | $52,000,000 | $54,422,460 | $52,100,429 | $39,900,000 |
| Scholarships & Fellowships | | $49,243,164 | $42,496,610 | |
| Auxiliary Enterprises | | $143,326,654 | $146,306,847 | |
| Depreciation | | $53,551,775 | $56,260,757 | |
| Total Operating Expenses | | $930,806,842 | $847,785,097 | |

Source: http://factbook.indiana.edu/fbook03/expend03.html

APPENDIX E

## Table 3. Facilities Condition Summary: Buildings Containing Academic/Administrative Space

| | Satisfactory | Under Construction | Remodel | Terminate | Total | Percent Terminate/ Remodel |
|---|---|---|---|---|---|---|
| ***2001*** | | | | | | |
| Bloomington | $1,664,703 | $162,833 | $2,819,851 | $143,978 | $4,791,365 | 62% |
| Indiana University System | $3,700,892 | $347,470 | $5,099,358 | $329,414 | $9,477,134 | 57% |
| Percent to Bloomington | 45% | 47% | 55% | 44% | 51% | 196% |
| ***2003*** | | | | | | |
| Bloomington | $1,914,255 | | $2,863,809 | $124,372 | $4,902,436 | 61% |
| East | $122,648 | | $48,719 | | $171,367 | 28% |
| Kokomo | $199,256 | | $93,294 | | $292,550 | 32% |
| Northwest | $98,376 | $63,955 | $263,838 | $37,688 | $463,857 | 65% |
| South Bend | $214,602 | | $296,583 | $21,116 | $532,301 | 60% |
| Southeast | $11,750 | | $231,177 | | $342,927 | 67% |
| IUPUI | $1,284,138 | $197,133 | $1,398,802 | $155,767 | $3,035,840 | 51% |
| Indiana University System | $3,945,025 | $261,088 | $5,099,358 | $338,943 | $9,741,278 | 56% |
| Percent to Bloomington | 49% | 0% | 56% | 37% | 50% | |

Conditions of Space Reported by institutions utilizing the following criteria:

a) Satisfactory- suitable for continued use with moral maintenance
b) Remodel- planned for remodeling space within the next 10 years
c) Terminate- scheduled for sale, demolition, or relinquishment within ten years

Source: Physical Facilities of Indiana Public Higher Education: Their Location, Value, Condition and Utilization, Fall 2001, p.9; Physical Facilities of Indiana Public Higher Education: Their Location, Value, Condition and Utilization, Fall 2003, p.9

APPENDIX F

# REQUEST FOR SERVICES

## Indiana University

## Office of the Vice President & Chief Administrative Officer

Forward completed form to the Department of Facilities
Service Building BL421, 700 N. Walnut Grove, Bloomington, IN 47405

**Campus**_____ **User Department/Office** _____

**User Representative** _____**Telephone**_____ **E-mail**_____

**Project Location:** Please specify address, building, and room numbers (attachment as required)

---

**Project Description:** (include approximate gross square footage)

_____

**Project Funding:** Account Number and Title_____

**Statement of need and required timing:** _____

**Types of Services Requested:**
Enter numbers for services desired: ___/___/___/___/___/___/___/___/___/ (for services listing, see below)
For "other" services, describe briefly:

_____

**Services**

**1.** Feasibility or Evaluation Study
**2.** Programming Assistance
**3.** Preliminary Design
**4.** Preliminary Cost Estimate
**5.** Contract Documents
**6.** Capital or Major Repair Request Preparation
**7.** OSHA Advice/Inspection
**8.** Architectural
**9.** Engineering – Mechanical
**10.** Engineering – Electrical
**11.** Landscape
**12.** Interiors
**13.** General Plant Operations
**14.** Grounds Maintenance
**15.** Building Services
**16.** Training
**17.** Roof Testing & Analysis
**18.** Roofing – Contract Documents
**19.** Other – please specify

# APPENDIX F

| | Signature | Date |
|---|---|---|
| Departmental Administrative Officer: | _____ | _____ |
| Campus Plant Director: | _____ | _____ |
| Campus Administrative Officer: | _____ | _____ |
| Campus Vice President / Chancellor: | _____ | _____ |
| Vice President & Chief Administrative Officer | _____ | _____ |

To be completed by Office of the Vice President & Chief Administrative Officer—Department of Facilities

Project Name: _____

Project Number:_____

Revised: 12-11-02

APPENDIX F

## Occupant Interview Form

# Occupant Interview *Page 1 of 2*

*Indoor Air Quality Forms* 185

Building Name: _____ File Number: _____

Address:

_____

Occupant Name: _____ Work Location: _____

Completed by:_____ Title: _____

Date:_____

Sections 4 discusses collecting and interpreting information from occupants.

SYMPTOM PATTERNS

What kind of symptoms or discomfort are you experiencing?

Are you aware of other people with similar symptoms or concerns? Yes _____ No _____

If so, what are their names and locations?

_____

Do you have any health conditions that may make you particularly susceptible to environmental problems?

