HETA 95-0024-2518
August 1995
U.S. Marshals Service
Miami, Florida

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SUMMARY

In December 1994 the National Institute for Occupational Safety and Health (NIOSH) conducted a health hazard evaluation (HHE) at the United States Marshals Service (USMS) facility in Miami, Florida. NIOSH was asked to evaluate the potential for tuberculosis (TB) transmission among USMS personnel who have contact with prisoners.

Confidential medical interviews were conducted with eight of eleven employees who were reported to have newly reactive tuberculin skin tests (TSTs). The on-site occupational health nurse was interviewed, and medical records and the employee TST program were reviewed. A walk-through inspection of the facility was conducted and ventilation measurements were made to evaluate the potential for dissemination of droplet nuclei containing *Mycobacterium tuberculosis*, the causative organism of TB.

Out of 63 USMS employees whose work involves direct contact with prisoners, 46 (73%) received a TST between May 1993 and February 1995. Seven (15%) of the tested employees had a reaction size of at least 10 millimeters (a positive response). Of these, none had a documented prior non-reactive TST. All denied known exposure to TB outside of work. Three reported contact with a prisoner who was diagnosed as having had active TB during his stay at the USMS' Miami facility, but in only one case did the positive TST occur at least two weeks after exposure to this prisoner.

The environmental evaluation revealed deficiencies in the amount of outdoor air supplied to the cell block area and in the delivery of supply air to the cell block and office areas. These deficiencies minimize the contribution of ventilation and directional airflow in diluting or removing contaminated air.

The available TST data are not sufficient to assess the prevalence of TB infection or the occupational risk of TB transmission among USMS employees. However, USMS employees have contact with prisoners, a group considered to be at high risk for developing active TB. In addition, many of the federal prisoners transported by USMS employees have not been adequately screened for TB by the contract jails in which they temporarily reside. Recommendations for improving the TST surveillance program and environmental controls are provided in the report.

KEYWORDS: SIC 9221 (Police Protection), *Mycobacterium tuberculosis*, tuberculosis, TB, tuberculin skin test, TST, correctional facility, prisoners, indoor environmental quality, IEQ, ventilation.

INTRODUCTION

In October 1994 the National Institute for Occupational Safety and Health (NIOSH) received a management request for a health hazard evaluation (HHE) at the United States Marshals Service (USMS) facility in Miami, Florida. The request was prompted by the employee health office's report of eleven "positive" tuberculin skin test (TST) reactions among USMS staff between January and April 1994. The TSTs were performed as part of a TB screening program for all U.S. Marshals. In response to this request, NIOSH investigators conducted a site visit on December 14-15, 1994, to evaluate data collected from the USMS TST program and to evaluate the environment with regard to dissemination of airborne infectious agents such as *Mycobacterium tuberculosis*.

BACKGROUND

The Miami office employs approximately 90 workers, including Marshals, guards, and administrative personnel. Federal prisoners are picked-up from federal institutions and contract facilities (state and local jails and prisons) by U.S. Marshals and are brought by bus to the USMS's Miami facility, where they are held in one of four holding cells for up to eight hours during the day. The prisoners are escorted by one of the Marshals to and from the court room for their appearance that day, and are then transported back to their respective correctional institutions at the end of the day. Some of the prisoners are new arrests (in custody less than 48 hours) and are "booked" at this facility. The Marshals also accompany prisoners when they are transported by air to other federal prisons in the U.S. after sentencing, and to medical facilities for treatment. In addition, USMS personnel travel overseas to pickup prisoners from correctional facilities outside the U.S. According to staff, approximately 15 overseas pick-ups occur each year; any Marshal can be assigned to perform this task and a team of two Marshals is usually assigned.

