Arnold Schwarzenegger
Governor

ATTACHMENT #13
MOLD-RESISTANT CONSTRUCTION TRAINING MATERIALS

PIER FINAL PROJECT REPORT

Prepared For:
California Energy Commission
Public Interest Energy Research Program

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Indoor Environmental Engineering

December 2005
CEC-500-2007-035-AT13

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MOLD-RESISTANT CONSTRUCTION WORKSHOP

UNDERSTANDING AND CONTROLLING MOISTURE IN BUILDINGS

by
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- Staff Scientist: IAQ Program, Lawrence Berkeley Laboratory
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- Published 26 Peer-Reviewed Studies on Building Air Quality
- IAQ Diagnostics/Mitigation in over 2000 Buildings

Workshop Purpose

The purpose of this builders workshop is :

To inform builders on how to minimize the risks associated with the occurrence of mold in the construction of new residential homes.

In addition, this workshop discusses the various roles and responsibilities that the developer, designer, builder, and homeowner each share in building a home which has a low risk of developing mold.

Workshop Purpose

Why the big concern about mold ???

Because mold growth in buildings has the potential for enormous financial ramifications ($$$$$$$$) from:

- **building material damage**
- **building content damage**
- **personal injury**
- **litigation costs**
- **reputation loss**

Workshop Outline

This workshop introduces

"A California Builder's Guide to Reducing Mold Risk".

This guide discusses strategies for mold resistant building construction.

Workshop Outline

1 **Introduction**

- **Mold, mildew, and fungi**
- **Causes of mold growth in buildings**
- **Impacts of mold growth in buildings**

Workshop Outline

2 **Moisture in Buildings**

- **Sources of moisture in buildings**
- **How building materials get wet**

Workshop Outline

3 **Strategies for Reducing the Risk of Mold**

- **Keep water out of the building**
- **Drain/dry moisture problems quickly**
- **Limit mold growth while drying out**

Workshop Outline

4 **Decisions for Reducing the Risk of Mold**

- **Development decisions**
- **Design decisions**
- **Construction decisions**
- **Homeowner responsibilities**

Workshop Outline

5 **Diagnostic Tools for Identifying Building Moisture Problems**

- **Building envelope leakage problems**
- **Concrete slab leakage problems**
- **Water vapor condensation problems**

Fungi and Mold

What is mold?

Molds belong to a class of organisms called "fungi" that are :

- **not plants** (because they lack chlorophyll), *and*
- **not animals** (because they have no organs for food uptake).

Fungi and Mold

Fungi may be divided into three groups:

- **Yeasts**
- **Fleshy fungi or macro fungi (mushrooms)**
- **Filamentous fungi or micro fungi (molds)**

Fungi and Mold

- The last of these (molds) are of concern in buildings with moisture-related problems. Spores may be emitted which can become airborne and be inhaled.

- At elevated concentrations, certain types of mold spores contain compounds which may cause irritation or disease to sensitive individuals. Health effects range from allergy to asthma and other respiratory effects, to systemic toxicoses. Skin rash and irritation may also occur following contact with some types of fungi.

Fungi and Mold

Is mold concealed inside of wall or ceiling cavities an indoor air quality problem ?

Yes, sometimes.

If the mold is growing on surfaces which are in communication with the indoor air.

Communicating surfaces include mold growing within building cavities.

Non-communicating surfaces include those where mold is growing on the interface of two adjacent surfaces (e.g. between exterior siding and shear wall, under VCT tile, or under vinyl wall paper). Mold in these locations become a concern when work is done that separates these surfaces.

Fungi and Mold

What causes mold to grow in buildings ?

For mold growth to develop in buildings, surfaces of materials must become wet and stay wet for prolonged periods of time (i.e. days, weeks).

Fungi and Mold

Building materials can become wet if :

The building envelope does not preclude liquid or capillary flow of water (rain or landscape irrigation), or if

The surface temperature of the building materials falls below the dew point and condensation occurs

Fungi and Mold

In addition to chronic moisture, mold growth requires...

- **nutrient source**
- **viable spores**

Fungi and Mold

Since mold spores are ubiquitous in the outdoor air and indoor air of all buildings, and since many building materials such as sheet rock are a nutrient source...

The critical factor underlying every building mold contamination problem is chronic moisture.

Fungi and Mold

The following (not included in this handout) are photos depicting various types of fungal contamination occurring in buildings.

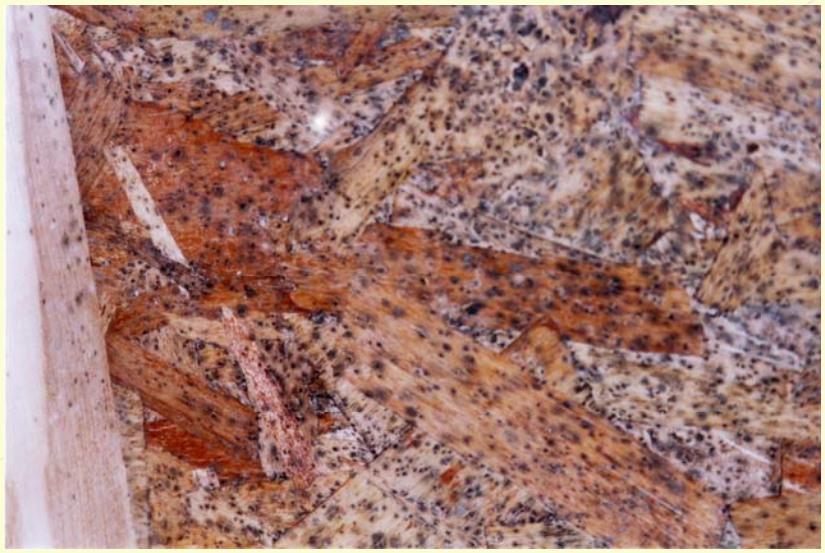
Building Moisture Case Study #1
Inadequate Attic Ventilation

- Investigation of home in a cold climate with moisture condensation problems in the attic.

