



NIOSH HEALTH HAZARD EVALUATION REPORT

HETA #2004-0417-2987

**El Dorado County Health Department
Placerville, CA and South Lake Tahoe, CA**

November 2005

**DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health**



PREFACE

The Hazard Evaluation and Technical Assistance Branch (HETAB) of the National Institute for Occupational Safety and Health (NIOSH) conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health (OSHA) Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employers or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

HETAB also provides, upon request, technical and consultative assistance to federal, state, and local agencies; labor; industry; and other groups or individuals to control occupational health hazards and to prevent related trauma and disease. Mention of company names or products does not constitute endorsement by NIOSH.

ACKNOWLEDGMENTS AND AVAILABILITY OF REPORT

This report was prepared by Erin Snyder and Teresa Seitz of HETAB, Division of Surveillance, Hazard Evaluations and Field Studies (DSHEFS). Desktop publishing was performed by Shawna Watts. Editorial assistance was provided by Ellen Galloway.

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For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

Highlights of the NIOSH Health Hazard Evaluation

Evaluation of the potential for airborne transmission of infectious diseases

On September 30, 2004, the National Institute for Occupational Safety and Health (NIOSH) received a request for technical assistance from a management official at the El Dorado County Health Department in Placerville, California. The request stated employees were concerned about the potential for airborne transmission of diseases, especially tuberculosis (TB) and varicella (chickenpox). At the time of the request, no health effects had been reported by employees.

What NIOSH Did

- We measured indoor environmental quality (IEQ) parameters: temperature, relative humidity, and carbon dioxide levels.
- We measured supply and return air flow rates for the ventilation system.
- We visually inspected the air handling units

What NIOSH Found

- The IEQ parameters were within acceptable ranges.
- Many supply and return air diffusers were non-functioning or obstructed.
- No rooms met the criteria for airborne infection isolation.

What El Dorado County Public Health Departments Managers Can Do

- Ask a certified contractor to test and balance the ventilation system.
- Designate an airborne infection isolation room at each clinic.
- Implement a written program for infection control.

What the El Dorado County Public Health Departments Employees Can Do

- Participate in training outlined in the written infection control program.
- Report any health or IEQ concerns to management.



What To Do For More Information:
We encourage you to read the full report. If you would like a copy, either ask your health and safety representative to make you a copy or call 1-513-841-4252 and ask for HETA 2004-0417-2987



**Health Hazard Evaluation Report 2004-0417-2987
El Dorado County Health Department
Placerville, CA and South Lake Tahoe, CA
November 2005**

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SUMMARY

On September 30, 2004, the National Institute for Occupational Safety and Health (NIOSH) received a request for technical assistance from a management official at the El Dorado County Health Department in Placerville, California concerning the potential for airborne transmission of infectious diseases within health department clinics. At the time of the request, no health effects had been reported. NIOSH representatives visited the El Dorado County Health Departments in Placerville, California and in South Lake Tahoe, California during March 7-10, 2005, to conduct a hazard evaluation. During the evaluation, indoor environmental quality (IEQ) parameters and the heating, ventilation, and air conditioning (HVAC) systems were evaluated.

The IEQ measurements did not indicate a problem with temperature, relative humidity, or carbon dioxide levels. However, many supply and return air diffusers were discovered to be either non-functioning, obstructed, or functioning at a capacity other than intended. None of the exam rooms at either clinic met the criteria for airborne infection isolation. Airborne infection isolation rooms should be used when providing care for patients with airborne infections such as tuberculosis and chickenpox.

The results of the IEQ measurements confirmed that the indoor environmental quality is within acceptable ranges. However, the air flow measurements indicated problems with the function of diffusers, thus affecting the supply of outdoor air and reducing the potential for dilution of normal room contaminants and potentially infectious aerosols. This report provides recommendations to address these issues and advises the designation of an airborne isolation infection room at both clinics.

Keywords: NAICS 923120 (Health Program Administration), Tuberculosis, Varicella, Health Department, IEQ, Indoor Environmental Quality, Airborne Infection, Airborne Disease Transmission.

