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EMERGENCY MANAGEMENT ISSUES SPECIAL INTEREST GROUP

Launching Emergency Management Leadership

Shelter in Place- Is it a Valid Choice in a Haz-Mat Emergency?

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Background

- Shelter in place is a commonly quoted protective action in an airborne release
  - Interior room (Preferably above grade)
  - Shut down HVAC
  - Close and seal windows and doors
    - (Duct tape and plastic)
  - Have a means of communication
  - Basic supplies
  - Recommend min 10 sq.ft. per person/ max. 3hrs

Reasoning

- *Short term* protective strategy
- Intuitive to create a barrier between the hazard and the "protected" space
- Easy to implement
- Buys time to develop exposure models

http://www.epa.gov/NHSRC/news/news010606b.html

According to the EPA

- Can be 500 times safer than staying outside under the following conditions:
  - Enter the shelter before the arrival of the contaminant
  - Exit the shelter as soon as the contaminant passes over
  - The contaminant passes over quickly

According to the EPA

- Effectiveness diminishes when:
  - Enter the shelter too late
  - Exit the shelter too late
  - When the contaminant is present outside for a long period of time
  - Going into a shelter after the contaminant has passed over can be harmful

Considerations

- Maximum outdoor plume concentration
- Interior volume
- Room isolation effectiveness
- Air exchange rate (1x=50%, 2x=75%, etc.)
- Plume arrival and departure times
- Air monitoring ability
- Consider CO2 and O2 concentrations

Studies

- "Effectiveness of expedient sheltering in place in a residence" James J. Jetter, Calvin Whitfield
  - air flow measurements were obtained for one interior room in a test house during two weather conditions. For each weather condition, nine experiments were performed with nine different participants sealing the room.
  - Protection factors developed for three outdoor exposure times (15 minutes, 1 hour, and 2 hours) and four shelter occupancy times (15 minutes, 1 hour, 2 hours, and 3 hours)

Studies

- "Effectiveness of Expedient Sheltering in Place in Commercial Buildings" James Jetter/ David Proffitt
  - Expedient sheltering measures (plastic sheeting and duct tape) were applied to four different rooms
  - Protection factors were compared for leaky, typical, and tight buildings under various occupancy times and plume pass-over times
  - Protection factors ranged from 1.0 to 3960, depending on the conditions and reinforced the importance of timing