Building Moisture Case Study #1
Inadequate Attic Ventilation

- Moisture staining resulting from condensation on attic side of the OSB roof sheathing surface on the north side of the attic.

Building Moisture Case Study #1
Inadequate Attic Ventilation



- Fungal resulting from condensation on attic side of the OSB roof sheathing surface on the north side of the attic.

Building Moisture Case Study #1
Inadequate Attic Ventilation

- Cause of problem: Soffit vents were blocked and ridge vent was sealed over with moisture barrier.

Building Moisture Case Study #1
Inadequate Attic Ventilation

- Additional source of indoor moisture: Unvented crawlspace with no vapor retarder to minimize water vapor from infiltrating into the residence.

Building Moisture Case Study #2
"Flooded Crawlspace"

- Front view of the residence.

Building Moisture Case Study #2
"Flooded Crawlspace"

- Construction grading behind the residence, or creatively,.. lakeside property development.

Building Moisture Case Study #2
"Flooded Crawlspace"

- Excessive water flowing through and pooling in the crawlspace. Efflorescence evident on foundation.

Building Moisture Case Study #2
"Flooded Crawlspace"

- Excessive efflorescence evident on pier footing.

Building Moisture Case Study #2 "Flooded Crawlspace"

- Leather couch with no visible fungal growth on outside surfaces.

Building Moisture Case Study #2
"Flooded Crawlspace"

Concealed fungal growth on fabric underside side of couch pillows.

Building Moisture Case Study #2
"Flooded Crawlspace"

- Leather bound books with visible fungal growth.

Building Moisture Case Study #2
"Flooded Crawlspace"

Fungal growth not visible to the unassisted eye on table top, made visible by flash photography.

Building Moisture Case Study #2
"Flooded Crawlspace"

Other belongings with visible fungal growth.

Building Moisture Case Study #3
"Sinking Building"

View of the residence.

Building Moisture Case Study #3
"Sinking Building"

Improper grading and soil compaction caused this slab on grade foundation to sink.

Building Moisture Case Study #3
"Sinking Building"

Moisture coming through the slab foundation, installed without a capillary break or vapor retarder, causes excessive moisture in the indoor air resulting in condensation and indoor rain.

Building Moisture Case Study #3
"Sinking Building"

High indoor moisture conditions contribute to growth of micro and macro fungi growing on all walls, ceilings and carpeting throughout the building.

Building Moisture Case Study #3
"Sinking Building"

Close up of macrofungi (i.e. mushrooms) growing along baseboard of exterior wall.

Building Moisture Case Study #4
"Leaky Clothes Dryer Vent"

View of multi-residential structure.

Building Moisture Case Study #4
"Leaky Clothes Dryer Vent"

View of clothes dryer vent on exterior wall.

Building Moisture Case Study #4
"Leaky Clothes Dryer Vent"

Close-up view of clothes dryer vent with a double layer of window screening for a bird screen.

Building Moisture Case Study #4
"Leaky Clothes Dryer Vent"

Close-up view of screening clogged with lint that had built-up restricting the exhaust of moisture from the clothes dryer

Building Moisture Case Study #4
"Leaky Clothes Dryer Vent"

Moisture accumulation in the exhaust duct caused dust to corrode and moisture to enter the ceiling cavity promoting fungal growth.

Building Moisture Case Study #4
"Leaky Clothes Dryer Vent"

Close up view of the exhaust duct where it exits the building, and has corroded away.

Building Moisture Case Study #5
"Wet Foundation Slab"

Lifting of sheet vinyl flooring covering is a sign that this foundation slab is pushing too much water vapor.

Building Moisture Case Study #5
"Wet Foundation Slab"

Water squirting up through seams of vinyl tiles is another sign that this foundation slab is pushing too much water vapor.

Building Moisture Case Study #5
"Wet Foundation Slab"

Rusting of bottom of file cabinet is yet another sign that this foundation slab is pushing too much water vapor.

Building Moisture Case Study #5
"Wet Foundation Slab"

High water table and insufficient capillary break is the cause of the excessive water vapor drive through the foundation slab.

Building Moisture Case Study #6
"Rain Intrusion During Construction"

Parapet not closed in which allowed rain to intrude into building and flood the concrete floor. Water was absorbed by capillary action into the gypsum wall board causing extensive mold growth on room and cavity side.

Building Moisture Case Study #7
"Excessive Window Condensation"

Excessive window condensation and ensuing mold on window stool and window curtain.

Building Moisture Case Study #7
"Excessive Window Condensation"

Excessive window condensation and ensuing mold on window jambs, stool and header.

Building Moisture Case Study #8
"Cellulose Insulation Installed Too Wet "

Visible fungal growth on cavity side exterior plywood and corrosion of piping and fasteners

Building Moisture Case Study #8
"Cellulose Insulation Installed Too Wet "

Visible fungal growth on cavity side

exterior plywood

Building Moisture Case Study #8
"Cellulose Insulation Installed Too Wet "

Visible fungal growth on cavity side of exterior wall.