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INTRODUCTION

On September 30, 2004, the National Institute for Occupational Safety and Health (NIOSH) received a request for technical assistance from a management official at the El Dorado County Health Department in Placerville, California. The request stated employees were concerned about the potential for airborne transmission of diseases, especially tuberculosis (TB) and varicella (chickenpox) within health department clinics. At the time of the request, no health effects had been reported by employees.

NIOSH representatives visited the El Dorado County Health Departments in Placerville and South Lake Tahoe, California during March 7-10, 2005, to conduct the evaluation. During the evaluation, indoor environmental quality (IEQ) parameters and the heating, ventilation, and air conditioning (HVAC) systems were evaluated. A brief meeting was held with employees and management representatives before and after each evaluation.

BACKGROUND

The El Dorado County Health Departments serve the general public and focus on preventative health care screening programs such as well-baby screenings, immunizations, and family planning. Tuberculin skin tests (TST) for TB infection are also performed. While not a primary care provider, the most common types of illnesses seen at the clinic are colds, influenza, and varicella infections. Employees are also responsible for case management of patients previously diagnosed with TB. Patients considered non-infectious may come to the clinic for their directly observed therapy (DOT). DOT is also administered in patient homes on occasion. Aerosol-generating procedures, such as sputum induction, are not performed at the clinics. However, sputum samples are occasionally collected outdoors, and specimens from other clinics and hospitals are sent to the laboratory at the Placerville clinic for analysis. Within the lab, these analyses are conducted in the "hot room" in a designated biological safety

cabinet. In addition, a ceiling mounted ultraviolet germicidal irradiation (UVGI) lamp provides supplemental air cleaning in the lab.

Most patients seen at the clinics have scheduled appointments. However, on occasion, persons with unknown health status are treated at the clinic. These occasions are of concern to employees due to the risk of airborne transmission of infectious agents such as TB, varicella, and new infections such as Severe Acute Respiratory Syndrome (SARS). In response, management representatives at the El Dorado County health department sought guidance from NIOSH into the designation of an exam room at each clinic as an airborne infection isolation (AII) room.

METHODS

Placerville Clinic

A discussion was held with the facilities management representative responsible for maintenance of the HVAC system to determine if there had been a history of IEQ complaints and to obtain background information on the ventilation systems serving the clinic. This was done to understand airflow patterns in the clinic and the ability of the ventilation system to dilute normal room contaminants and odors as well as potentially infectious aerosols that may be released by clients with airborne infections. The air handling units were visually inspected.

To evaluate current environmental conditions, air temperature, relative humidity (RH), and carbon dioxide (CO₂) measurements were made with TSI® Q-Trak™ Plus (Model 8554) IAQ Monitors. Seven stationary monitors were placed in exam rooms #2 and #4, the waiting area, the staff reception area, the nurses' station, the hot room, and the office of the Director of Health Services. These monitors recorded temperature, RH, and CO₂ concentration every 5 minutes from about 8:30 a.m. until 3:45 p.m. One additional indoor air quality monitor was used to take periodic (spot) measurements throughout the day in various locations.

A TSI® AccuBalance® Air Capture Hood (Model 8371) was used to measure supply and return air flow rates throughout the clinic. Smoke tubes were used to visually assess air flow patterns.

South Lake Tahoe Clinic

As at the Placerville clinic, a discussion was held with the facilities management representative responsible for maintenance of the HVAC system to determine if there had been a history of IEQ complaints and to obtain background information on the ventilation systems serving the clinic. The air handling units were then visually inspected.

To evaluate current environmental conditions, air temperature, RH, and CO₂ measurements were made with TSI® Q-Trak™ Plus (Model 8554) IAQ Monitors. On March 9, 2005, six stationary monitors were placed in exam room #2, the interview room, the IZ room, the nurses' office, the front office, and the lab. These monitors recorded temperature, RH, and CO₂ concentration every 5 minutes from approximately 9:00 a.m. until 4:00 p.m. One additional monitor was used to take periodic measurements throughout the day in various locations. Similarly, on March 10, 2005, five stationary monitors were placed in the IZ room, the interview room, the nurses' office, the treatment room, and exam room #2; one additional monitor was used for spot checks.