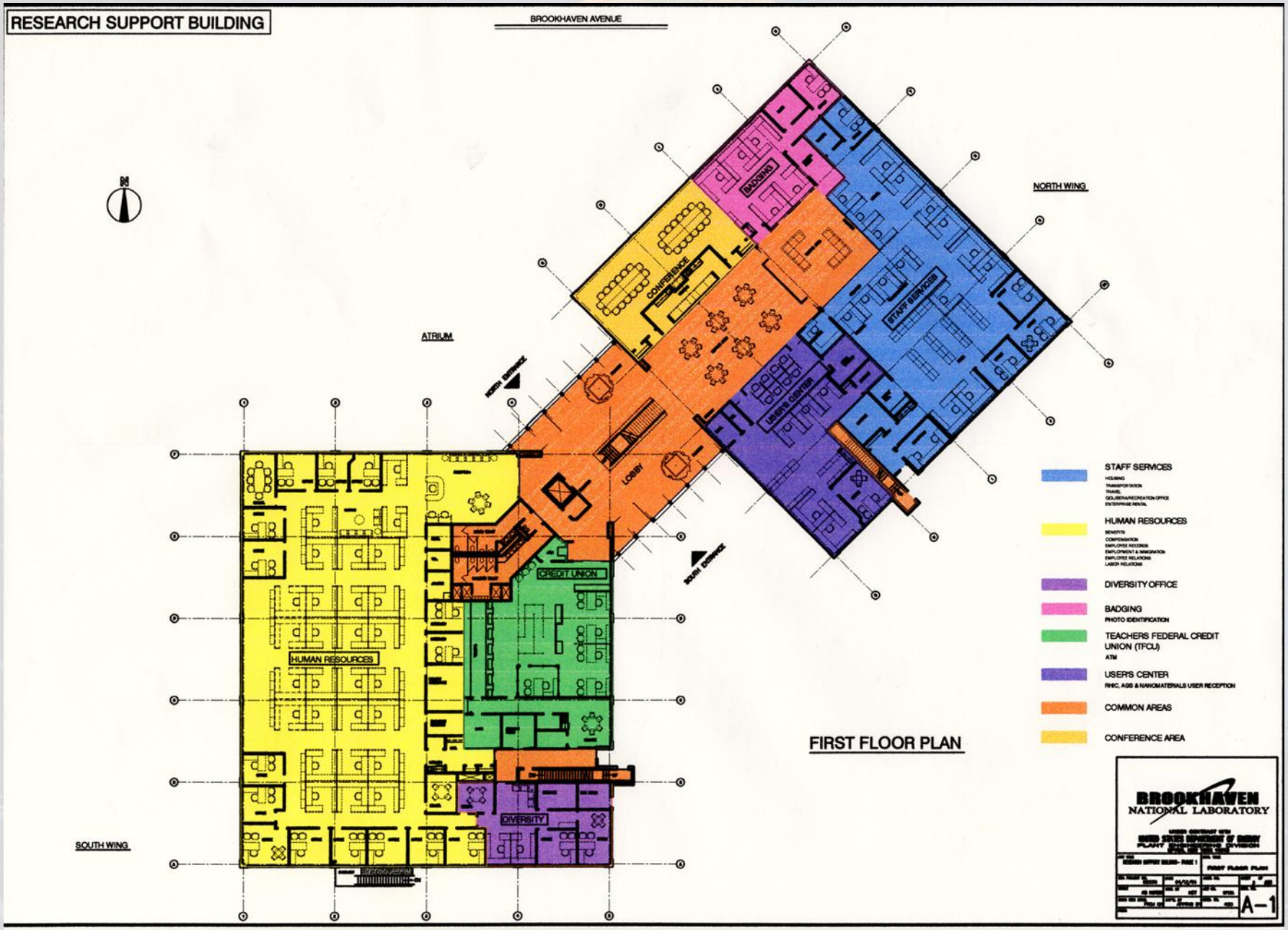
Additional Studies

- "Expedient Sheltering in Place – An Evaluation for CSEPP"
- "Deciding Between In-Place Protection and Evacuation in Toxic Vapor Cloud Emergencies" Glickman
- "Effectiveness of Urban Shelter-in-Place II: Residential Districts" Chan, Nazaroff (LBNL)

BNL Research

- PFT Tracer Study in Bldg. 400
- Track cigarette smoke
- Two tests – Fall 2009, Winter 2010
  - Temperature inversion, calm winds in Winter
- Results
  - Tenfold increase in indoor peak concentrations during temp inversion w/o HVAC changes
  - In/out concentration ratio of 19%
  - Max concentration registered at SIP area

Bldg. 400- RSB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BROOKHAVEN AVENUE
NORTH WING
ATRIUM
SOUTH WING
CONFERENCE
BADGING
STAFF SERVICES
USER'S CENTER
LOBBY
CREDIT UNION
HUMAN RESOURCES
DIVERSITY
STAFF SERVICES
HUMAN RESOURCES
DIVERSITY OFFICE
BADGING
PHOTO IDENTIFICATION
TEACHERS FEDERAL CREDIT UNION (TFCU)
ATM
USER'S CENTER
RHIC, AGS & NANOMATERIALS USER RECEPTION
COMMON AREAS
CONFERENCE AREA
FIRST FLOOR PLAN
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Results

- "…the community must implement SIP without delay and exit from shelter when it first becomes safe to do so. Otherwise, the community can be subjected to even greater risk than if they did not take shelter indoors."

Conclusions

- Lower peak indoor concentrations compared to outdoor concentrations are encountered after a *short-term* release because building envelopes limit indoor-outdoor air exchange
- Delays in notification and response, and the timing of shelter implementation and termination, can impact the effectiveness of the strategy