Emerging Combined Energy Efficiency (EE) and Indoor Environmental Quality (IEQ) Research Agendas for Buildings and Their Security

Presented at

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Presented by

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IEQ is Many Interrelated Issues

- Under **ordinary** circumstances –
  - Lighting
  - Noise
  - Ergonomics
  - Comfort (thermal)
  - **Indoor Air Quality (IAQ)**
- Under **extraordinary** circumstances –
  - Terrorism
  - **Airborne chemical or biological attack**

EE and IAQ “Tug of War”?

Energy Efficiency

Indoor Air Quality

EE improvements may:

- Improve IAQ
- Degrade IAQ
- Be IAQ Neutral

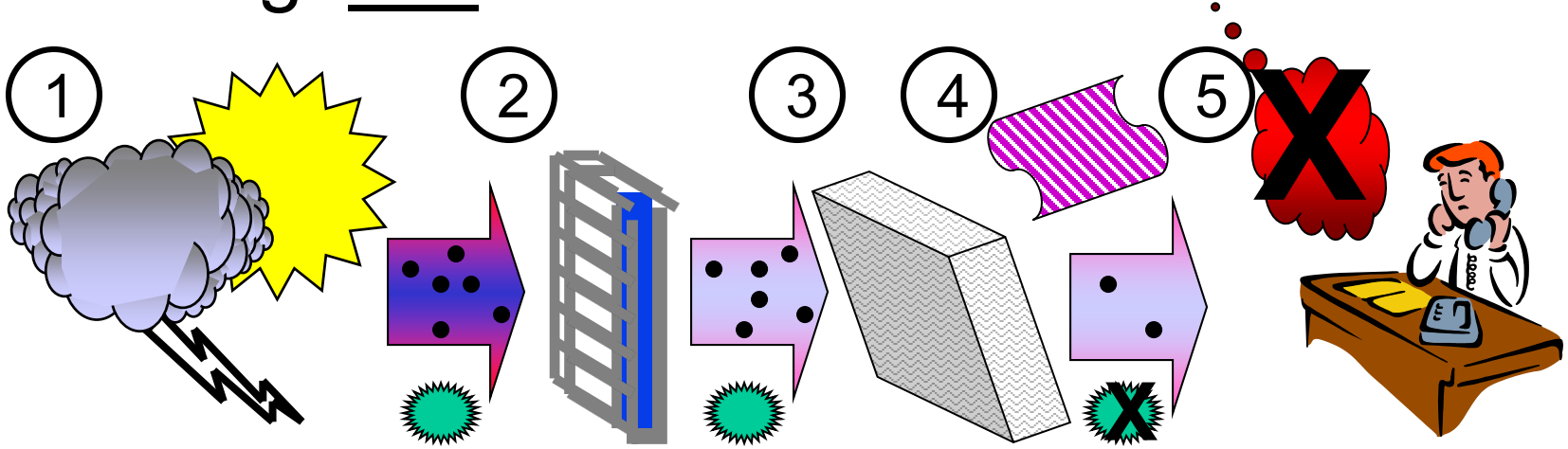
IAQ improvements may:

- Improve EE
- Degrade EE
- Be EE Neutral

IAQ Investments

… in the 5 "tions" as IAQ control mechanisms

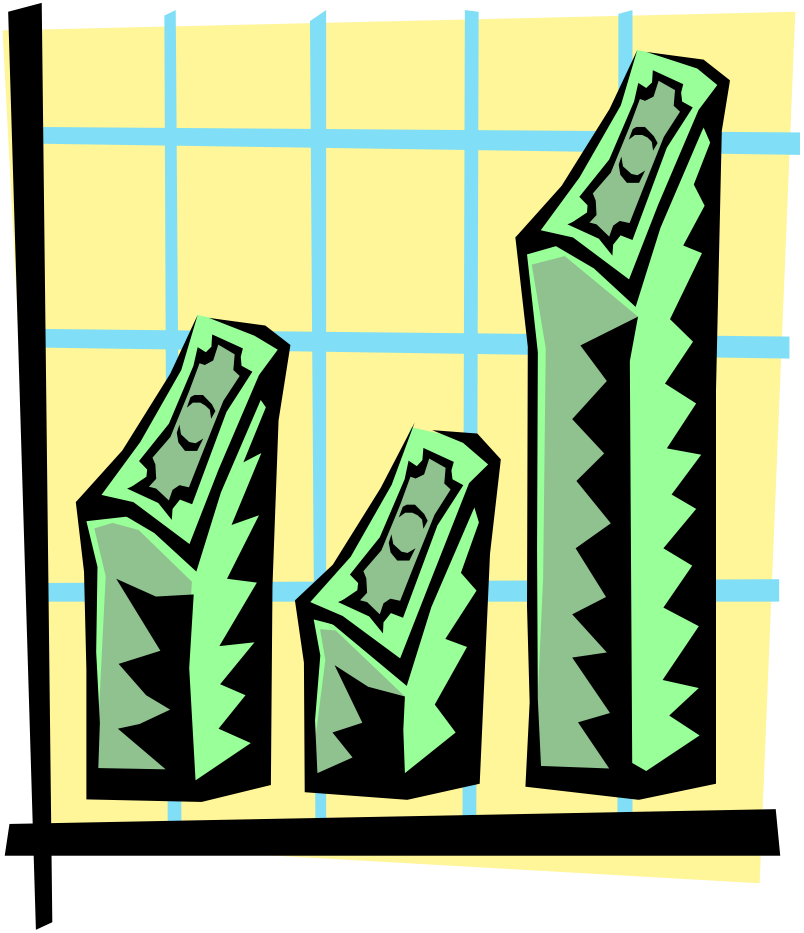
1. Ventila*tion* … dilution of contaminants
2. Dehumidifica*tion* … control of mold, etc.
3. Filtra*tion* … control of particulates/gases
4. Irradia*tion* … control of virus/bacteria
5. Mitiga*tion* … limit source contaminants



IAQ Returns

… must be better quantified by "conclusive, informative" RD&D that links investments to returns

- Health
- Productivity
- Patronage



Fisk/LBNL SOA Paper

- Some Evidence
- Only Crude Estimates
- Paradigm Shift Possible with Better Evidence

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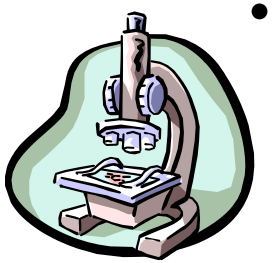
IAQ is Many Sciences

Indoor Air July 2001Editorial: … "true science within areas like Indoor Air Quality … must be truly multidisciplinary … [and] report association, or lack of association, between indoor exposures and health, comfort, productivity, …"

Medicine

- occupational & environmental health (industrial hygienists)

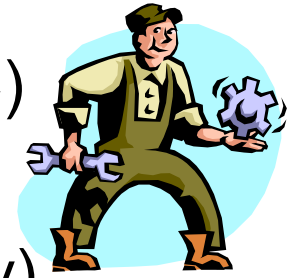
- epidemiology (biostatistics)
- mycology (fungi)



- microbiology (bioaerosols)

Engineering

- mechanical (HVAC)



- civil & materials (building technology)
- electrical (controls)

- chemical (contaminants)