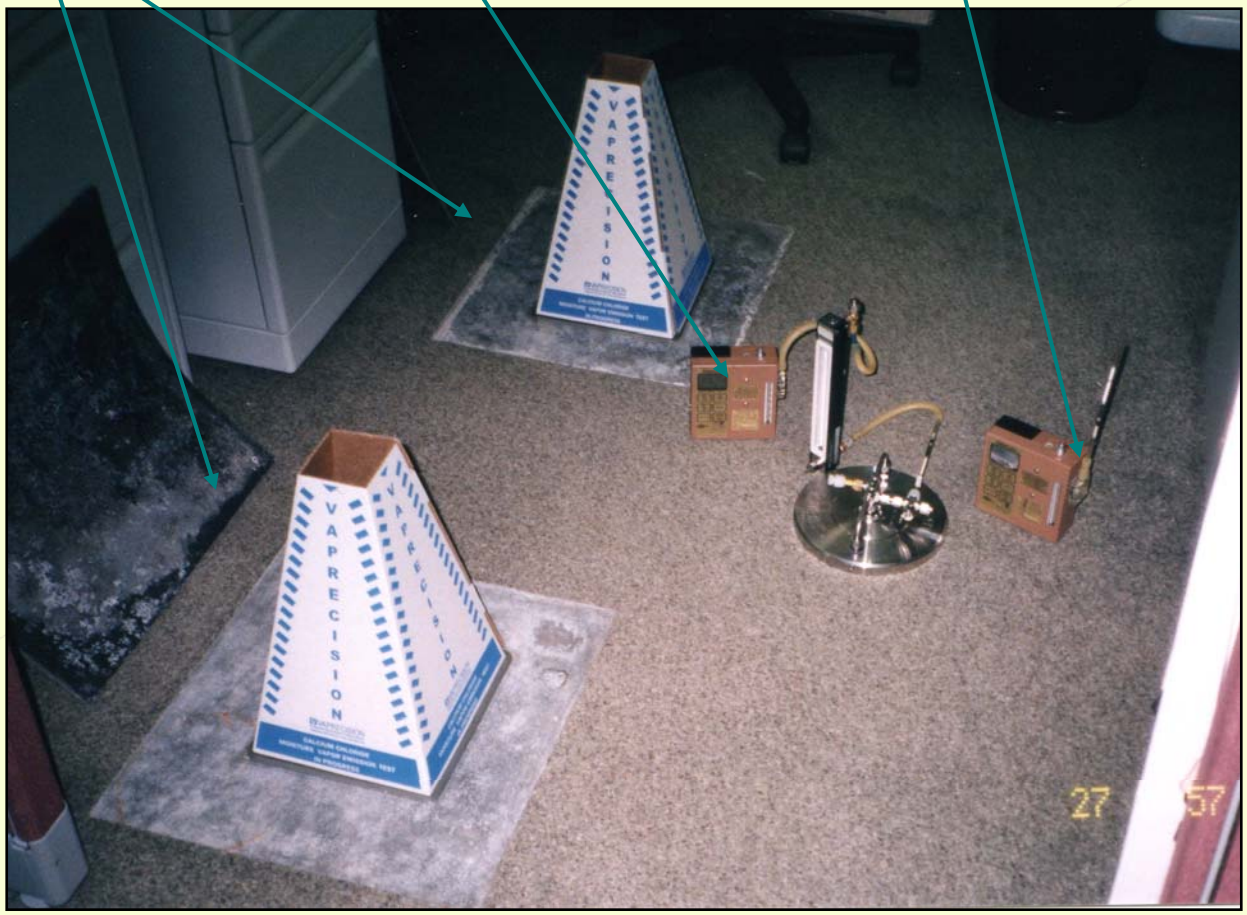
Building Moisture Case Study #9
"Contaminant Emissions From PVC Carpet Tiles on Damp Concrete"

Direct lay down system (glueless) on concrete with heavy white and green/brown deposits on back.

CaCl water vapor emission domes

FLEC carpet VOC emission sampler

Indoor VOC sampler



Sources of Moisture in Buildings

There are three sources of moisture in buildings:

1.) indoor sources

2.) outdoor sources

3.) underground sources

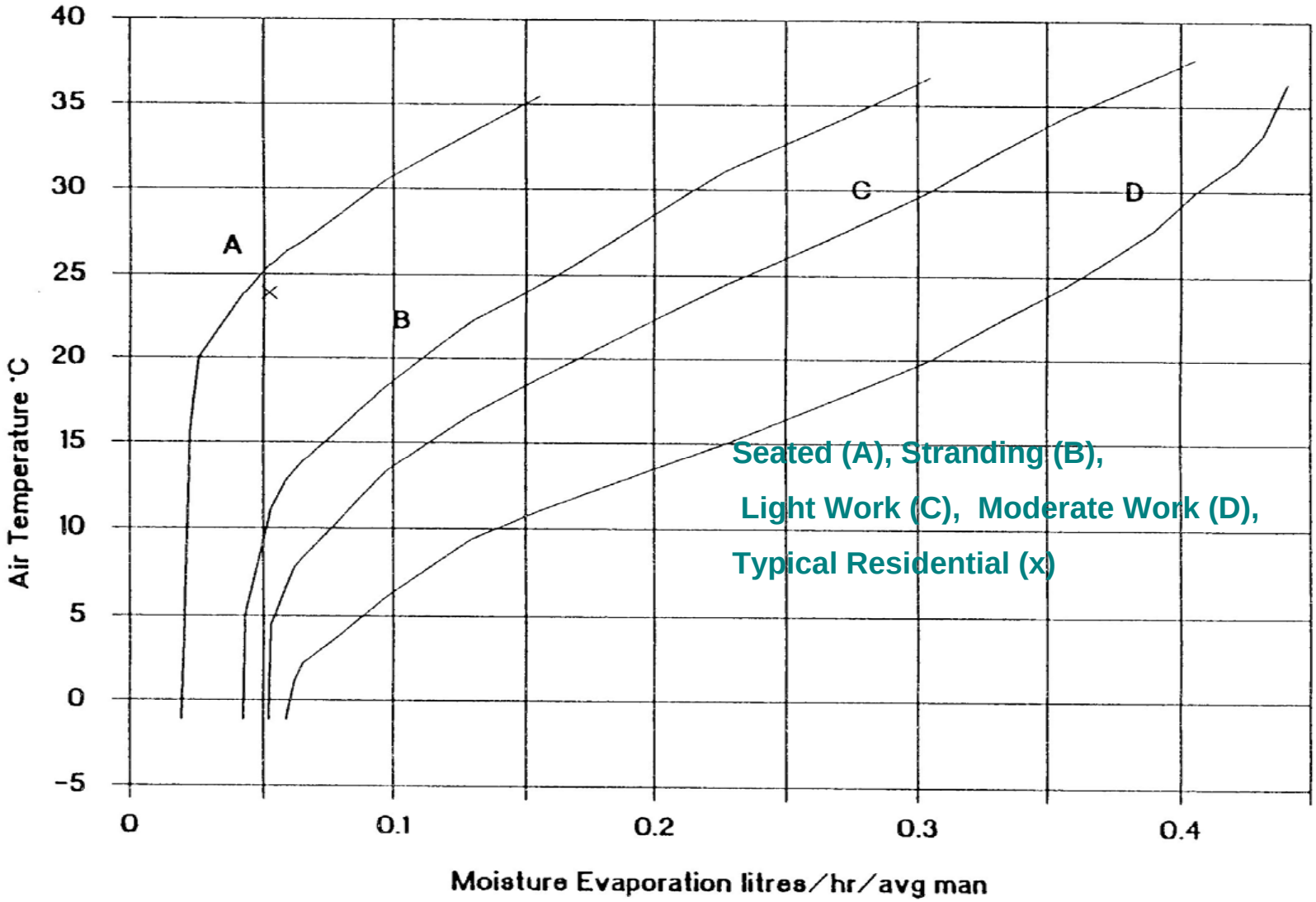
Indoor Sources of Moisture (Liters)