- contact lenses q chronic cardiovascular disease q undergoing chemotherapy or radiation therapy
- allergies q chronic respiratory disease q immune system suppressed by disease or other causes
- chronic neurological problems

TIMING PATTERNS

When did your symptoms start?

When are they generally worst?

Do they go away? If so, when?

Have you noticed any other events (such as weather events, temperature or humidity changes, or activities in the building) that tend to occur around the same time as your symptoms?

# Occupant Interview *Page 2 of 2*

SPATIAL PATTERNS

Where are you when you experience symptoms or discomfort?

Where do you spend most of your time in the building?

ADDITIONAL INFORMATION

Do you have any observations about building conditions that might need attention or might help explain your symptoms (e.g., temperature, humidity, drafts, stagnant air, odors)?

Have you sought medical attention for your symptoms?

Do you have any other comments?

*Indoor Air Quality Forms* 186

Available at: http://www.epa.gov/iaq/largebldgs/graphics/occint.pdf

APPENDIX G

# Table 1. Preliminary R & R Amounts

Commission for Higher Education
2003 Fall Term Analysis

Preliminary R & R Amounts, 2005-07 Biennium

| | Annual | | | Biennial |
|---|---|---|---|---|
| | General R & R Formula (1) | Infrastructure Formula | Combined Formula | Combined Formula |
| INDIANA UNIVERSITY | | | | |
| Bloomington | $10,729,567 | $4,639,234 | $15,368,801 | $30,737,601 |
| East | 80,435 | 113,674 | 194,109 | 388,217 |
| Kokomo | 144,272 | 90,158 | 234,430 | 468,860 |
| Northwest | 313,233 | 180,347 | 493,580 | 987,160 |
| South Bend | 273,261 | 133,162 | 406,423 | 812,847 |
| Southeast | 444,693 | 223,537 | 668,230 | 1,336,461 |
| IUPUI | 5,034,335 | 1,083,483 | 6,117,818 | 12,235,637 |
| IU Total | $17,019,796 | $6,463,595 | $23,483,391 | $46,966,782 |
| PURDUE UNIVERSITY | | | | |
| West Lafayette | $10,178,802 | $5,418,787 | $15,597,589 | $31,195,178 |
| Calumet | 651,708 | 379,134 | 1,030,842 | 2,061,685 |
| North Central | 171,763 | 126,692 | 298,455 | 596,911 |
| IUPU Fort Wayne | 696,209 | 407,596 | 1,103,805 | 2,207,610 |
| PU Total | $11,698,482 | $6,332,210 | $18,030,692 | $36,061,384 |
| INDIANA STATE UNIVERSITY | 2,776,346 | 1,475,299 | 4,251,645 | 8,503,291 |
| UNIV OF SOUTHERN INDIANA | 588,305 | 381,214 | 969,519 | 1,939,038 |
| BALL STATE UNIVERSITY | 4,073,718 | 1,936,000 | 6,009,718 | 12,019,435 |
| VINCENNES UNIVERSITY | 1,617,605 | 480,086 | 2,097,691 | 4,195,382 |
| IVY TECH STATE COLLEGE | | | | |
| 1 Northwest (Gary) | 115,564 | 28,388 | 143,952 | 287,904 |
| 2 North Central (South Bend) | 77,594 | 6,929 | 84,523 | 169,046 |
| 3 Northeast (Fort Wayne) | 55,535 | 19,173 | 74,708 | 149,416 |
| 4 Lafayette | 93,699 | 3,740 | 97,439 | 194,878 |
| 5 Kokomo | 130,457 | 5,783 | 136,240 | 272,481 |
| 6 East Central (Muncie) | 73,435 | 21,272 | 94,707 | 189,415 |
| 7 Terre Haute | 81,520 | 21,879 | 103,399 | 206,797 |
| 8 Central Indiana (Indpls.) | 591,321 | 3,145 | 594,466 | 1,188,931 |
| 9 Whitewater (Richmond) | 80,642 | 7,372 | 88,014 | 176,027 |
| 10 Columbus | 14,492 | 6,834 | 21,326 | 42,651 |
| 11 Southeast (Madison) | 27,365 | 3,152 | 30,517 | 61,033 |
| 12 Southwest (Evansville) | 107,829 | 13,845 | 121,674 | 243,348 |
| 13 So.Central (Sellersberg) | 38,689 | 4,355 | 43,044 | 86,087 |
| 14 Bloomington | 27,103 | 17,810 | 44,913 | 89,826 |
| ITSC Total | 1,515,245 | 163,675 | 1,678,920 | 3,357,840 |
| STATE TOTAL | $39,289,497 | $17,232,079 | $56,521,576 | $113,043,152 |

NOTE:
(1) Using January 2004 Markel Index.