- engineering economics

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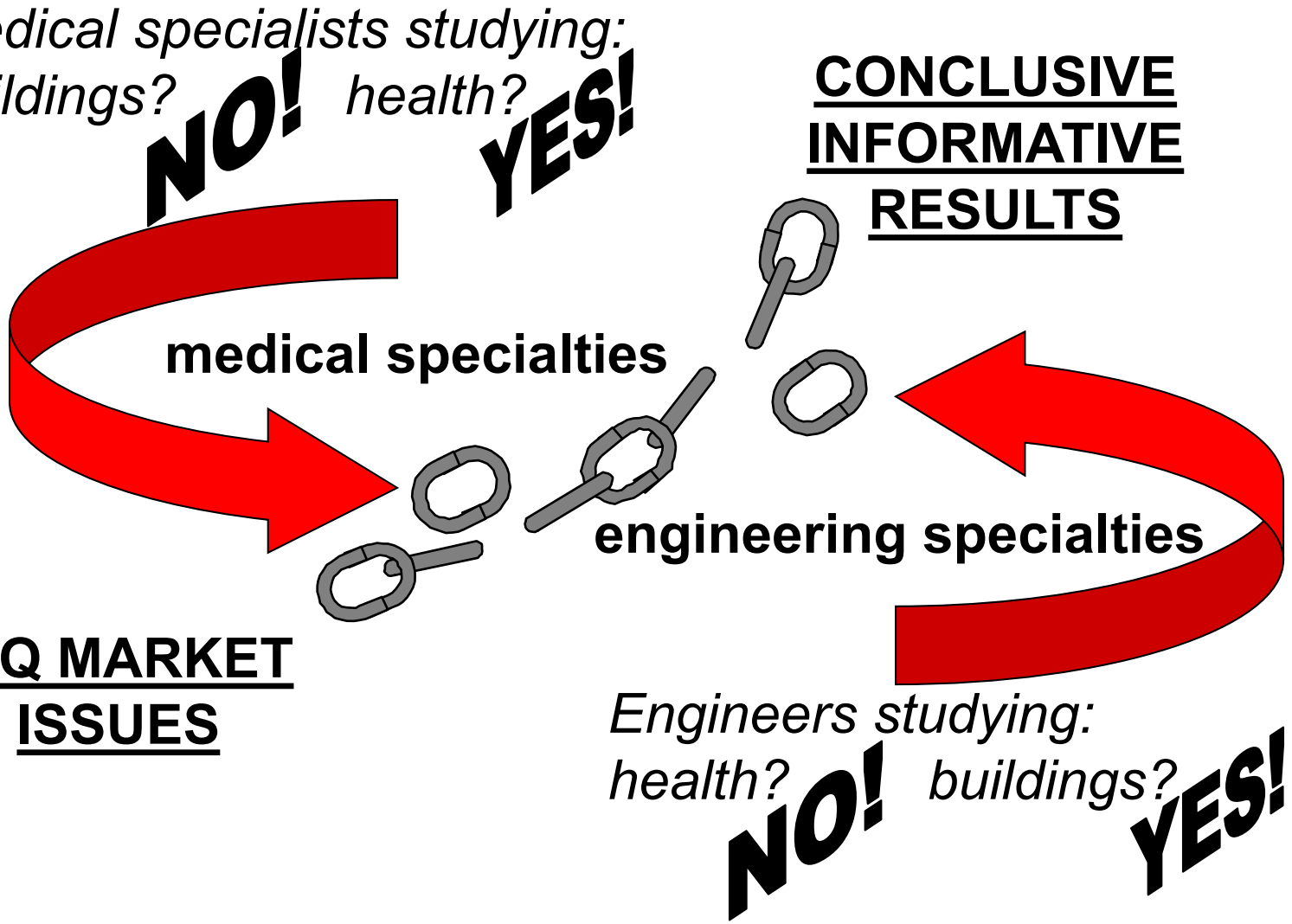
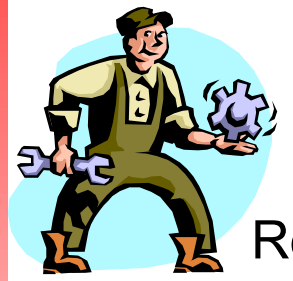
Sciences Must Be Linked

… for research results to be <u>accepted</u> by multiple sciences and to be <u>applied</u> by engineers in buildings



Multidisciplinary Approach

… can link cause & effect between IAQ & people's health, etc., and drive IAQ friendly technologies into buildings



HVAC/Building Standards Making:
Science based, code ready IAQ control practices

IAQ Friendly HVAC/Building RD&D:
Research, develop & demonstrate healthy and productive IAQ control technologies

Contaminant Source & Sink Measurements:
Quantify contaminant source emission and control mechanism removal rates