A TSI® AccuBalance® Air Capture Hood (Model 8371) was used to measure supply and return air flow rates throughout the health department. Smoke tubes were used to visually assess air flow patterns.

EVALUATION CRITERIA

Indoor Environmental Quality

Standards specific to the non-industrial indoor environment do not exist. The American National Standards Institute (ANSI)/American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) has published recommended building

ventilation and thermal comfort guidelines.^{1,2} The American Conference of Governmental Industrial Hygienists (ACGIH) has also developed a manual of guidelines for approaching investigations of building-related symptoms that might be caused by airborne living organisms or their effluents.³ Other resources that provide guidance for establishing acceptable IEQ are available through the Environmental Protection Agency (EPA) at www.epa.gov/iaq, especially the joint EPA/NIOSH document, *Building Air Quality, A Guide for Building Owners and Facility Managers* (www.epa.gov/iaq/largebldgs/baqtoc.html) and the EPA *Indoor Air Quality Building Education and Assessment Model (I-BEAM)* software available for download (www.epa.gov/iaq/largebldgs/ibeam_page.htm).

Heating, Ventilating, and Air-Conditioning

One of the most common deficiencies in the indoor environment is the improper operation and maintenance of ventilation systems and other building components.⁴ NIOSH investigators have found correcting HVAC problems often reduces reported symptoms. Most studies of ventilation rates and building occupant symptoms have shown that rates below 20 cubic feet per minute per person (cfm/person), are associated with one or more health symptoms, including non-specific symptoms such as eye, nose, and throat irritation.⁵ Moreover, higher ventilation rates have been associated with further significant decreases in the prevalence of symptoms.⁴ Thus, improved HVAC operation and maintenance, higher ventilation rates, and comfortable temperature and RH can all potentially improve symptoms without ever identifying specific cause-effect relationships. When conducting an IEQ survey, NIOSH investigators often measure ventilation and comfort indicators, such as CO₂, temperature, and RH to provide information relative to the functioning and control of HVAC systems.

Carbon Dioxide

CO₂ is a normal constituent of exhaled breath and is not considered a building air pollutant. It is an indicator of whether sufficient quantities of outdoor air are being introduced into an occupied space. However, CO₂ is not an effective indicator of ventilation adequacy if the ventilated area is not occupied at its usual level at the time the CO₂ is measured. ASHRAE recommends keeping the indoor CO₂ concentration within 700 parts per million (ppm) of the outdoor concentration for comfort (odor) reasons.² Elevated CO₂ concentrations suggest that other indoor contaminants may also be increased. If CO₂ concentrations are elevated, the amount of outdoor air introduced into the ventilated space needs to be increased. ASHRAE's most recently published ventilation standard, *ANSI/ASHRAE 62.1-2004: Ventilation for Acceptable Indoor Air Quality*, recommends outdoor air supply rates of 17 cfm/person for office spaces and libraries, 13 to 15 cfm/person for classrooms (depending on the students' age), 7 cfm/person for reception areas, and 5 cfm/person for auditoriums.²

Temperature and Relative Humidity

Temperature and RH measurements are often collected as part of an IEQ investigation because these parameters affect the perception of comfort in an indoor environment. The perception of thermal comfort is related to one's metabolic heat production, the transfer of heat to the environment, physiological adjustments, and body temperature.⁶ Heat transfer from the body to the environment is influenced by factors such as temperature, humidity, air movement, personal activities, and clothing. The *ANSI/ASHRAE Standard 55-2004: Thermal Environmental Conditions for Human Occupancy*, specifies conditions in which 80% or more of the occupants would be expected to find the environment thermally acceptable.¹ Assuming slow air movement and 50% RH, the operative temperatures recommended by ASHRAE range from 68.5°F to 76°F in the winter, and from 75°F to 80.5°F in the summer. The difference between the two is largely due to seasonal clothing selection. ASHRAE also

recommends that RH be maintained at or below 65%.² Excessive humidity can promote the excessive growth of microorganisms and dust mites.