APPENDIX G

## Law IC 20-12-6-1, Re. Trustee Responsibility

Sec. 1. The trustees of Indiana University, the trustees of Purdue University, the Ball State University board of trustees, the Indiana State University board of trustees, the board of trustees for Vincennes University, the University of Southern Indiana board of trustees, and the trustees of Ivy Tech State College (sometimes referred to in this chapter collectively as "corporations" or respectively as "corporation") are respectively authorized, from time to time as they find the necessity exists, to acquire, erect, construct, reconstruct, improve, rehabilitate, remodel, repair, complete, extend, enlarge, equip, furnish, and operate:
(1) any buildings, structures, improvements, or facilities;
(2) any utilities, other services, and appurtenances related to an item described in subdivision (1) (including, but not limited to, facilities for the production and transmission of heat, light, water and power, sewage disposal facilities, streets and walks, and parking facilities); and
(3) the land required for items described in subdivision (1) or (2);

as the governing boards of the corporations from time to time deem necessary for carrying on the educational research, the public service programs, or the statutory responsibilities of the educational institutions and various divisions of the institutions under the jurisdiction of the corporations respectively, or for the management, operation, or servicing of the institutions, (the buildings, structures, improvements, facilities, utilities, services, appurtenances, and land being sometimes referred to in this chapter collectively as "building facilities" or respectively as "building facility"). The building facilities may be located at any place within Indiana at which the governing board of the corporation determines the need exists for the building facilities.

APPENDIX G

## Background on Responsibility Centered Budgeting (RCM)

Indiana University implemented a budgeting system termed Responsibility Centered Budgeting (RCM) in 1990. RCM was initiated by President Thomas Ehrlich in order to decentralize the budgeting system at IU. "President Ehrlich's goal was to develop a system guided by three basic principles:

- all costs and income attributable to each school and other academic unit should be assigned to that unit;
- appropriate incentives should exist for each academic unit to increase income and reduce costs to further a clear set of academic priorities; and
- all costs of other units should be allocated to the academic units."

In the fall of 1999 a Committee was appointed by Vice President and Chancellor Kenneth Gros Louis to review the policies and procedures of the financial planning, budgeting, and financial administration system known as Responsibility Centered Management.[167]

[167] Report of the RCM Review Committee Responsibility Centered Management at Indiana University Bloomington, May, 2000. p. 2. Retrieved 3/30/05 from http://www.indiana.edu/~obap/ (Second Assessment of RCM in 10 year period)

## Table 2. Bloomington Interest Income FY 2003-2004: Sources and Uses

| Academic Labs/Classrooms | |
|---|---|
| Chemistry | $552,833 |
| Geology | $359,887 |
| Social Work | $5,363 |
| Swain Hall | $618,497 |
| Jordan Hall | $537,201 |
| Law School | $208,115 |
| Fine Arts | $5,000 |
| | $2,286,896 |

| Administrative Renovations/Maintenance | |
|---|---|
| Maxwell Hall | $177,766 |
| Chancellor's House | $98,729 |
| Franklin Hall | $80,056 |
| Hoosier Courts Nursery School | $285,787 |
| Radio & TV | $2,456 |
| Information Commons | $25,000 |
| Eigenmann | $47,750 |
| | $717,544 |

APPENDIX G

# Table 3. 2004-05 Operating Budget as of July 1, All Funds Budgeted Expenditures by Responsibility Center

| Campus and Center | General Fund Total | Designated | Restricted | Contracts & Grants | Auxiliary | Total | Memo Item: Service Accounts* |
|---|---|---|---|---|---|---|---|
| BLOOMINGTON | | | | | | | |
| Arts & Sciences | $160,126,838 | $2,148,177 | $1,443,230 | $57,041,835 | $732,536 | $221,492,616 | $811,818 |
| Health Sciences | $1,601,794 | $0 | $0 | $63,808 | $0 | $1,665,602 | $0 |
| Journalism | $4,197,619 | $169,795 | $563,487 | $136,533 | $2,015,335 | $7,082,769 | $0 |
| School of Business | $47,304,622 | $1,173,007 | $2,144,017 | $2,150,469 | $133,050 | $52,905,165 | $0 |
| School of Education | $22,516,991 | $282,832 | $93,685 | $9,722,125 | $2,782,625 | $35,398,258 | $505,000 |
| School of HPER | $18,236,194 | $4,621,919 | $66,082 | $4,588,445 | $2,188,393 | $29,701,033 | $0 |
| School of Law | $15,282,322 | $37,990 | $1,235,671 | $56,877 | $0 | $16,612,860 | $0 |
| Library and Info Science | $3,605,609 | $0 | $0 | $265,367 | $0 | $3,870,976 | $0 |
| School of Music | $29,150,022 | $2,566,636 | $225,938 | $18,669 | $0 | $31,961,265 | $400,000 |
| School of Optometry | $9,307,166 | $456,716 | $129,000 | $1,323,341 | $0 | $11,216,223 | $0 |
| Other Academic Programs | $18,552,792 | $0 | $0 | $569 | $0 | $18,553,361 | $0 |
| Public and Environ Affairs | $13,508,519 | $109,394 | $0 | $9,526,879 | $15,000 | $23,159,792 | $0 |
| Informatics | $8,979,581 | $35,076 | $0 | $165,529 | $0 | $9,180,186 | $0 |
| Subtotal, Academic | $352,370,069 | $11,601,542 | $5,901,110 | $85,060,446 | $7,866,939 | $462,800,106 | $1,716,818 |
| Dean of Faculties | $16,154,001 | $688,500 | $99,462 | $155,480 | $0 | $17,097,443 | $0 |
| Research & Univ Grad Sch | $18,710,388 | $2,070,814 | $7,206,392 | $24,622,182 | $2,724,780 | $55,334,556 | $11,184,681 |
| Academic Computing | $16,639,512 | $0 | $0 | $0 | $0 | $16,639,512 | $1,591,010 |
| Library | $27,012,597 | $0 | $847,539 | $342,009 | $0 | $28,202,145 | $0 |
| Student Support | $2,475,913 | $1,159,914 | $356,070 | $41,502 | $11,147,082 | $15,180,481 | $0 |
| Vice Pres-General Admin | $2,891,378 | $190,469 | $0 | $46,126 | $1,087,447 | $4,215,420 | $0 |
| Vice Pres-Acad Affairs | $17,045,064 | $621,500 | $1,413,843 | $1,986,687 | $0 | $21,067,094 | $0 |
| Enrollment Services | $31,520,004 | $745,000 | $0 | $0 | $0 | $32,265,004 | $0 |
| Diversity & Academic Sppt. | $6,681,664 | $17,180 | $0 | $1,245,568 | $0 | $7,944,412 | $0 |
| Dean of Budget-Stdnt Sup | $11,666,830 | $170,000 | $0 | $0 | $0 | $11,836,830 | $0 |
| Dean of Budget-Gen Admin | $8,555,711 | $546,056 | $0 | $0 | $121,101,138 | $130,202,905 | $7,227,589 |
| Physical Plant | $51,102,548 | $0 | $0 | $0 | $0 | $51,102,548 | $26,797,298 |
| Intercampus Transfers | $32,338,831 | $0 | $0 | $0 | $0 | $32,338,831 | $0 |
| Subtotal, Support | $242,794,441 | $6,209,433 | $9,923,306 | $28,439,554 | $136,060,447 | $423,427,181 | $46,800,578 |
| Facilities Debt Service | $21,237,515 | | | | | $21,237,515 | |
| Total | $616,402,025 | $17,810,975 | $15,824,416 | $113,500,000 | $143,927,386 | $907,464,802 | $48,517,396 |