Methods Evaluations:
Improved health enhances productivity

Intervention Studies:
Control contaminant levels to improve health

Hypothesis Investigations:
Contaminants lead to building related illnesses

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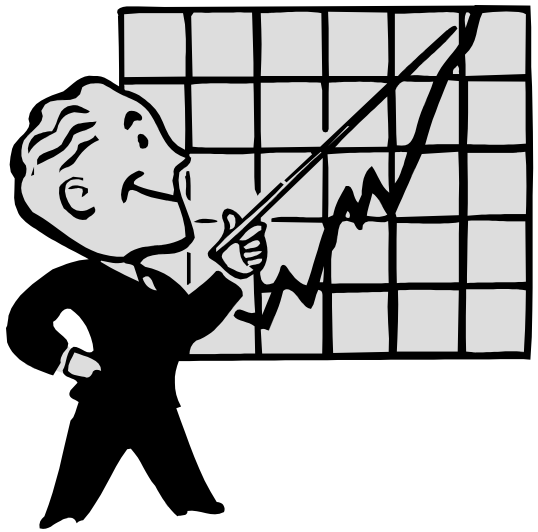
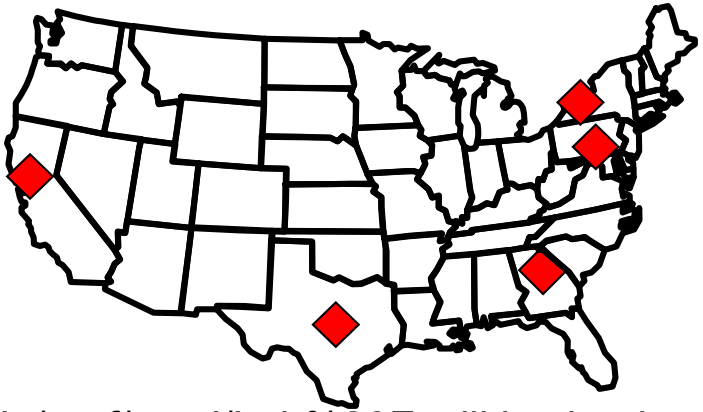
IAQ Market Needs Will Grow

… RD&D Resources Must Be in Place to Support Needs



- IAQ Market Growth Technologies
  - Sensors/Controls
  - Ventilation: energy recovery & dehumidification (for fungi control)
  - Filtration: bioaerosols, particulates and gas/vapor phase chemicals
  - Irradiation: viruses and bacteria



- Limited Resources to Meet Research Agendas
  - LBNL: http://eande.lbl.gov/IEP/
  - U of TX: http://www.ce.utexas.edu/prof/corsi/Lab%20Facilities.html
  - GA Tech: http://www.gtri.gatech.edu/eoeml/shetd/area_indoorair.html
  - Syracuse (part of NYIEQ): http://www.nyieq.com/index.php
  - Penn State: http://www.bio.psu.edu/people/faculty/whittam/research/cure.html

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IEQ Research Agendas

… emerging at federal level

- DOE – EPA – OSHA – NIH – DOD
  - no lead IEQ agency
  - limited IAQ programs
  - no mainstream (ordinary IAQ) agenda
- NIH RFP for New Biodefense Centers
  - first responder capabilities development
  - biodefense mission training
  - biosafety level 4 (maximum containment)
  - emerging infectious disease research also

