

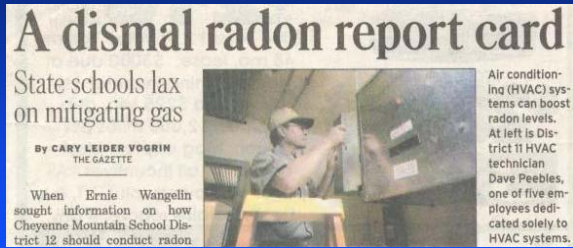
Avoid Bad Press



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Avoid Bad Press



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Radon Management in Schools



Colorado Springs School District No. 11



Colorado Department of Public Health and Environment



Center for Environmental Research & Technology

2011 IAQ Tools for Schools National Symposium

Center for Environmental Research and Technology

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Acknowledgements

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Regional Information

- Colorado Springs
- Located at the base of Pikes Peak
- Elevated radium bearing granite
- Approximately 40% of homes at or above US EPA's action level of 4.0 pCi/L
- The average national indoor radon level is 1.3 pCi/L
- The average indoor radon levels of El Paso County, is 7.2 pCi/L
- US EPA Radon Zone 1 - El Paso County



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District Profile

- School District 11 serves the major metropolitan area
- 62 Schools + 15 Support Buildings
- 4.5 million square feet
- 28,000 students 3500 staff
- School age range: 3 to 109 yrs old
- Mean = 46.4 years Median = 43 years

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What is Radon?

- Radon is a gas
- It is naturally occurring
- It is inert and cannot be seen or smelled
- It enters buildings from the soil beneath them
- Radon is Group A Carcinogen

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Why Test Schools?

- Radon can pose a health risk in any indoor environment
 - Homes
 - Schools
 - Office Buildings

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So What Are The EPA Testing Protocols For Schools?

```

    graph TD
      S1[Step 1: Short-Term Test] --> Q1{Equal to, or greater than 4 pCi/L?}
      Q1 -- No --> N1[No Mitigation Recommended]
      Q1 -- Yes --> S2[Step 2: Long-Term Test]
      S2 --> Q2{Equal to, or greater than 4 pCi/L?}
      Q2 -- Yes --> M1[Mitigation Recommended]
      Q2 -- No --> N2[No Mitigation Recommended]
  
```

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Long Term vs Short Term Testing

- Short-Term Test – minimum 2 days
 - Occupied and Unoccupied hours – no weekends
- Long-Term Test – minimum 90 days
 - Includes weekends in addition to evenings
- Integrating measurements are biased to conditions existing when children are NOT in school and HVAC is adjusted for energy savings

	Test Hours	Occupied Hours	Unoccupied Hours	Percentage Unoccupied
2-day Short-Term test	48	20	28	58%
3-month Long-Term test (12 weeks)	2016	600	1416	70%

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1990 Radon Testing

- District hired consultant to implement EPA's 1989 "Radon Measurements in Schools – An Interim Report" procedures
- Consultant trained facility staff to deploy/retrieve devices
- All buildings were tested using the short-term procedures

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1990 Radon Testing

- Results of short-term testing concluded that 15 schools required long-term testing
- Long-term results determined that 5 schools required mitigation
- District hired mitigation system consultant to design and install systems in the 5 schools

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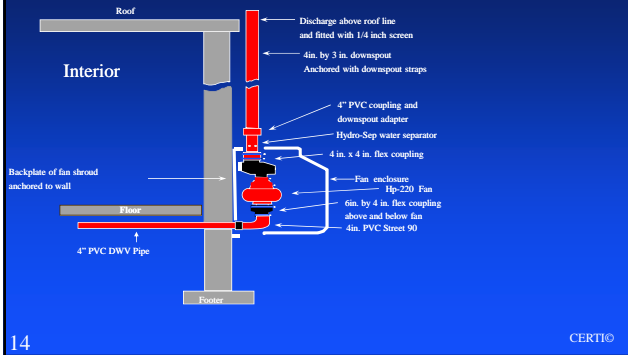
Active Soil Depressurization



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Active Soil Depressurization



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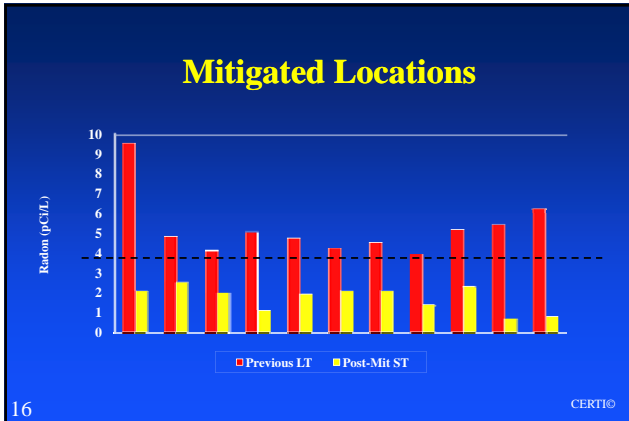
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Active Soil Depressurization