Aquariums	Replacement of evaporative loss
Bathing: tub (excludes towels and spillage) shower (excludes towels and spillage)	0.06/standard size bath 0.25/5-min shower
Clothes washing (automatic, lid closed, standpipe discharge)	0+/load (usually nil)
Clothes drying: vented outdoors; not vented outdoors or indoor drying line	0+/load (usually nil) 2.2 to 2.92/load (more if gas dryer)
Combustion: unvented kerosene space heater	0.95/L per litre of kerosene burned
Cooking: breakfast (family of four, average)	0.17 (plus 0.28 if gas cooking)
lunch (family of four, average)	0.25 (plus 0.32 if gas cooking)
dinner (family of four, average)	0.58 (plus 0.75 if gas cooking)
simmer at 95°C, 10 min, 0.15-m pan (plus gas)	less than 0.005 if covered, 0.06 if uncovered
boil 10 min, 0.15-m pan (plus gas)	0.23 if covered, 0.27 if uncovered
Dishwashing: breakfast (family of four, average)	0.1
lunch (family of four, average)	0.08
dinner (family of four, average)	0.32

Indoor Sources of Moisture (Liters)

Firewood storage indoors (cord of green firewood)	190 (softwood) to 380 (hardwood)/6 months
Floor mopping	0.15/m^2
Gas range pilot light(each)	0.18/or less/day
Gas refrigerator	1.3/day
House plants (5 to 7 plants, average)	0.41 to 0.45/day
Humidifiers: 0 to 120+/day	(2.08 average/h)
Pets	
Respiration and perspiration (family of four, average)	Fraction of human adult weight 0.21/h
Refrigerator defrost	
Saunas, steambaths, and whirlpools	1.03/day (average)
Vegetable storage (large-scale storage is significant)	0 to 1.08 +/h
	0 + (not estimated)

Human Respiration and Perspiration Rates



Indoor Sources of Moisture

Non-household related sources :

- **desorption from building materials**
  - **-seasonal 3-8 liters/ average day**
  - **-new construction + 4.7 liters/average day**

- **plumbing leaks 0-many liters/day**

- **combustion exhaust gas backdraft or spillage**

0 - 9 Liters/day

Indoor Sources of Moisture

Problematic indoor moisture sources

- firewood storage in basement - 5 liters/day
- clothes drying inside or using an unvented clothes dryer - 12 liters day
- plant room or greenhouse - 0.1 to 100 liters/day depending on plant size
- daily wet mopping of a large kitchen - 9 liters day
- standing water in basement - 140 liters/day

Outdoor Sources of Moisture

- **High outdoor absolute humidity**

30 to +120 Liters/day

- especially high in buildings which are bringing in lots of outside air without adequate dehumidification

- **Rain or snowmelt penetration**

0 to many Liters/day

Underground Sources of Moisture

- Ground moisture migration 0 - 72 Liters/day
  - especially high in homes on hillsides with uncovered dirt crawlspaces and in homes with damp basements

Properly constructed foundations with good subdrainage and dampproofing should maintain moisture loads from foundations to less than 3 liters/day.

Typical Residential Moisture Loads

- In properly constructed and operated residential buildings, the single largest moisture source is people (i.e. 5-6 liters/day for a family of four.

- Cooking and cleaning double the moisture load to 10 liters/day.

- Construction sources, such as the moisture trapped within fresh concrete and green lumber materials, double the total load to 20 liters/day for the first year.

Building Science

Building materials can become wet if :

- the building envelope does not preclude liquid or capillary flow of water (rain or landscape irrigation), or if

-the surface temperature of the building materials falls below the dew point and condensation occurs

Building Science

With respect to condensation of water vapor, the relationship Between air temperature, relative humidity, humidity ratio, and dew point are summarized in the ASHRAE Psychrometric chart.

If a surface temperature falls below the dew point temperature, then condensation of moisture will occur on that surface (e.g. surface temperatures lower than 55 ^{O}F in air that is 50% relative humidity @ 75 ^{O}F).

Building Science

The four moisture transport mechanisms in buildings are:

1.) liquid flow
2.) capillary flow
3.) air flow
4.) diffusion

Moisture problems and resulting fungal growth can occur:

- on indoor surfaces (e.g. walls, ceilings, windows) and
-on concealed surfaces (e.g. inside of wall, ceiling, and floor cavities).

Reducing Mold Risk

This builders' guide describes a three-part strategy to reduce mold risk:

1st. Keep the water away

2nd. Keep the water out

3rd. Limit mold growth while moisture dries out

Reducing Mold Risk

Keeping the water away.

Most moisture gets into buildings from water outdoors.

- **irrigation**
- **groundwater**
- **rain or snow**
- **humidity in outdoor air**

The early decisions made by the developer and owner have the most effect on keeping the water away (e.g. decisions on site drainage, roof overhangs, types of plants and grasses used).