* Beginning with the 2004-05 fiscal year, budgets for service accounts are not reflected in the total budget since their revenue sources are other University funds.

# Table 4. 2004-05 Operating Budget Assessment Revenue



Indiana University Bloomington
**2004-05 Operating Budget**
**Assessment Revenue**

| RC | UITS | Library | Dean of Faculties | Rsrch & Univ Grad School | Student Affairs | EMAS | Enrollment Services | EXMT | Diversity & Acad Sppt | Dean Budget Stu Sppt | Dean Budget General | Physical Plant | University Tax | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A&S | (4,840,513) | (14,183,260) | (8,743,062) | (7,588,145) | (1,344,561) | (4,098,240) | -16828218 | (1,498,015) | -3703522 | (4,094,435) | (3,915,554) | (23,988,213) | (15,080,532) | (109,906,270) |
| Med Sci | (108,085) | (230,695) | (77,499) | (109,967) | (21,283) | (53,306) | -274126 | (14,448) | -59607 | (61,697) | (37,661) | (563,525) | (146,929) | (1,758,828) |
| Jour | (136,982) | (307,111) | (172,820) | (223,184) | (32,159) | (88,672) | -362549 | (38,009) | -83505 | (113,953) | (53,315) | (387,705) | (268,466) | (2,268,430) |
| KSOB | (1,140,672) | (3,252,784) | (1,743,155) | (2,040,638) | (327,321) | (1,154,819) | -3850217 | (336,393) | -870269 | (1,095,608) | (564,824) | (4,457,874) | (3,413,545) | (24,248,119) |
| Educ | (698,680) | (1,474,669) | (1,256,980) | (1,409,930) | (167,477) | (619,441) | -1730853 | (226,456) | -414892 | (656,510) | (573,981) | (1,808,133) | (2,302,990) | (13,340,992) |
| HPER | (637,925) | (2,044,630) | (1,022,320) | (739,343) | (192,848) | (518,273) | -2436080 | (184,838) | -534040 | (578,253) | (422,586) | (8,387,916) | (1,721,206) | (19,420,258) |
| Law | (308,981) | (165,023) | (156,561) | (1,075,240) | (66,162) | (338,238) | -162372 | (100,033) | -97647 | (468,505) | (148,104) | (2,398,706) | (1,017,308) | (6,502,880) |
| SLIS | (64,176) | (53,055) | (192,601) | (294,433) | (16,754) | (87,289) | -54896 | (26,648) | -26478 | (113,111) | (56,727) | (217,095) | (271,005) | (1,473,268) |
| Music | (638,179) | (1,149,840) | (1,344,715) | (1,348,040) | (127,985) | (669,310) | -1342378 | (196,871) | -319558 | (493,811) | (533,133) | (5,645,256) | (1,973,457) | (15,782,533) |
| Optom | (220,025) | (88,826) | (235,434) | (473,602) | (29,056) | (226,035) | -90266 | (78,792) | -45292 | (198,149) | (121,913) | (896,319) | (801,292) | (3,505,001) |
| O Acad | (65,020) | (419,969) | (91,249) | (75,362) | (37,582) | (89,939) | -502696 | (24,065) | -107626 | (101,479) | (30,766) | (491,588) | (244,734) | (2,282,075) |
| SPEA | (370,870) | (930,511) | (300,153) | (644,999) | (98,651) | (295,787) | -1099518 | (129,123) | -254551 | (354,631) | (220,153) | (1,067,829) | (1,311,913) | (7,078,689) |
| Info | (87,800) | (144,401) | (58,264) | (102,421) | (14,074) | (118,600) | -170585 | (34,687) | -38059 | (45,088) | (46,534) | (355,339) | (352,758) | (1,568,610) |
| DOF | 0 | 0 | 15,394,813 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15,394,813 |
| RUGS | 0 | 0 | 0 | 16,125,304 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16,125,304 |
| UITS | 9,317,908 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9,317,908 |
| Library | 0 | 24,444,774 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24,444,774 |
| StuAff | 0 | 0 | 0 | 0 | 2,475,913 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,475,913 |
| EXMG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,888,378 | 0 | 0 | 0 | 0 | 0 | 2,888,378 |
| EMAS | 0 | 0 | 0 | 0 | 0 | 8,357,949 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8,357,949 |
| OES | 0 | 0 | 0 | 0 | 0 | 0 | 28904754 | 0 | 0 | 0 | 0 | 0 | 0 | 28,904,754 |
| ASDV | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6555046 | 0 | 0 | 0 | 0 | 6,555,046 |
| Bud-SS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8,375,230 | 0 | 0 | 0 | 8,375,230 |
| BUD-GA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6,724,251 | 0 | 0 | 6,724,251 |
| Phys Plnt | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50,665,498 | 0 | 50,665,498 |
| UTAX | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28,906,135 | 28,906,135 |
| Net | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Source: University Budget Office.