IEQ Research Agendas

… emerging at other levels

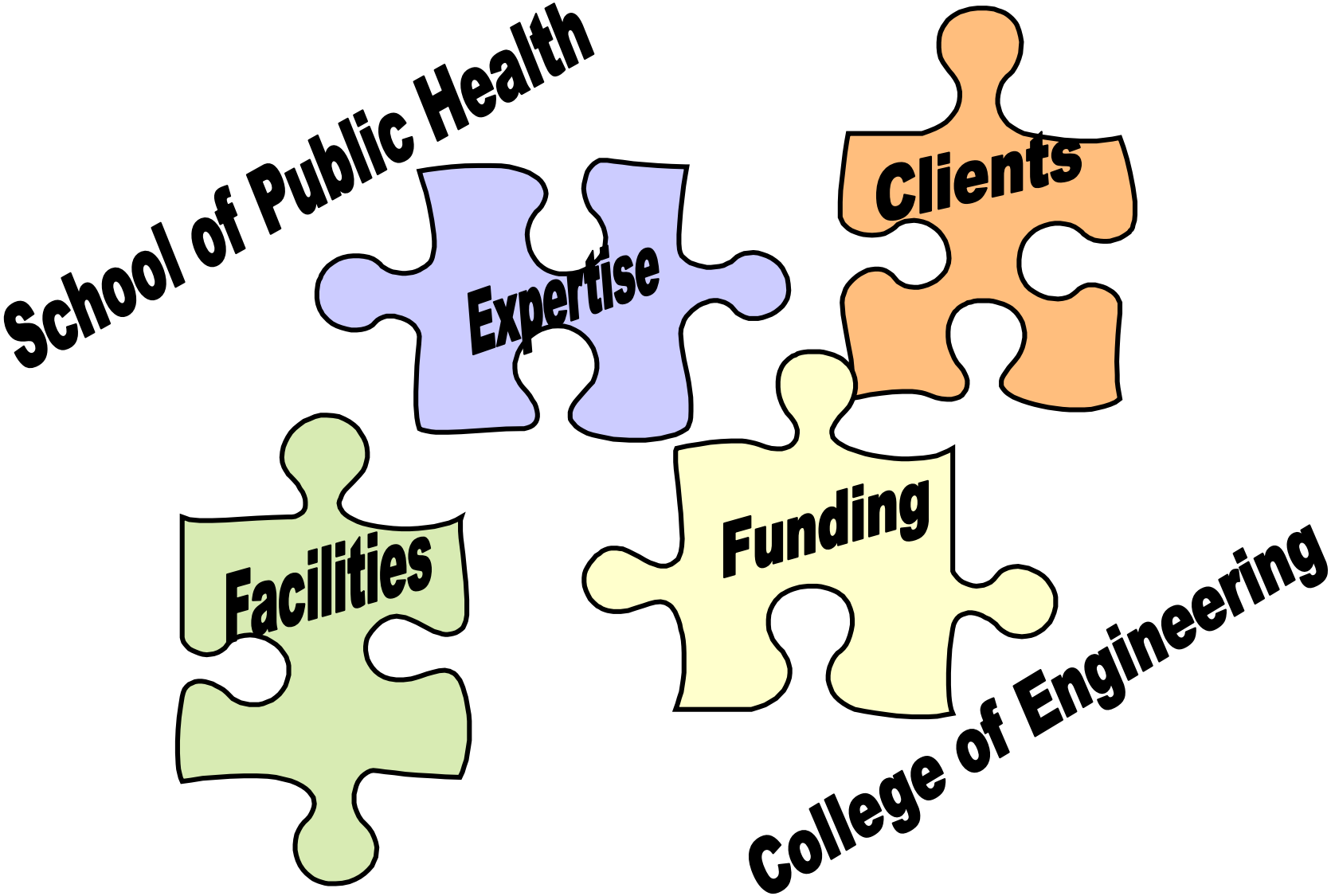
- State and industry pull on feds
  - ASERTTI & DOE
    - Energy related IEQ research agenda
      http://www-library.lbl.gov/docs/LBNL/513/28/PDF/LBNL-51328.pdf
    - Part of $12 MM/yr building research starts 2003
    - CEC $6 MM RFP on Energy Related IEQ
      http://www.energy.ca.gov/contracts/RFP_500-02-501/500-02-501_IEQ_RFP_TEXT.PDF
    - NYSERDA state IEQ office
      http://www.nyieq.com/
  - NEMI & DOE
    - Energy relate IEQ research agenda pending
      http://www.nemionline.org
    - Part of $5 MM/yr building research starts 2003

Key IEQ Agenda Priorities

- Benchmarking IAQ in building sectors
- Ventilation effectiveness & controls
- Microbial growth in envelopes & HVAC
- IAQ Product Evaluations
- Advanced, improved IAQ HVAC
- Best IEQ practices