Reducing Mold Risk

Keeping water out.

Some rain is always going to fall on the roof and flow down the exterior walls, and groundwater is always under the foundation, and some moisture gets into materials during construction.

To insure that these moisture encounters don't help mold grow:

- **drain the roof and walls**
- **waterproof the foundation**
- **don't trap too much moisture in materials during construction**

Reducing Mold Risk

Limiting mold growth while moisture dries out.

Indoors, sooner or later, there will be plumbing leaks, condensation, and water spills.

- **design the building so that water cannot spread into materials around the source of the spill or leak**

- **use building materials on which mold grows more slowly or not at all**

Reducing Mold Risk
Development Decisions

Keeping water away.

- Proper site grading, paving, lot coverage and drainage.
- Utilize xeriscape (Dry landscaping)
- Extra care with irrigated landscaping
- Extra care with plantings near foundations ("Landscaper's Moat")

Figure 5.2 Foundation shrubs increase mold risk

Figure 5.3 Daily irrigation increases mold risk

Reducing Mold Risk
Development Decisions

Keeping water out.

- Roof lines that favor water-exclusion (e.g. roof overhangs)
- Progress payments that favor water tight connections.
- Extra care with below-grade walls on hillsides.

Figure 2.4 Roof overhangs - longer is better

Figure 3.2 Roof overhangs reduce risk

Reducing Mold Risk
Development Decisions

Limiting mold growth.

Designer and builder can reduce mold risk if they have budgets for:

- **sheathing panels intended for exterior use rather than for interior finish**

- **tub/showerwall panels designed fro periodic wet exposure instead of standard interior finish**

Reducing Mold Risk
Design Decisions

Keeping water away.

- Keeping surface water from reaching the foundation by site grading and by excellent drainage.

- Keeping irrigation and earth berms away from the foundation to avoid daily puddles.

- Overhanging roofs so that only a small fraction of the the annual rainfall can flow down the side of the building. NOTE: fireproof roof overhangs in urban-wildlife interface zones)

- Provide xeriscape

- Extra attention for houses with zero setback lot lines.

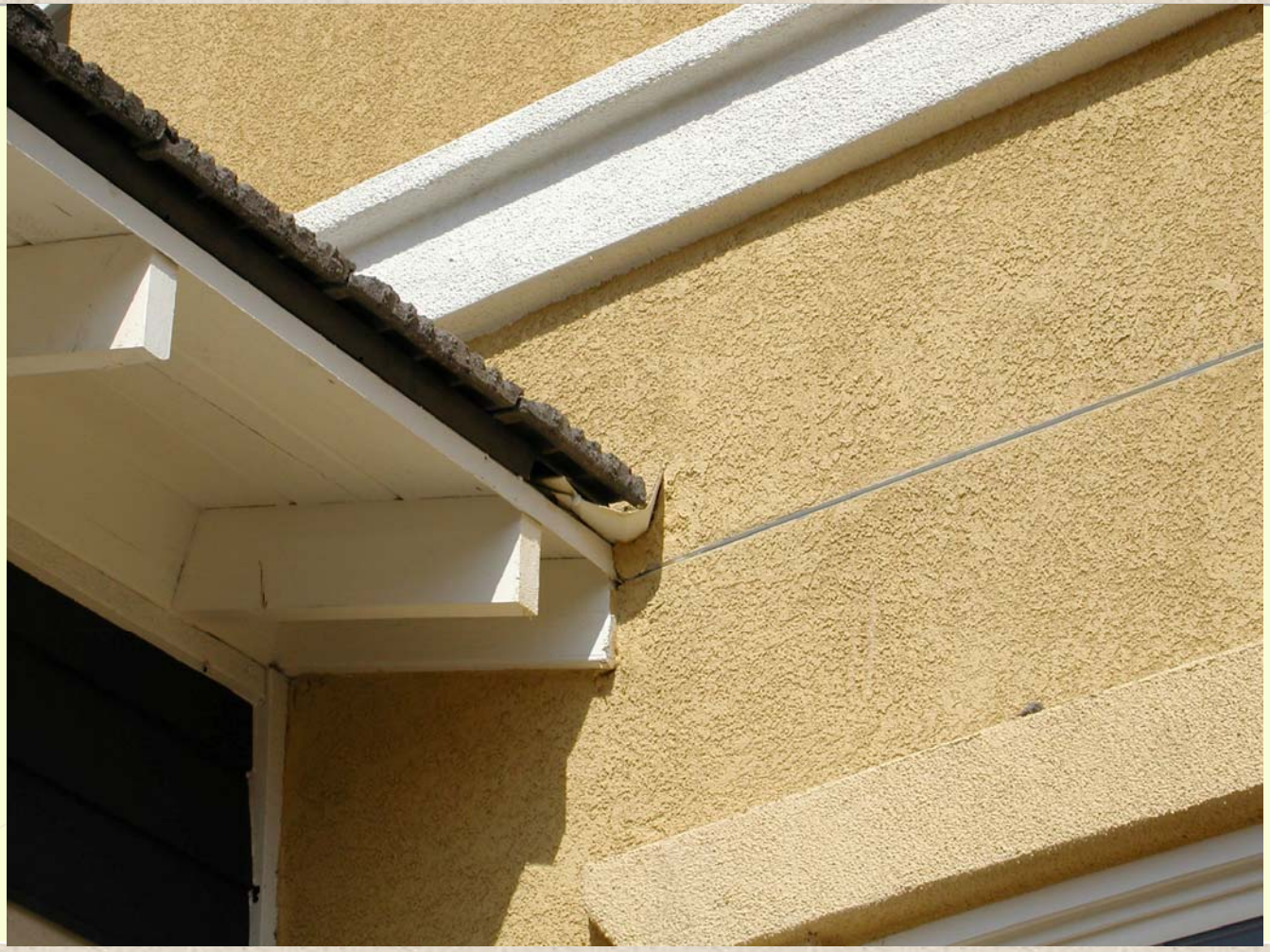
Reducing Mold Risk
Design Decisions

Keeping water out.