Tuberculosis

TB is an infectious disease caused by the bacterium *Mycobacteria tuberculosis* (*M. tuberculosis*). *M. tuberculosis* is carried in airborne particles (called droplet nuclei) that can be generated when persons with TB of the lungs or throat cough, sneeze, or speak. The droplet nuclei are so small that normal air currents can keep them airborne for hours and can spread them throughout a room or building. Infection occurs when a person inhales aerosolized *M. tuberculosis* and the bacteria become established in the alveoli (small air sacs) of the lungs and spread throughout the body.

Within 2 to 10 weeks, the immune system of a person infected with *M. tuberculosis* usually acts to prevent further multiplication and spread of the bacteria; however, some *M. tuberculosis* bacteria remain dormant and can survive for many years. At this point, a person will usually have a positive tuberculin skin test (TST). The bacterial dose required to initiate infection is not known. In general, people who become infected with *M. tuberculosis* have about a 10% risk for developing active pulmonary TB disease during their lifetimes, but the risk is considerably higher for persons who are immunosuppressed, including those with HIV infection.⁷ Groups of persons known to have a higher prevalence of TB infection include contacts of persons who have active TB, foreign-born persons from areas with a high prevalence of TB, medically underserved populations, homeless persons, current or former correctional inmates, alcoholics, injecting drug users, and the elderly.⁸

Varicella (chickenpox)

Varicella, commonly known as chickenpox, is a common childhood disease caused by the varicella-zoster virus (VZV). It is usually mild but can cause serious complications, especially in infants, adolescents, adults, and immunocompromised persons.⁹ Initial

symptoms can include fever, aches, fatigue, irritability, and sore throat. These symptoms are followed by a red rash that appears on the face, trunk, and scalp, and sometimes in the mouth. While it is generally considered to be a childhood disease, varicella can affect persons of any age if they have not previously had the disease or been vaccinated. It occurs most often during the winter and spring. Varicella is spread from person-to-person through contact with fluid from the blisters, or by droplet or airborne spread of vesicle fluid or secretions of the respiratory tract during coughing and sneezing. It is contagious from 1 to 2 days before the appearance of rash until all lesions have dried up and become scabs. In 1995, a varicella vaccine was licensed in the United States. The Advisory Committee on Immunization Practices (ACIP) expanded recommendations for vaccination in 1999, including recommendations for outbreak situations and for persons who live or work in environments where transmission of VZV is likely or can occur.⁹

RESULTS

Placerville Clinic

The spot measurements of environmental conditions on the day of the NIOSH survey are shown in Table 1. It should be noted that the weather was unusually warm and that windows were open. All IEQ measurements fell within the ASHRAE-recommended guidelines for occupant comfort. A review of the data from the seven stationary monitors showed similar results with two exceptions: peak CO₂ concentrations in both the waiting room and the reception area of 1004 ppm (at 8:15 a.m.) and 1006 ppm (at 8:16 a.m.) respectively. These spikes are most likely explained by the staff meeting that was held in these adjoining areas at the beginning of the work day. By 9:00 a.m., after the meeting had concluded, the CO₂ concentrations in both locations had returned to approximately 600 ppm.

Table 2 shows the air flow measurements reported during the survey versus those identified on the HVAC design specification

plans (dated September 14, 1966) provided by the health department. It should be noted that none of the measurements taken on the day of the survey matched those of the HVAC plans. However, modifications not reflected on the original plans have been made to the building in recent years, including the remodeling of the laboratory space. The women's restroom was found to be under positive pressure, not negative pressure, as is recommended for restrooms.

Temperature measurements taken on the day of the survey were in fairly good agreement with the thermostats throughout the department. Smoke tube traces indicated that the laboratory was under negative pressure as is recommended. The hoods in the laboratory hot room were clean and in good condition; they had also been tested and inspected within the past year. The HVAC unit serving the lab is separate from the rest of the clinic and operates 24 hours per day, including weekends. This system exhausts 100% of the air directly to the outside, with no recirculation to other areas of the facility.