APPENDIX G

# Table 5. Support Center Assessment Revenue

| | 1989-90 | 1990-91 | 1991-92 | 1992-93 | 1993-94 | 1994-95 | 1995-96 | 1996-97 |
|---|---|---|---|---|---|---|---|---|
| Dean of Faculties | $3,157,415 | $7,844,085 | $11,695,332 | $12,121,419 | $12,381,230 | $11,837,084 | $12,419,070 | $13,127,139 |
| RUGS | $10,294,300 | $9,982,934 | $9,517,329 | $9,732,393 | $9,907,386 | $10,566,836 | $11,166,159 | $11,618,355 |
| UITS | $6,889,594 | $7,269,514 | $7,245,960 | $7,271,408 | $7,133,645 | $7,112,320 | $7,355,833 | $7,706,604 |
| Library | $13,407,868 | $14,866,368 | $15,016,802 | $15,561,079 | $15,955,003 | $16,583,468 | $17,322,592 | $18,012,273 |
| Student Support | $653,131 | $697,281 | $1,488,588 | $1,451,295 | $1,454,072 | $1,567,775 | $1,595,980 | $1,646,284 |
| Undergraduate Life | $5,038,245 | $5,458,053 | | | | | | |
| Vice Pres- General Admin | $3,582,449 | $3,903,539 | $3,809,470 | $3,865,404 | $3,786,451 | $3,988,982 | $4,252,358 | $4,393,403 |
| Vice Pres- Academic Affairs | $8,118,633 | $6,840,665 | $7,305,803 | $6,337,156 | $6,121,759 | $7,271,309 | $9,161,418 | $9,605,438 |
| Enrollment Services | | | | | | | | |
| Diversity Academic Support | | | | | | | | |
| Dean Budget Student Support | $6,544,401 | $6,563,824 | $9,997,825 | $10,430,848 | $10,663,595 | $11,261,381 | $11,856,132 | $12,270,641 |
| Dean Budget - General Admin | $2,792,520 | $4,951,329 | $4,729,902 | $4,358,356 | $5,792,062 | $5,092,337 | $4,873,657 | $4,757,496 |
| Physical Plant | $33,498,291 | $34,215,261 | $34,634,922 | $35,318,883 | $35,579,746 | $36,409,000 | $36,738,616 | $38,364,394 |
| President's Office | $16,664,127 | $17,172,977 | $13,249,083 | $12,693,296 | $12,947,162 | $13,344,371 | $14,734,879 | $16,486,208 |
| TOTAL | $110,640,974 | $119,765,830 | $118,691,016 | $119,141,537 | $121,722,111 | $125,034,863 | $131,476,694 | $137,988,235 |
| Percent change from previous year | | 8.2% | -0.9% | 0.4% | 2.2% | 2.7% | 5.2% | 5.0% |