- Minimize the numbers of roof valleys and dormers,
- Kickout flashing wherever a sloping roof ends at a vertical wall.
- Keep liquid water and vapor out of concrete slab foundations.
- Provide vapor retarding groundcovers for crawlspaces.
- Two layers of building paper between stucco and sheathing.

Figure 3.3 Each roof-wall or balcony connection increases mold risk

Figure 3.4 Kickout flashing is essential



Reducing Mold Risk
Design Decisions

Keeping water out.

- Expansion cracks between stucco and window frames.
- No impermeable paint over stucco.
- 3-D design documents for pan flashing under windows.
- Extra care with below grade exterior walls on hillsides.

Figure 3.10 Flashing sequence diagram showing all layers

Reducing Mold Risk
Design Decisions

Limiting mold growth.

- Breathable interior finish.
- Vapor barriers … Location, location, location.

  - essential for foundation slabs and crawlspaces

  - except for the very cold climate zones in California (Zones 14 and 16), vapor barriers in walls are usually counterproductive.

  - in cold climate zones the vapor barrier should be installed just behind the interior wall board.

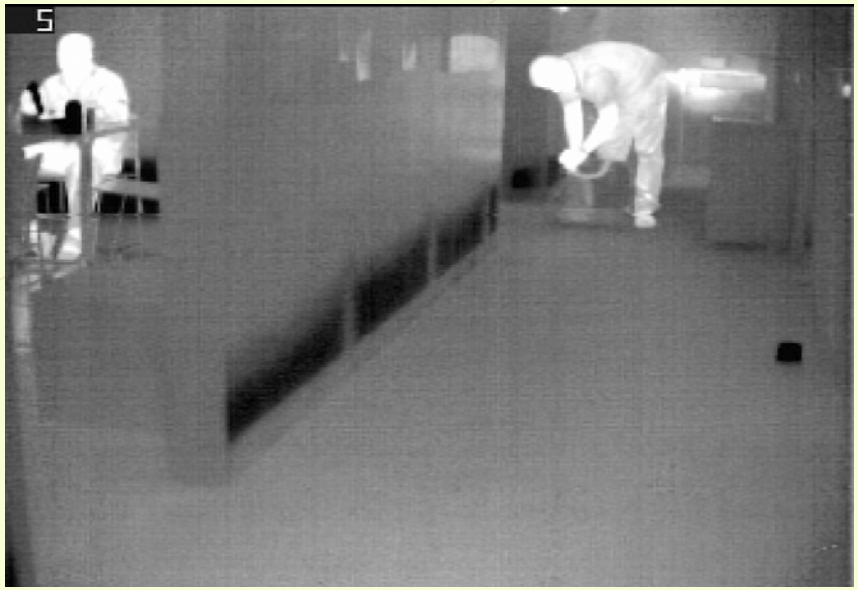
  - vapor retarders such as impermeable paint on the outside surface of exterior walls are not recommended for any part of California.

Reducing Mold Risk
Design Decisions

Limiting mold growth.

- AC system which dehumidifies.
- AC system that does not pull humid air into the house.
- Extra attention to shower and bathtub surrounds - use moisture-tolerant materials.
- In kitchens, bathrooms, and laundry rooms, design for occasional water leaks and spills - install gypsum board with 2/8 to 1/2 inch gap at base to avoid capillary suction of water or specify cement board for these areas.

Figure 4.4 Importance of capillary break at the base of gypsum wall board



Reducing Mold Risk
Design Decisions

Limiting mold growth.

- Specify pans under washers and refrigerators.

- Utilize moisture tolerant materials

In order of decreasing tolerance to periodic wetting:
- Lumber - most tolerant
- Plywood - somewhat less tolerant than lumber
- OSB - much less tolerant than plywood
- Fiberglass-faced gypsum board - low tolerance
- Paper-faced gypsum board - least tolerant.

Reducing Mold Risk
Construction Decisions

Keeping water away.

- Extra attention to landscaping and irrigation.

  - finish grading must slope away from the building

  - irrigation spray heads must not spray water against the side of the building

- Dry-storage for pre-purchased lumber and wall board.

  - store lumber and gypsum board up on pallets

  - cover the palletized stacks with tarps before it rains

Reducing Mold Risk
Construction Decisions

Keeping water out.