All county employees receive an initial TST. Annual screening is performed for those employees with direct patient care responsibilities, but is optional for others who want to receive a periodic TST (e.g., front office staff).

South Lake Tahoe Clinic

There are three air handling units in the building that houses the health department. One services the sheriff's office, one services the probation department and the public defender's office, and the third unit services the district attorney's office and the health department. There is no common plenum for the entire building, and fire walls separate the three zones. There is some minimal mixing of air from the opening and closing of doors, but the construction of the building, with high vaulted ceilings, allows for good general dilution ventilation. Visual inspection of the air handling units and the filters found them to be clean and in good working order.

The spot measurements of environmental

conditions on the days of the NIOSH survey are shown in Tables 3 & 4. All IEQ measurements fell within the ASHRAE-recommended guidelines for occupant comfort; however, the temperature in the conference room was elevated relative to the rest of the department. A review of the data from the stationary monitors placed throughout the clinic also indicated all IEQ measurements fell within the ASHRAE-recommended guidelines. It should be noted that at such low humidity levels (range 16.4% – 22.6%) some employees may experience symptoms such as dry eyes, dry skin, and irritation of the mucous membranes.

Table 5 shows the air flow measurements reported during the survey. HVAC plans were not available at the time of the site visit but were received subsequently. However, there were no current air flow measurements or design criteria for comparison. It should be noted that ten diffusers were non-functioning on the day of the survey. Most of the diffusers throughout the department were clean. Smoke tube traces indicated that the bathrooms were under negative pressure as recommended.

NIOSH investigators reviewed the South Lake Tahoe employee TB skin test records for the last 3 years. To date, there have not been any known skin test conversions. At the time of the site visit, annual testing had not yet been performed due to the intention to use a new QuantiFERON® testing method.

DISCUSSION

Measurements of IEQ parameters during the on-site surveys indicated CO₂, RH, and temperature levels that were within recommended guidelines. Having windows open would keep the CO₂ concentrations low; thus levels may be higher at other times. Many air supply and return diffusers were either not functioning at the original capacity or not functioning at all. Some diffusers were obstructed, preventing proper air flow throughout the work space.

The current policy for dealing with clients who may have an infection that can be transmitted by

the airborne route is to provide them with a disposable respirator and expedite their treatment. Given the potential for encountering a person with recognized TB disease (or another airborne infection such as varicella) and the need to conduct aerosol-generating procedures in the future, the designation of an AII room at each clinic is encouraged. At the Placerville Clinic, exam room #4 is a good choice due to its proximity to the clinic entrance. At the South Lake Tahoe clinic, any of the four rooms could be converted to an AII room. The AII rooms should follow design specifications outlined in the Centers for Disease Control and Prevention's document entitled, Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Facilities.¹⁰ Because there are separate air handling units that serve most other departments in the South Lake Tahoe government building and there is good dilution ventilation in the lobby, the potential for disease transmission outside the clinic is minimized.

CONCLUSIONS

The IEQ evaluation indicates environmental conditions within acceptable ranges. The air flow measurements indicate the need for an additional evaluation of the HVAC system at each clinic. In addition, the designation of an AII room within each department is encouraged to address the risk of disease transmission if patients with airborne infections such as TB and varicella visit the clinic for care or there is a desire to perform aerosol-generating procedures such as sputum induction in the future.

RECOMMENDATIONS

Based on the observations and measurements made during the HHE, the following recommendations are intended to improve workplace conditions at the El Dorado County health departments:

Placerville

1. Ask a certified contractor familiar with ASHRAE guidelines to test and balance

- the HVAC system. Filters in the air handling units should be changed on a regular basis as needed. All restrooms facilities should be under negative pressure.
2. Post a warning sign near the UVGI lamp in the laboratory hot room. Ideally such a lamp would be placed on a separate wall switch from lights and other equipment, so as to prevent accidental operation while the room is occupied. Overexposure to ultraviolet radiation can result in acute effects on the eyes and skin such as erythema (skin redness) and photokeratitis (feeling of sand in the eyes) that can be debilitating until resolved.¹⁰ Examples of suitable signs can be found in the CDC publication, Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Facilities.
 3. Designate exam room #4 as the airborne infection isolation (AII) room for those patients with suspected airborne infectious disease and for performing aerosol-generating procedures such as sputum induction. The exam room should be taken off the return air system that supplies the remainder of the building, and an exhaust fan should be installed to exhaust air directly to the outside away from people. AII rooms in new or renovated healthcare facilities should have a minimum of 12 air changes per hour, be under negative pressure, and exhaust air to the outside.¹⁰ Ideally, the pressure differential should be at least 0.01 inches of water gauge.¹¹
 4. Implement a written infection control program for TB and varicella that includes training, employee screening, and use of respiratory protection (for TB). Employees who use respiratory protection should be covered under a formal respiratory protection program that meets current Occupational Safety and Health Administration (OSHA) guidelines.¹²

5. Ensure that healthcare workers who may have contact with varicella patients are immune.

South Lake Tahoe

1. Ask a contractor familiar with ASHRAE guidelines to test and balance the HVAC system. Filters in the air handling units should be changed on a regular basis as needed.
2. Designate at least one exam room as the airborne infection isolation (AII) room for those patients with suspected airborne infectious disease and for performing aerosol-generating procedures such as sputum induction. Because of the centralized grouping of the four exam rooms and the common return air system for the health department and district attorney's office, it may be practical to place all four exam rooms on a separate exhaust ventilation system and remove them from the current return air system. This would enable all rooms to be used for patients with potential airborne infections.
3. Implement a written infection control program for TB and varicella that includes training, employee screening, and use of respiratory protection (for TB). Employees who use respiratory protection should be covered under a formal respiratory protection program that meets current California Occupational Safety and Health Administration (CalOSHA) standards.¹²
4. Ensure that healthcare workers who may have contact with varicella patients are immune.
5. Replace all stained ceiling tiles. The source of the leakage that caused the stains should be investigated and repaired to prevent further damage and mold growth.
6. Adjust the air handling unit to a set point that will allow some minimum outside air supply while the building is occupied. During winter months, the outside air damper is reportedly closed,

which does not allow any outside air supply.

REFERENCES

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**Table 1. IEQ Parameter Measurements
El Dorado County Health Department
Placerville, CA
March 8, 2005**

Location	Sample Time (military)	Temperature (°F)	Relative humidity (%)	CO₂ (ppm)	Comments
Outside	0915	65.8	40.6	246	Sunny, no wind
Lobby	0920	67.9	43.8	430	Across from bathrooms
Waiting room	0920	68.9	42.9	535	0 people present
Hallway	0921	69.8	42.1	560	Outside Exam room #4
Gayle's office	0923	70.5	39.0	360	
Dagmar's office	0925	71.0	39.1	398	
Thermostat #7	0926	71.3	39.7	471	Reading = 71.5° F
Room #12	0930	72.5	36.2	386	
Hallway	0931	72.5	37.2	460	Outside lab
Lab Thermostat #4	0932	73.8	36.4	496	Reading = 76.0 °F
Lab hot room	0935	73.4	35.7	490	
Lab offices	0940	73.6	35.3	451	
Break room	0941	73.2	35.8	471	
Inner office Thermostat	0947	74.0	36.2	550	Ceiling fan on; reading = 72.0 °F
Nancy's office	0950	74.3	34.0	473	Both doors open
Exam Room #4	1450	73.4	44.2	682	
Outside	1453	72.6	42.3	225	Sunny, no wind
Lobby	1455	72.6	44.0	608	
Waiting room	1457	72.7	43.5	559	3 people present
Hallway	1459	72.4	43.0	533	Outside exam room #4
Gayle's office	1501	72.9	46.0	515	
Room #11	1503	73.5	44.6	500	
Thermostat #7	1507	73.3	42.1	543	Reading = 73.5°F
Dagmar's office	1508	73.3	43.7	475	
Room #12	1509	73.6	41.0	407	
Lab Thermostat	1511	74.7	40.2	475	Reading = 76.0 °F
Lab hot room	1513	74.8	38.9	485	Hoods off
Lab offices	1515	74.7	39.6	510	
Hallway	1518	74.9	39.8	477	Outside lab window
Break room	1520	74.6	39.2	440	
Inner office thermostat	1522	76.7	40.7	690	Reading = 76.0 °F
Nancy's office	1524	77.1	40.2	560	1 door open
Pat's office	1526	76.2	39.4	615	Space heater on during morning