UIC Positioning Resources

… to assist Great Lakes Region



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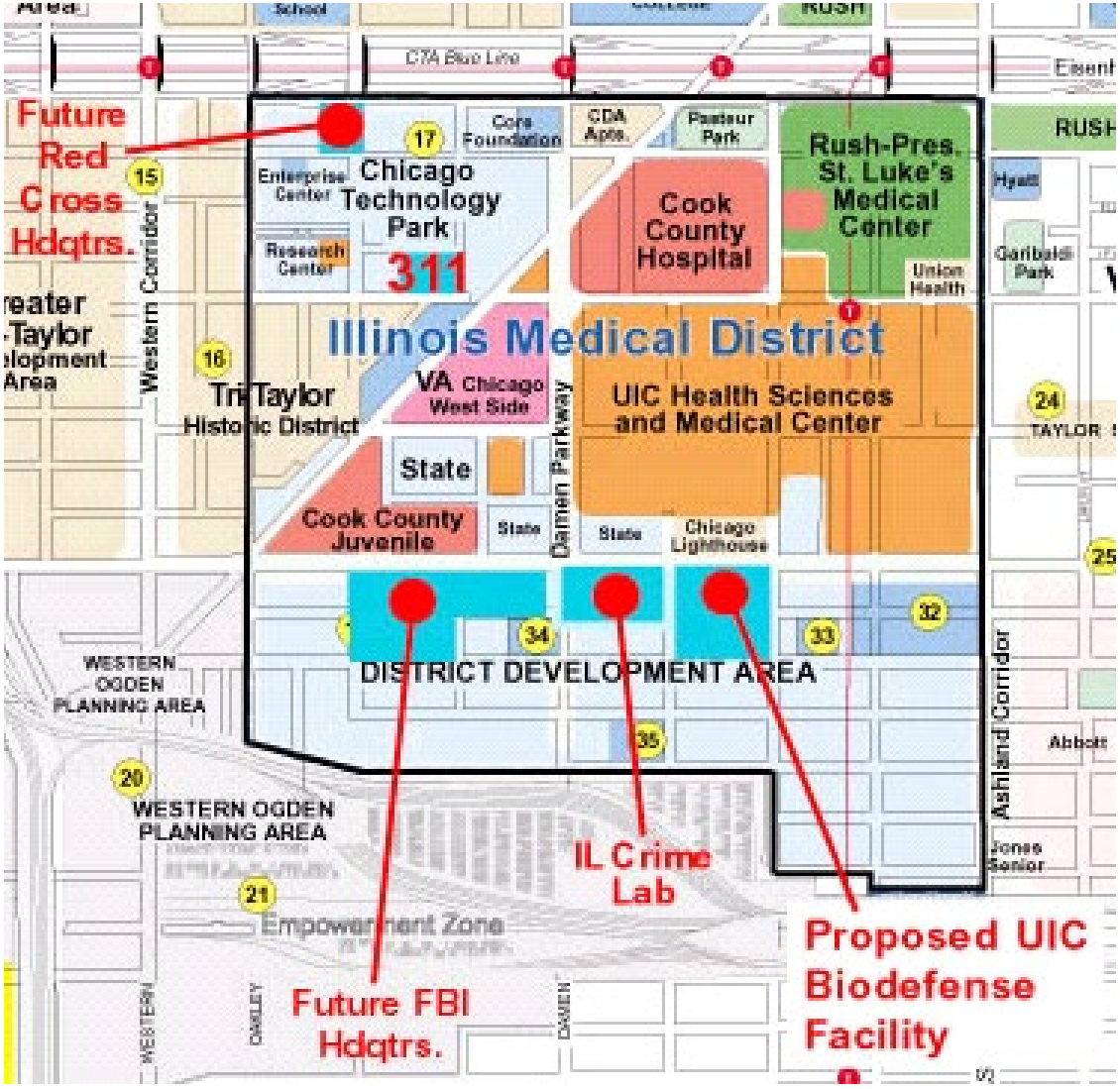
UIC SPH Proposes Biodefense Center to NIH



Further project information at:

www.biodefense.uic.edu

UIC COE ERC Proposing IEQ Environmental Chamber

High Bay Building Room

~ 50’ X 90’ X 25’ with Small Overhead Crane

Mechanical Mezzanine

Mezzanine Walkway

Interchangeable HVAC and IAQ Equipment

IEQ Laboratory

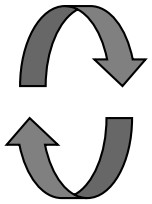
Ceiling Cable Raceway

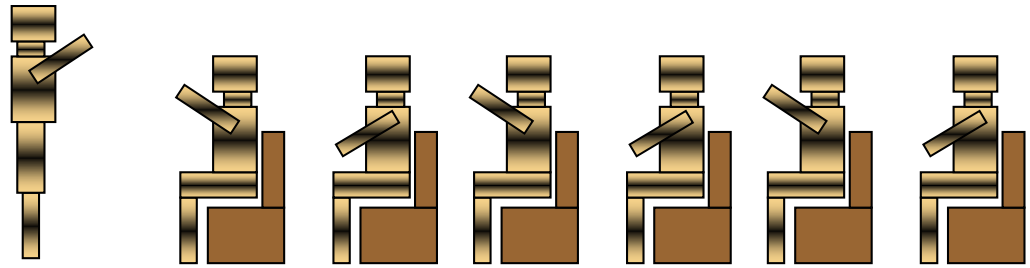
Ceiling Plenum

Data Acquisition Room

Airlock Vestibule

Test Chamber ~30’ X 50’ X 10’





Floor Cable Raceway

Floor Plenum

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Questions?