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- ### Mitigation System Inspection
- 2006 – District hired original 1990 mitigation systems consultant to inspect existing systems
 - Found systems operating as designed
 - Found systems were not maintained
 - Life expectancy of mitigation system
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Mitigation System Preventative Maintenance

- Monthly inspections to include:
 - Inspect fan indicator
 - Fan operation
 - Visible pipe connections



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District Receives Grant

- Consultant contacted State of Colorado requesting grant to retest district radon levels
- State approved grant
- Historical long-term measurements > 3.5 pCi/L conducted in 1990 were proposed to be retested in the same 15 buildings (over 300 locations) 17 years later

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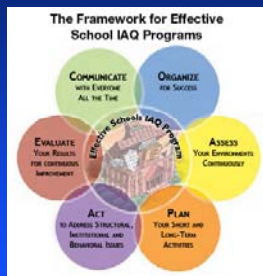
News Travels Fast



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Key Drivers



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**ORGANIZE
for Success**

Organize

- 2006 – Work with outside consultant to help implement radon testing
- Analyze previous historical data
- Organize current floor plans and compare to original test plans
- Review deployment locations
- Assemble deployment/retrieval team

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Field Log Sheet

Seq	Time	Radon	Temp	Humidity	Wind	Dir	Pressure	Notes
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
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28								
29								
30								

- Sequence Number
 - Order in which deployed
 - Ties to Floor Plan

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**COMMUNICATE
with stakeholders**

Communicate

- Reviewed plan for implementing tests with principals and building managers
- Distribute Communication plan

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COMMUNICATION Plan



- Extremely Important
- Proactive
- Indicate what will happen after survey is complete:
 - Where results can be accessed
 - What steps will be taken if elevated

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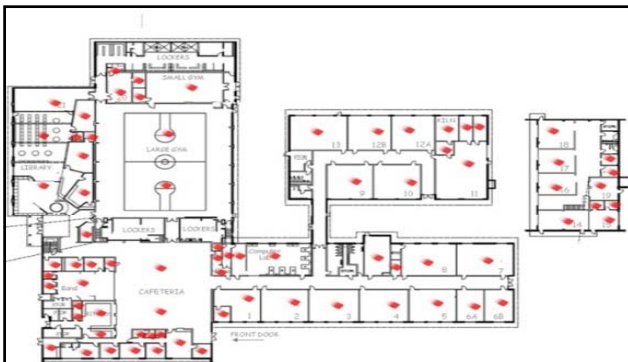
ASSESS Your Environment



- Determined test kits to use
- Determine placement of test kits
- Survey building structure & HVAC for possible radon entry

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ASSESS HVAC Equipment



- Belt on Air-Handler serving Room was found to be broken.
- The effect of this would be to reduce air circulation as well as no fresh air make-up to this room.

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PLAN Long-Term Activities



- With consultant, identify action plan and set schedule for testing 15 schools based on historical elevated levels
- Consultant instructed facilities staff on deployment/retrieval of kits

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Planning the Survey – When?



- When school is in session
- HVAC System
 - When operating normally
 - When economizers are not typically in use
 - After major building or HVAC modifications.

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Determine the Final Number of Devices Needed

Building Total

Regular:	Number of occupied ground floor rooms	Reg =	_____
Duplicates	Multiply the number of locations by 0.10*	Dup =	_____
Blanks	Multiply the number of locations by 0.05*	Blank =	_____
Bldg Total	Sum of Regular, Duplicates, and Blanks	Bldg Total	_____

Survey Total

Spikes	Multiply total number of locations by 0.03*	Spikes =	_____
Total	Add all Bldg Totals to number of Spikes	Total:	_____

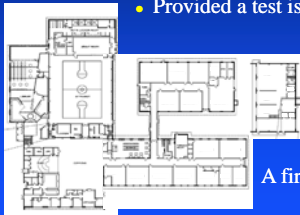
* Round up to nearest whole number

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Planning the Survey – Where to Test

- All frequently occupied rooms
 - In contact with soil and above crawlspaces
- No need to test upper floors
 - Provided a test is conducted in room beneath it

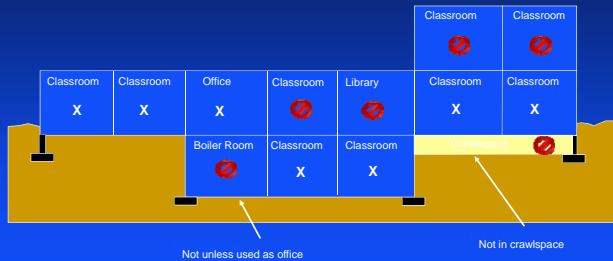


A fire escape plan is a great tool

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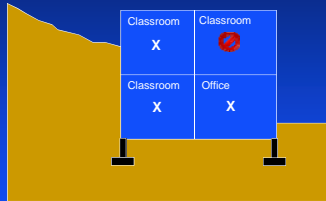
Lowest Location in Contact with Soil