EVALUATION CRITERIA

Tuberculosis

Since 1984, cases of active TB have been increasing in the United States. In 1994, there was a 3.7% decrease in the overall number of cases in the U.S. as compared with 1993 (24,361 vs. 25,287), however, Florida and several other states experienced an increase in the number of TB cases over 1993.[1] These increases are thought to be associated with the human immuno-deficiency virus (HIV) epidemic, increased immigration from countries where TB is common, and outbreaks of TB in high-risk environments. Populations in the U.S. known to have a high incidence of TB include: (1) residents of correctional institutions, mental institutions, nursing homes, and other long-term residential facilities; (2) medically undeserved low-income populations including racial or ethnic minorities (African Americans, Hispanics, Asians/Pacific Islanders, and Native Americans/Alaskan Natives); (3) persons living under crowded conditions; (4) alcoholics and intravenous drug users; (5) the homeless; (6) the elderly; (7) foreign-born

persons from areas of the world with a high prevalence of TB; (8) immunocompromised individuals such as those with HIV infection; and (9) persons living in the same household with members of these high risk groups.[2,3,4] Workers who have close contact with individuals with unsuspected TB disease have an increased risk of acquiring TB infection, but the extent of the risk is unknown for most work settings.[5,6]

Tuberculosis (TB) is an infectious disease caused by the bacterium *Mycobacterium tuberculosis*. *M. tuberculosis* is carried in airborne particles, known as droplet nuclei, that can be generated when persons with TB of the lungs or throat cough, sneeze, or vocalize. The droplet nuclei are so small (1-5 microns) that normal air currents keep them airborne for long periods of time and can disperse them throughout a room or building. Infection occurs when a person inhales aerosolized *M. tuberculosis* and the bacteria become established in the alveoli of the lungs and spread throughout the body.[7] Within 2-10 weeks, the immune system is usually able to prevent further multiplication and spread of the bacteria. At this point, a person will usually have a positive tuberculin skin test.

Because infection requires the inhalation of aerosolized *M. tuberculosis*, the probability that a person will become infected depends upon the concentration of infectious droplet nuclei in the air. The actual dose required to initiate infection is not known. Environmental factors that enhance transmission include: the sharing of a relatively small, enclosed space with an infectious person; inadequate ventilation that results in insufficient dilution or removal of infectious droplet nuclei; and recirculation of air containing infectious droplet nuclei.[7]

Most persons infected with TB will never have symptoms from this infection; the bacteria will be contained by the immune system and cause no overt illness. In the U.S., approximately 5% of newly infected individuals will develop active TB in the first two years after infection, and another 5% will develop active disease some time during the rest of their life. When a patient develops active pulmonary TB, the infection destroys lung tissue as it grows, forming a cavity. When the cavity erodes into an airway, infectious material (which includes live *M. tuberculosis* bacteria) in the airway causes the patient to cough, which can aerosolize *M. tuberculosis*. Cough is the predominant symptom associated with active TB. Fever, weight loss, and fatigue may also be present. Infected persons are more likely to develop active disease if they experience physical or emotional stress, or if they become immunocompromised as can occur with HIV infection. To decrease the chance of developing active disease once infected, the Centers for Disease Control and Prevention (CDC) recommends that all persons with positive TSTs be evaluated for preventive drug therapy.[8]

Guidelines for Preventing Tuberculosis Transmission

In October 1993 the Occupational Safety and Health Administration (OSHA) issued enforcement guidelines concerning occupational TB exposure.[9] These OSHA guidelines are based on the 1990 CDC guidelines for preventing TB transmission in health-care facilities.[5] In 1989, CDC issued recommendations addressing similar issues, in less detail, for correctional facilities.[6] This document is currently being revised and is expected to provide additional information on the

control of TB transmission in jails, where TST screening is particularly difficult due to the rapid turnover of inmates. The workplaces covered by the OSHA guidelines include health care settings, correctional institutions, homeless shelters, drug treatment centers, and long-term care facilities for the elderly. The OSHA guidelines require a protocol for the early identification of individuals with active TB; a skin test surveillance program for employees; medical evaluation and management of workers with positive skin tests or symptoms of active TB; placement of individuals with confirmed or suspected TB in isolation rooms; performance of high-risk procedures in areas with negative pressure and appropriate exhaust ventilation; and employee training on TB transmission, signs and symptoms of the disease, medical surveillance, follow-up therapy, and proper use of controls.