**Table 2. Air Flow Measurements
El Dorado County Health Department
Placerville, CA
March 8, 2005**

Location	Plan Supply (cfm)	Measured Supply (cfm)	Plan Return (cfm)	Measured Return (cfm)
Women's restroom *	130	93	160 (exhaust)	47 (exhaust)
Nurse's room	250	**	200	84
Dagmar's Office	250	145	200	392
Gayle's office	610	**	490	**
Room #10	300	182	240	164
Room #11	280	**	230	149
Room #12	280	200	230	**
Room #13	280	**	230	**
Lab	600	360	50	145
Lab hot room	220	**	**	330
Lab staff area	**	85	330	**
Office near lab	200	**	160	40
Break room	150	110	120	**
Office	150	**	120	42
Lobby waiting area (right of front door)	140	78	N/A	N/A
Lobby waiting area (left of front door)	150	80	N/A	N/A
Waiting area	160	**	N/A	N/A
Staff reception	170	90	N/A	N/A
Lobby public side	**	199	500	300
Staff corridor	100	32	N/A	N/A
Staff corridor			250	102
Staff corridor	100	0	N/A	N/A
Front office	225	120	450	60
Front office	225	119	N/A	N/A
Nurse's station	230	102	230	**
Exam room #1	150	63	160	136
Exam room #2	150	65	150	0
Exam room #3	130	72	130	0
Exam room #4	250	120	200	70
Interview booth			**	79

* Restrooms should be under negative pressure; however, the restrooms were under positive pressure on the day of the survey.

** Values are unknown due to obstructed air ducts or remodeling that is not reflected on the original HVAC design plans.

Table 3. IEQ Parameter Measurements*
El Dorado County Health Department
South Lake Tahoe, CA
March 9, 2005

Location	Time (military)	Temperature (°F)	Relative humidity (%)
Conference room	0958	73.9	16.6
Valerie's office	1054	73.2	18.2
Kathy's office	1055	72.3	19.2
Nurse's office	1057	72.3	18.5
Kitchen	1100	71.1	17.3
Lenette's office	1102	71.2	18.2
Lab	1104	70.7	17.9
Treatment room	1112	69.4	18.3
Exam room 4	1115	69.3	19.0
Exam room 1	1116	69.8	19.1
Exam room 2	1122	70.2	18.1
Interview room #1	1125	70.0	18.0
Front office	1126	69.3	18.3
Interview booth	1128	68.0	18.5
Waiting area	1133	67.5	19.3
Outside	1135	52.9	28.3
Conference room	1508	78.3	20.4
Kathy's office	1510	76.6	19.7
Valerie's office	1512	75.4	19.1
Nurse's office	1513	74.8	18.8
Break room	1514	73.8	18.7
Lenette's office	1520	72.9	19.0
Lab	1520	72.7	19.4
Exam room 3	1521	72.1	19.1
Exam room 2	1525	72.0	19.0
Exam room 1	1527	71.6	19.2
Exam room 4	1528	71.4	19.6
Treatment room	1530	71.2	20.0
IZ room	1532	71.8	20.1
Interview room #1	1534	71.6	20.0
Allyson's office	1537	72.1	20.8
Front office	1539	71.6	20.0
Interview booth	1542	69.6	21.4
Waiting area	1543	69.4	22.6
Outside	1545	54.9	30.1