| | 1997-98 | 1998-99 | 1999-00 | 2000-01 | 2001-02 | 2002-03 | 2003-04 | 2004-05 | Percent Change, 1989-2005 |
|---|---|---|---|---|---|---|---|---|---|
| Dean of Faculties | 13517518 | 14019588 | 13663465 | 13694873 | 14248738 | 14746430 | 14955300 | 15394813 | 388% |
| RUGS | 12010630 | 12447625 | 12560663 | 12880118 | 14839423 | 15498028 | 15789578 | 16125304 | 57% |
| UITS | 7901359 | 8016046 | 8298837 | 8406334 | 8811668 | 9013991 | 9205597 | 9317908 | 35% |
| Library | 18535770 | 18910283 | 19820255 | 20290507 | 21734322 | 22538996 | 24081773 | 24444774 | 82% |
| Student Support | 1697093 | 1760086 | 1825478 | 1872849 | 2113457 | 2187629 | 2332294 | 2475913 | 279% |
| Undergraduate Life | | | | | | | | | -100% |
| Vice Pres- General Admin | 4605597 | 4957158 | 5430001 | 5339929 | 2584570 | 2665059 | 2715447 | 2888378 | -19% |
| Vice Pres- Academic Affairs | 10064307 | 21355808 | 7771323 | 9197448 | 9032751 | 9787087 | 11529469 | 8357949 | 3% |
| Enrollment Services | | | 15196607 | 17089849 | 21299170 | 23550015 | 27861466 | 28904754 | |
| Diversity Academic Support | | | 4085107 | 4417526 | 4624280 | 4911403 | 5814628 | 6555046 | |
| Dean Budget Student Support | 16004807 | 9868464 | 10664183 | 10279707 | 8321892 | 8670213 | 7902396 | 8375230 | 28% |
| Dean Budget - General Admin | 4260293 | 5766649 | 6068063 | 5448834 | 5240214 | 6163287 | 6938820 | 6724251 | 141% |
| Physical Plant | 39538371 | 40647647 | 41282329 | 42090485 | 43124985 | 47246077 | 50023781 | 50665498 | 51% |
| President's Office | 17468333 | 18523317 | 20069377 | 21502372 | 26227144 | 27187235 | 28074235 | 28906135 | 73% |
| TOTAL | 145604078 | 156272671 | 166735688 | 172510831 | 182202614 | 194165450 | 207224784 | 209135953 | 89% |
| Percent change from previous year | 6% | 7% | 7% | 3% | 6% | 7% | 7% | 1% | |

APPENDIX G

## Table 6. IUB Assessments, 1989-2005

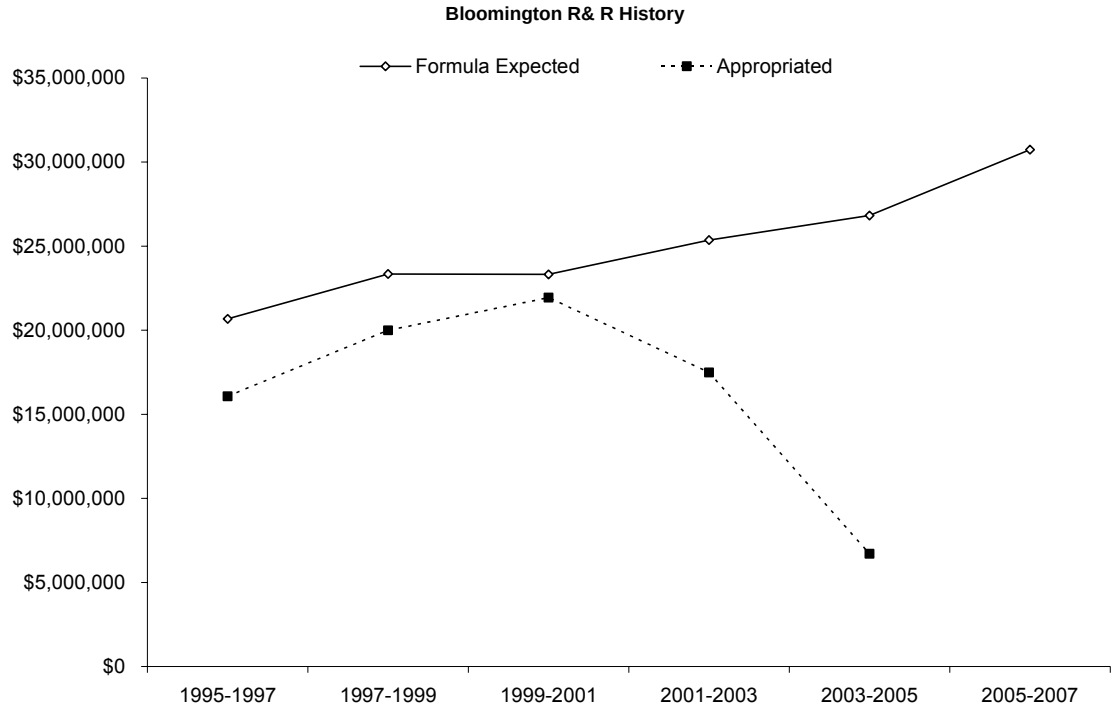
| Assessments | COAS | Health Sciences | Journalism | Business | Education | HPER | Law |
|---|---|---|---|---|---|---|---|
| 1989-90 | $67,879,011 | NA | $1,385,287 | $10,827,937 | $7,114,556 | $5,247,167 | $2,083,534 |
| 1990-91 | $74,290,682 | $1,186,700 | $1,411,164 | $10,887,692 | $7,869,165 | $6,194,875 | $2,462,076 |
| 1991-92 | $73,262,741 | $1,207,749 | $1,493,517 | $10,812,049 | $7,917,052 | $5,613,607 | $2,596,858 |
| 1992-93 | $72,816,585 | $1,297,024 | $1,449,284 | $10,546,096 | $7,940,874 | $5,662,682 | $3,212,089 |
| 1993-94 | $73,283,626 | $1,312,240 | $1,543,527 | $10,537,861 | $8,487,022 | $6,342,604 | $3,170,189 |
| 1994-95 | $74,987,542 | $1,356,599 | $1,591,739 | $10,720,484 | $8,937,546 | $6,756,282 | $3,190,360 |
| 1995-96 | $77,988,566 | $1,436,853 | $1,652,523 | $11,552,574 | $9,523,047 | $7,256,557 | $3,497,555 |
| 1996-97 | $81,217,819 | $1,538,805 | $1,747,657 | $12,610,957 | $10,025,035 | $7,643,725 | $3,669,663 |
| 1997-98 | $85,639,509 | $1,629,431 | $1,973,509 | $13,624,906 | $10,156,889 | $7,660,439 | $3,952,012 |
| 1998-99 | $90,209,818 | $1,655,801 | $1,990,689 | $15,640,690 | $10,770,074 | $9,752,090 | $4,061,953 |
| 1999-2000 | $93,092,174 | $1,904,586 | $2,090,971 | $18,210,252 | $11,491,046 | $10,862,191 | $4,565,774 |
| 2000-01 | $96,290,335 | $1,768,837 | $2,201,929 | $19,226,340 | $11,760,624 | $11,395,037 | $4,566,025 |
| 2001-02 | $99,645,522 | $1,681,228 | $2,173,179 | $21,372,638 | $12,424,529 | $12,056,494 | $4,955,502 |
| 2002-03 | $106,494,374 | $1,809,816 | $2,244,322 | $23,086,171 | $13,621,657 | $12,587,660 | $5,169,315 |
| 2003-04 | $114,467,717 | $1,778,877 | $2,307,784 | $24,159,509 | $14,544,844 | $13,484,987 | $5,214,241 |
| 2004-05 | $109,906,270 | $1,758,828 | $2,268,430 | $24,248,119 | $13,340,992 | $19,420,258 | $6,502,880 |