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Rooms in Contact with Soil



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ACT Structural & HVAC Issues

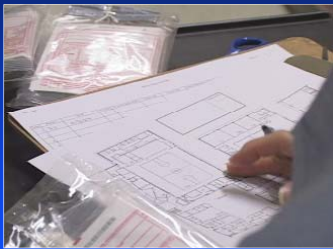


- Testing - Refer to "Radon Measurement in Schools: Revised Edition," EPA 402-R-92-014
- Repair structural & HVAC issues
- Train for deployment of test kits

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Conducting the Survey – Deployment Record Keeping



- Log Sheet
 - Sequence. #
 - ID#s
 - Location
 - Type
- Fire Escape Plan
 - Sequence #


Use for Deployment and to verify device numbers at retrieval

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Long-Term, High Precision Devices Utilized

- Deployed Mid November to Mid April
- Deployed by District personnel
 - Trained
 - QA/QC procedures in place
 - Notices to staff as being part of a study
 - Affixed to walls with advice and contact information
 - Excellent return rate



Notices Posted





Deployed Device

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Example of Deployment

- Out of drafts
- 3 feet from exterior walls
- Minimum 20 inches from floor
- Away from hot surfaces
- Where it will not be disturbed!

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Large Rooms (1/2000 Sq.Ft.)






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EVALUATE Data for Improvement

- Retrieve test samples
- Compared 2006 data to 1990 data
- Determine additional testing needs and follow-up.

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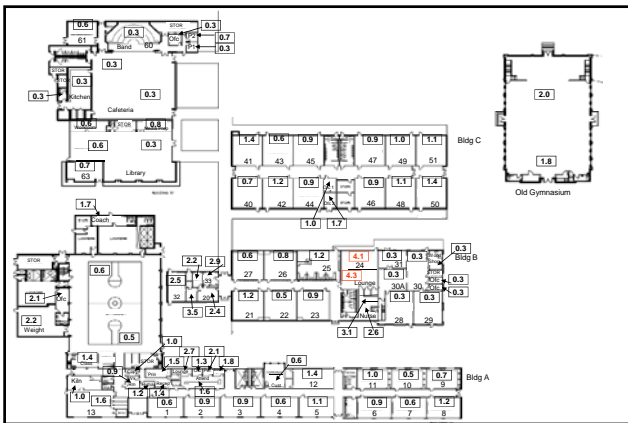
Enter Results on Floor Plan

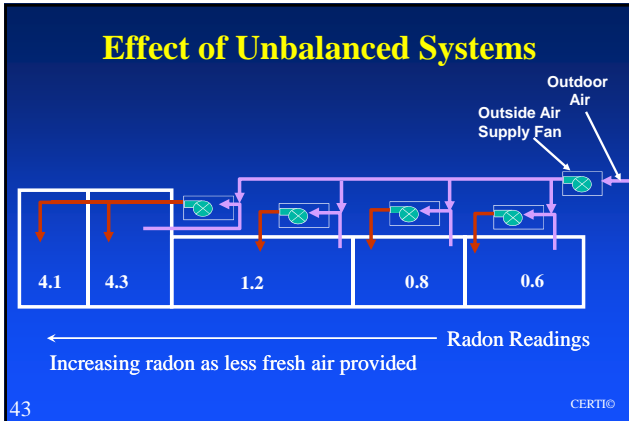


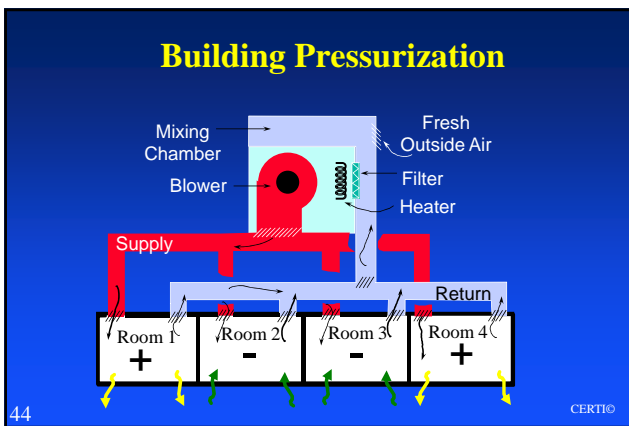
- Allows for clear interpretation of location of results
- Room designations change over time.
- Useful for visualizing problem areas
- Great tool for response follow-up

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Understanding Radon Entry into Large Buildings



- Pressure differences
 - Stack (chimney) effect
 - HVAC Systems
 - Fresh air make-up can reduce radon
 - Unbalanced or poorly maintained systems can increase radon.