*CO₂ measurements are not reported due to equipment failure

**Table 4. IEQ Parameter Measurements
El Dorado County Health Department
South Lake Tahoe, CA
March 10, 2005**

Location	Sample Time (military)	Temperature (°F)	Relative humidity (%)	CO₂ (ppm)	Comments
Conference room	0856	72.7	19.9	655	After opening conference
Valerie's office	0858	72.0	18.8	558	
Kathy's office	0901	71.1	19.1	593	
Nurses' office	0904	71.1	20.2	545	
Break room	0907	70.0	20.4	563	
Lenette's office	0909	70.0	20.1	584	
Lab	0912	70.0	20.1	550	
Treatment room	0914	69.3	19.8	522	
Exam room 4	0917	69.3	20.3	564	
Exam room 3	0920	69.4	20.0	522	
Exam room 2	0924	70.2	19.7	550	
Exam room 1	0926	69.8	19.4	520	
Interview #1	0929	69.3	20.7	650	
Allyson's office	0931	69.4	20.2	546	
IZ room	0935	70.0	20.2	610	
Reception	0937	69.4	19.5	517	
Interview booth	0939	68.4	20.1	540	
Waiting area	0942	69.1	21.1	541	
Outside	0950	48.2	43.3	519	Sunny, no breeze
Conference room	1429	78.3	18.2	675	
Valerie's office	1432	76.8	16.4	514	
Kathy's office	1438	74.3	18.1	547	
Nurses' office	1441	74.5	17.2	465	
Break room	1443	73.6	17.0	518	
Lenette's office	1448	73.6	17.1	501	
Lab	1449	72.9	17.3	525	
Treatment room	1449	72.1	16.9	485	
Exam room 4	1452	72.0	17.3	499	
Exam room 3	1453	72.0	17.8	503	
Exam room 2	1455	72.1	17.9	494	
Exam room 1	1456	72.0	17.8	494	
IZ room	1457	72.1	17.9	536	
Interview room	1459	72.3	18.2	537	
Allyson's office	1501	72.7	18.3	590	
Interview booth	1504	70.9	17.7	530	
Waiting area	1506	71.4	19.8	532	
Front office	1520	71.4	18.4	519	

**Table 5. Air Flow Measurements
El Dorado County Health Department
South Lake Tahoe, CA
March 9-10, 2005**

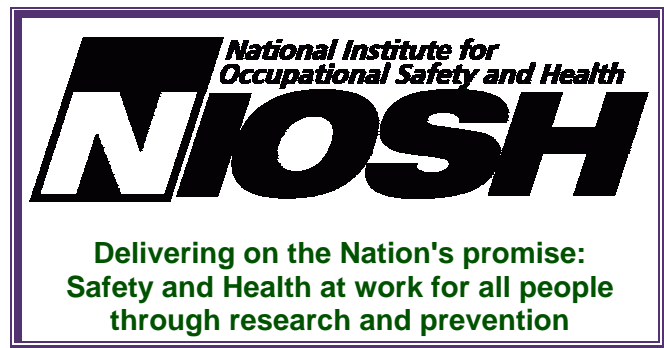
Location	Measured Supply (cfm)	Measured Return (cfm)	Comments
Conference room	285	81	
Valerie's office	102	52	
Kathy's office	35	74	
Hallway	50	0	Between Valerie and Kathy's offices
Lenette's office	65	101 (exhaust)**	
Nurses' office	392	400	Right of doorway from hall
Nurses' office	182	0	Left of doorway from hall
Nurses' office	154	N/A	Left of doorway from hall
Break room	122	157 (exhaust)**	
Staff Hallway	65	0	Toward Lenette's office
Staff Hallway	52	N/A	Toward Allyson's office
Lab	117	117 (exhaust)**	
Exam room 4	64	34	
Exam room 3	50	0	
Exam room 2	0	52	
Exam room 1	0	44	
Treatment room	0	*	
IZ room	0	*	
Interview room	53	0	
Allyson's office	58	0	
Front office	183	76	
Interview booth	385	N/A	

* Values unknown due to inaccessible ducts

**Plans received subsequent to the NIOSH site visit indicate these are exhaust grilles, not returns

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