| Assessments | SLIS | Music | Optometry | Other Academic | SPEA | Informatics | Total |
|---|---|---|---|---|---|---|---|
| 1989-90 | $1,140,113 | $8,502,962 | $1,656,426 | $1,891,221 | $2,882,760 | NA | $110,610,974 |
| 1990-91 | $1,278,348 | $8,751,486 | $1,829,343 | $649,972 | $2,954,327 | NA | $119,765,830 |
| 1991-92 | $1,303,308 | $8,924,089 | $1,925,789 | $623,545 | $3,010,712 | NA | $118,691,016 |
| 1992-93 | $1,331,257 | $8,913,164 | $2,231,721 | $567,677 | $3,173,084 | NA | $119,141,537 |
| 1993-94 | $1,491,949 | $9,201,951 | $2,256,846 | $713,221 | $3,381,075 | NA | $121,722,111 |
| 1994-95 | $1,523,713 | $9,402,895 | $2,520,160 | $761,231 | $3,556,312 | NA | $125,304,863 |
| 1995-96 | $1,610,245 | $9,988,501 | $2,396,534 | $804,273 | $3,769,466 | NA | $131,476,694 |
| 1996-97 | $1,660,793 | $10,514,272 | $2,539,261 | $820,076 | $4,000,172 | NA | $137,988,235 |
| 1997-98 | $1,732,448 | $11,750,596 | $2,511,282 | $899,751 | $4,073,306 | NA | $145,604,078 |
| 1998-99 | $1,679,555 | $12,556,736 | $2,553,186 | $910,224 | $4,491,855 | NA | $156,272,671 |
| 1999-2000 | $1,841,559 | $13,621,496 | $2,879,523 | $1,158,092 | $5,018,024 | NA | $166,735,688 |
| 2000-01 | $1,828,160 | $13,759,460 | $3,030,900 | $1,276,582 | $5,406,602 | NA | $172,510,831 |
| 2001-02 | $1,826,041 | $14,853,584 | $3,402,918 | $1,502,384 | $6,118,684 | $189,911 | $182,202,614 |
| 2002-03 | $1,912,555 | $15,185,414 | $3,709,294 | $1,637,137 | $6,348,821 | $358,914 | $194,165,450 |
| 2003-04 | $2,153,310 | $15,861,690 | $4,041,698 | $1,788,421 | $6,635,321 | $786,385 | $207,224,784 |
| 2004-05 | $1,473,268 | $15,782,533 | $3,505,001 | $2,282,075 | $7,078,689 | $1,568,610 | $209,135,953 |