Roof Top HVAC Unit with Fresh Air Make-Up

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Follow-Up - CRMs

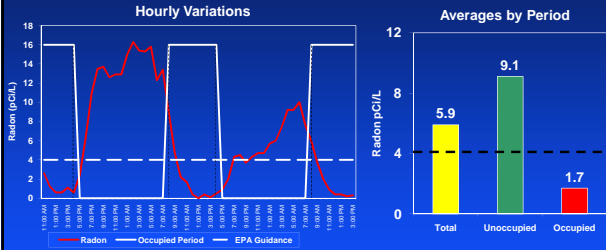


- Continuous Radon Monitors
 - Record hourly
 - Run for 2+ days
 - Provide insight into conditions during occupancy

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Follow-up Data with Continuous Radon Monitor

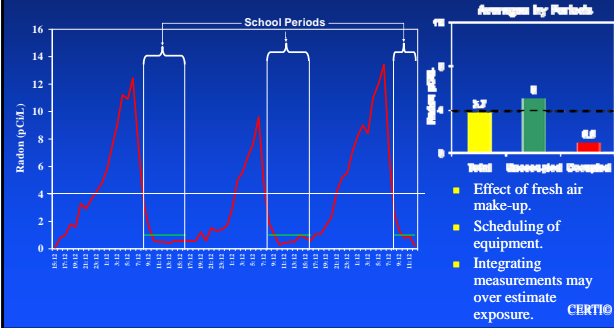


Occupied periods assumed to be: 7:30 AM to 3:30 AM
 Hourly measurements are average for preceding hour
 Test Period: April 18-20, 2007
 Post HVAC adjustments
 Pre-HVAC ST Measurement: 6.0 pCi/L overall

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Typical Hourly Variations in a School

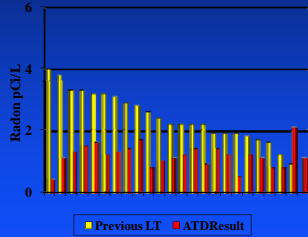


- Effect of fresh air make-up.
- Scheduling of equipment.
- Integrating measurements may over estimate exposure.

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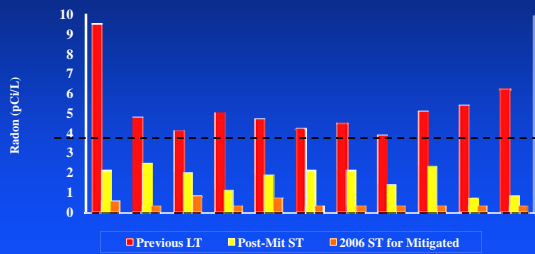
HVAC Modifications

- Improved IAQ
 - Happened in all buildings
- Paired comparison of current long-term to historic long-term.
- There is a statistical difference
 - Current exposures are lower
 - No levels were in excess of 4.0 pCi/L



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Retested Mitigated Locations



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Summary of Key Points

- You have to test
- Test during school year when economizers are OFF
- Conduct short-term tests during school week
- Typically only a few rooms will be elevated
 - Usually associated with HVAC problems
- Response
 - Follow-up measurements and investigation
 - Mitigation works
- One elevated reading (if confirmed) exhibits potential for entire school
 - HVAC vigilance
 - Retesting?
 - Additions

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Key Drivers



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Questions?

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CERTI Training

Key Points

Purpose: To enable radon professionals or environmental managers to design, implement and interpret the results of a radon survey conducted in schools and which would also have application to other large buildings such as commercial buildings.

Program Elements:

- Basis for testing schools and large buildings
- Determine the number of test devices needed for a thorough radon survey
- Develop a communication plan for teachers, parents and employees for the successful execution of a survey
- Execute the survey and maintain proper records
- Interpret the results of the survey, including Quality Assurance measures and convey the health risks associated with the results obtained
- Prepare report with recommendations for follow-up action if necessary
- Discussion on follow-up approaches when survey results are elevated

Course Materials:

- Video and audio segments
- Protocols
- Online quizzes for reinforcement
- Certificate of completion will be provided at conclusion of course

Resources:

- Generic notices for communication plan
- Field log sheets
- Generic survey report
- Generic video that can be embedded into a school's web page to help convey the elements of the survey

Listing:

- Individuals who complete this course will be listed on CERTI's web page as having received this specialized education
- Listing is at the option of the student

Basic:

- US EPA Radon Measurement in Schools, Revised Edition, EPA 402-R-92-014
- Twenty years of experience in conducting surveys in over 200 school buildings

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