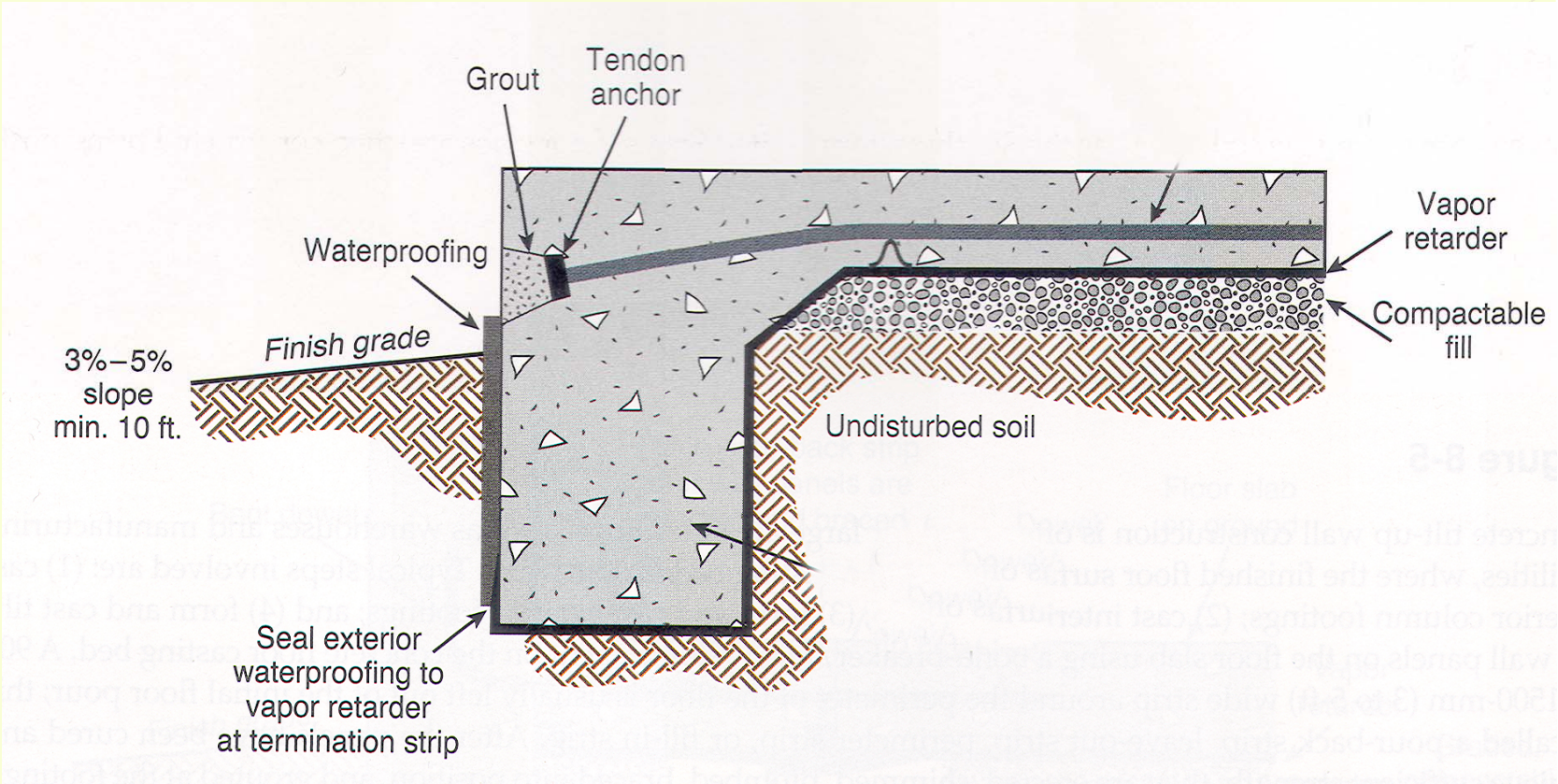
- Foundation slabs ground water/vapor management.

  - first place a capillary break (crushed stone or coarse aggregate layer), then lay a vapor retarder over the stone and then pour the slab directly on top of the vapor retarder (NO SAND).

- To avoid premature dryout, spalling, cracking, and warping:

  - spray slab with a curing compound immediately after pouring
  - use a wetted covering to keep moisture in the slab until it has 80% of it's ultimate strength (e.g. 7-30 days).

Figure 3.7 Vapor barrier below the slab–not below the stone



Reducing Mold Risk
Construction Decisions

Keeping water out.

- Logical and consistent trade sequence to minimize leaks around windows (e.g. have framing crew install the weather resistive barrier and then install the windows).

- Spray lubricant on stucco “weep screeds” to drain water.

- Measure moisture in wood framing before “rocking the walls”. Also measure the moisture content of cellulose insulation, if wet applied, before closing the walls.

- Measure moisture in wall board before installing cabinets or painting.

Reducing Mold Risk
Construction Decisions

Keeping water out.

- Sequencing (and supervision) to ensure the home is built as designed.
- Require documented plumbing pressure test.
- Check and set the arc of irrigation spray heads.

Reducing Mold Risk
Construction Decisions

Limiting mold growth.

What to do when materials get wet ?

- **For areas of a structure that are likely to naturally dry out,such as a semi-finished garage, proceed with construction.**

- **For areas with which would require costly repair such as bathrooms and kitchens, or rooms with extensive finished woodwork, dry the materials quickly with fans and dehumidifiers.**

- **For extensive wetting situations call a professional drying service (e.g. restoration contractors).**

Reducing Mold Risk
Ownership Decisions

Keeping water away.

- Choosing wider roof overhangs minimizes rain water intrusion and energy required for cooling.
- Choosing complex roofs is risky.
- Plants and irrigation near the foundations are risky.
- Adjust irrigation spray heads to keep water off of the house.
- Xeriscape (dry landscaping) reduces mold risk.
- Keep gutter and downspouts clean and make sure that the water is discharged away from the home.

Reducing Mold Risk
Ownership Decisions

Keeping water out.

- Don't paint exterior stucco.
- Avoid interior wall finishes which are vapor retarders.
- Use the exhaust fans or windows in bathrooms when using the bathtub or shower
- Use the kitchen exhaust fan or windows when cooking especially when simmering or boiling liquids.
- Open windows for ventilation following wet process carpet cleaning and insure that the carpet is thoroughly extracted.

Reducing Mold Risk
Ownership Decisions

Keeping water out.

- Do not disconnect the exhaust from the clothes dryer.
- Careful of over watering plants especially those in wicker baskets.

Reducing Mold Risk
Ownership Decisions

Limiting mold growth.

- Dry moist materials immediately. Call a restoration company to professionally dry any major source of water intrusion (e.g. flooding from a broken water pipe).
- Know where the shutoff valve is for your main water supply.
- Avoid storing paper and fabric in damp locations.
- If you notice water stains developing on walls or windows, call the builder or a contractor to investigate and repair as required.

Reducing Mold Risk
Ownership Decisions

Limiting mold growth.

- If the windows of your home frequently develop condensation then there is too much water vapor being generated and/or not enough ventilation. This is your homes way of telling you that there is a moisture problem and if left unresolved there will be mold growth.

Building Moisture Diagnostics

Diagnostic Tools for Building Moisture Problems

- **Envelope Leakage Problems**

  - Water spray tests with or without applied static pressure differential - typically requires the destructive removal of inside finishes to see leakage points (with dust containments erected)

Building Moisture Diagnostics

Diagnostic Tools for Building Moisture Problems

- **Concrete Slab Leakage Problems**

  - Water vapor emission rate tests with calcium chloride domes or imbedded hygrometers.