## Table 7. Bloomington R & R History

| Biennium | 1995-1997 | 1997-1999 | 1999-2001 | 2001-2003 | 2003-2005 | 2005-2007 |
|---|---|---|---|---|---|---|
| *R & R Funding Expected (based on formula)* | | | | | | |
| Building | $16,065,154 | $17,976,362 | $17,793,330 | $19,208,972 | $18,938,036 | $21,459,134 |
| Infrastructure | $4,611,763 | $5,364,504 | $5,520,340 | $6,145,280 | $788,934 | $9,278,467 |
| Total | $20,676,917 | $23,340,866 | $23,313,670 | $25,354,252 | $26,821,970 | $30,737,601 |
| *R & R Funding Appropriated* | | | | | | |
| Building | $16,065,154 | $17,976,362 | $17,793,330 | $13,344,998 | $4,734,509 | |
| Infrastructure | | $2,011,689 | $4,140,255 | $4,140,255 | $1,970,984 | |
| Total | $16,065,154 | $19,988,051 | $21,933,585 | $17,485,253 | $6,705,493 | |
| Percent Appropriated | 78% | 86% | 94% | 69% | 25% | N/A |

## Figure 1. IUB Repair and Rehabilitation Funding




Source: Physical Facilities of Indiana Public Higher Education: Their Location, Value, Condition and Utilization, Fall 2003, p.9

APPENDIX H

# Estimating the Costs of Health Care and Lost Productivity: Data Sources and Assumptions

***Discount Rate***
The discount rate follows a normal distribution with a mean and variance calculated from historical rates (1980 to 2005) used by the Office of Management and Budget.[168]

***IUB Student, Faculty, and Staff Population***
The Indiana University Fact Book 2004-2005 provided the current IU Bloomington resident, non-resident student, faculty, and staff populations. We used historical trends to calculate a mean and variance for population growth rates and assumed a normal distribution for the growth rate.

***Exposure Duration***
Resident students were assumed to be in campus buildings for 34 weeks a year (two semesters of 17 weeks), 7 days a week and 20 hours per day. Non-resident students were assumed to be in campus buildings 34 weeks a year and 15 hours per week. We assumed the standard 40 hours per week for 50 weeks for IUB faculty and staff. All these numbers were divided by the total hours in a year to produce a fraction of time on campus for each group.

***Faculty and Staff Salaries***
Average faculty salary was taken from the Indiana University Fact Book 2004-2005.[169] We computed the mean and variance of the salaries and assumed a normal distribution. The Indiana University Human Resource Services website[170] lists the staff salary pay schedule. Once again, we assumed a normal distribution for staff salary and computed the mean and variance.

***Health Care Costs***
A log-normal distribution was used to represent average health effects in sensitive populations. This distribution was created by assuming the health care costs from case studies of asthmatics with mold sensitivities as a high-end for distribution. Populations without mold sensitivities were assumed to have no health care costs.

***Days Lost***
Information regarding days lost attributed to mold were based on research conducted by William Fisk, head of the Indoor Environment Department at Lawrence Berkeley National Laboratory, and his colleagues. Fisk has shown that productivity can be affected between 0.5 and 5 percent annually as a result of issues of Indoor Air Quality including mold. However, the actual 1.2 – 1.9 days lost per year is derived from an evaluation by Glenross and Walters that studied 3720 employees in 40 buildings, using sick leave data of office workers as a measure to evaluate

[168] OMB Circular A-94
[169] Indiana University; *Indiana University Fact Book* [on-line]; available from http://factbook.indiana.edu/fbook04/index.shtml; Internet; accessed March 2005.
[170] IU Human Resource Services; *Pay Guidelines and Schedules* [on-line]; available from http://www.indiana.edu/~hrm/salary/alleepay.html; Internet; accessed March 2005.

indoor air quality.[171] The results showed an association between varying indoor air quality and short-term sick leave. Specifically, in spaces with lower ventilation rates, an additional increase of 1.2 to 1.9 days of sick leave per person per year, depending on age and gender, was found. This is then assumed to be a relevant proxy for sick days experienced among full time Indiana University employees spending 40 hours a week 50 weeks per year in University buildings and offices. This number would refer to employees with no reported allergies or sensitivities to mold. We used this empirical data and assumed a log normal distribution to construct a probability distribution.

***Sensitivity to Mold***

Since accurate estimates of the proportion of Americans that are affected negatively by mold were not obtainable, the asthma prevalence rate was used as a proxy. Prevalence rates (per 1000 people) for 2002 were obtained from the American Lung Association study, "Trends in Asthma Morbidity and Mortality." While the asthma prevalence rate may not exactly replicate the mold sensitivity rate, we assumed that these rates would be similar since mold exposure can trigger responses in asthmatics.

***Chance of Exposure***

There is no data on the prevalence of mold in IUB Buildings. Therefore, we assumed that between 10 and 30% of buildings on campus had mold levels high enough to trigger a negative health effect.

[171] Milton, DK, Glencross, P, Walters, MD. 2000. Risk of sick leave associated with outdoor air supply rate, humidification and occupant complaints. Indoor Air - International Journal of Indoor Air Quality and Climate 10 (4): 212-221.