Building Moisture Diagnostics

Diagnostic Tools for Building Moisture Problems

- **Water Vapor Condensation Problems**

  - Surface temperature and dew point measurements

  - Long term monitoring of temperature, relative humidity, and dew point with inexpensive data loggers.

SUMMARY

While houses in California face do not face the difficult challenge of high outdoor humidities that are encountered in the southeast of the United States, they do face the common challenges of rain, landscape irrigation, groundwater, interior moisture loads, structural leaks, and plumbing leaks.

Durable affordable houses require that the developer, designer, builder, and homeowner each make informed choices that provide the desired system performance for the unique challenges faced by each house in it's specific location.

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Date: January 26, 2006

To: Mr. Neil Leslie
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From: Bud Offermann PE CIH

Subject: Builder Training Sessions – Participant Feedback

Pages transmitted (including this page): 1 Hard Copy to Follow: No

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The following is the participant feedback from the two mold resistant construction workshops that were presented in California in the month of December, 2005.

Downey, CA. December 13, 2005

Attendance: 73
Written comments : 22

Comments.

• More information on mold diagnostics and mitigation – give links to mold info (e.g. EPA)

• More information on homeowner responsibilities

• More information on shower installations

• More discussion on the differences between recommended practice and today's standard practice.

• More discussion on cost effectiveness of recommendations.

• Describe and specify more products.

• Have a workshop in a "Valley" area.

Stockton, CA. December 15, 2005

Attendance: 9
Written comments : 4

NOTE: For this class, based upon the feedback from the Downey, CA workshop, we included more specific information on mold diagnostics and mitigation.

• More information on homeowner responsibilities

Mold-Resistant Construction Workshop

This workshop is intended for members of the construction industry who need to understand how to minimize the risks associated with the occurrence of mold in the construction of new residential homes, which has become a significant proportion of construction defect claims in California as well as the rest of the United States.

This workshop will introduce the new "California Builders Guide to Mold Resistant Construction". This workshop will include discussions of the causes and impacts of mold in buildings, the sources of moisture in buildings, how building materials get wet, strategies for reducing the risk of mold, key decisions in the building process required to reduce the risk of mold, and diagnostic tools for identifying building moisture problems.

INSTRUCTOR:

Francis (Bud) J. Offermann III, PE, CIH

President of Indoor Environmental Engineering, a nationally recognized indoor air quality consulting firm, Mr. Offermann is certified as an industrial hygienist and is a professional mechanical engineer with over 25 years experience diagnosing and mitigating indoor air quality problems. For additional information, visit **www.IEE-SF.com**.

TOPICS COVERED WILL INCLUDE:

1 Introduction

- Mold, mildew, and fungi
- Causes of mold growth in buildings
- Impacts of mold growth in buildings

2 Moisture in Buildings

- Sources of moisture in buildings
- How building materials get wet

3 Strategies for Reducing the Risk of Mold

- Keep water out of the building
- Drain/dry moisture problems quickly
- Limit mold growth while drying out

4 Decisions for Reducing the Risk of Mold

- Development decisions
- Design decisions
- Construction decisions
- Homeowner responsibilities

5 Diagnostic Tools for Identifying Building Moisture Problems

- Building envelope leakage problems
- Concrete slab leakage problems
- Water vapor condensation problems

Date: **Tuesday, December 13, 2005**

Time: **7:30am – 8:30am Registration & Continental Breakfast**
8:30am – 12:00pm Seminar

Cost: **The seminar is sponsored by the Home Builders Council (HBC), The Gas Company, A Sempra Energy Utility Company and The California Energy Commission (CEC). There is no cost associated with this educational seminar.**

Location: **The Gas Company Energy Resource Center**
9240 E. Firestone Blvd.
Downey CA, 90242

MAP: http://www.socalgas.com/business/resource_center/erc_location.shtml

Building Industry Association of Southern California
1330 South Valley Vista Drive
Diamond Bar, CA 91765

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Educational Seminar Announcement

Educational Seminar Announcement

IMPORTANT

Yes! **I will attend this seminar**

Building Industry Association Southern California

Mold-Resistant Construction Workshop - December 13, 2005

Make reservation for _____ people in the name of (please print):

Firm _____

Names _____

_____

E-mail _____

Phone ( ) _____

Fax ( ) _____

BIA Member: Yes No

RSVP TO: (no later than November 29, 2005)

BIA Southern California
1330 South Valley Vista Drive
Diamond Bar, CA 91765

Phone: 909.396.9996 ext.257
E-mail: pnearhoff@biasc.org

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5. Diagnostic Tools for Identifying Building Moisture Problems
- Building envelope leakage problems
- Concrete slab leakage problems
- Water vapor condensation problems

DATE: Thursday, December 15, 2005

TIME: 7:30 a.m. – 8:30 a.m. – Registration and Continental Breakfast
8:30 a.m. – 12:00 p.m. – Seminar

COST: ***Free!*** This seminar is sponsored by the California Energy Commission (CEC) and Pacific Gas & Electric's Energy Training Center (ETC). There is no cost associated with this educational seminar.

LOCATION: PG&E's Energy Training Center
1129 Enterprise Street
Stockton, CA 95204

Pacific Gas and Electric Company®

Energy Training Center – Stockton
1129 Enterprise Street
Stockton, CA 95204

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Educational Seminar Announcement

Yes! **I will attend this seminar.**

Mold-Resistant Construction Workshop – December 15, 2005

Make reservations for _____ people from (PLEASE PRINT):

Company _____

Names _____

_____

E-mail _____

Phone ( ) _____

Fax ( ) _____

RSVP TO: (no later than December 8, 2005)

PG&E's Energy Training Center
1129 Enterprise Street
Stockton, CA 95204
Phone: (800) 244-9912
Fax: (209) 932-2502
E-mail: ETCRegistration@pge.com

ENERGY TRAINING CENTER
ETC
STOCKTON