In October 1994 the CDC published a revision of its 1990 Guidelines.[7] The revised document directs health-care facilities to conduct a TB risk assessment and to implement a TB control program appropriate to their level of risk of TB transmission. The revised document recommends a hierarchy of controls to prevent TB transmission in health care settings including:

- *Administrative controls* to reduce the risk for exposing uninfected persons to persons who have infectious TB. This includes developing and implementing effective written policies and protocols to ensure the rapid detection, isolation, diagnostic evaluation, and treatment of persons likely to have TB. Administrative controls also include the use of effective work practices, employee education, and TST screening of health-care workers.

- *Engineering controls* to reduce the spread and concentration of *M. tuberculosis* in a facility. This includes direct source control with local exhaust ventilation, directional airflow control, dilution and removal of contaminated air by general ventilation, and air cleaning with high-efficiency particulate air (HEPA) filters or ultraviolet germicidal irradiation.

- The use of *personal respiratory protection* (i.e., NIOSH-approved respirators) in the few areas where exposure to TB may still occur when administrative and engineering controls are in place, such as in TB isolation rooms, during transport of infectious patients in an enclosed vehicle, and in areas where cough-inducing procedures are performed.

The frequency of TST screening recommended by CDC is dependent on the level of risk determined in the preliminary risk assessment. The OSHA enforcement guidelines require a baseline TST at time of initial employment for all employees in covered facilities; annual TSTs for all employees in these facilities; and testing every six months for employees with frequent exposure to persons with TB or employees performing high hazard procedures (sputum induction, bronchoscopy, etc).

If a person with a previously negative skin test reacts positively to a TST, the test should be followed by a chest x-ray to determine whether active TB has developed. A series of prophylactic (preventive) drug therapies is generally prescribed to prevent the infection from advancing to active TB disease. In addition to identifying individuals for whom prophylactic treatment is appropriate, routine TST screening can also serve as a surveillance tool to identify areas or occupations for which there may be an increased risk of TB transmission.

A diagnosis of active TB should be considered for any person with persistent cough or other symptoms compatible with TB, such as weight loss, anorexia (loss of appetite), or fever. Because these symptoms are not specific for TB (they can be caused by a number of illnesses), a person may be infectious for some time before TB is diagnosed. For this reason, the possibility of TB should be kept in mind, especially for members of populations considered to be at high risk. Early diagnosis of TB is critical for minimizing transmission. Upon diagnosis, drug therapy should be promptly initiated, and the infected individual should be isolated until the drug therapy has been shown to have killed enough bacteria to render the patient non-infectious.

Ventilation in Cells and Office Buildings

The probability of tuberculosis transmission is affected by the number of infectious persons and their level of infectiousness, the susceptibility and proximity of uninfected individuals, and the building ventilation. Ventilation guidelines are available for minimum outside air intake and temperature control in correctional facilities and offices. The American Society of Heating, Refrigerating, and Air-Conditioning Engineers recommends outdoor air supply rates of 20 cubic feet per minute per person (cfm/person) for cells and office spaces.[10] It should be noted, however, that these guidelines were established for comfort and odor control and do not address infectious disease transmission.

The measurement of ventilation and comfort indicators such as carbon dioxide (CO_2), temperature, and relative humidity (RH) has proven useful in providing information relative to the proper functioning and control of ventilation systems in office environments. Carbon dioxide is a normal constituent of exhaled breath and, if monitored, may be useful as a screening technique to evaluate whether adequate quantities of outdoor air are being introduced into an occupied space. Indoor CO_2 concentrations are normally higher than the generally constant ambient CO_2 concentration (range 300-400 ppm). NIOSH has recently stated that a level of 800 ppm should trigger inspection of ventilation system operation.[11]

METHODS

Industrial Hygiene Evaluation

A walkthrough survey and ventilation system evaluation were conducted to assess the potential for dissemination of airborne *M. tuberculosis*. The ventilation system evaluation included a review of the available mechanical plans; discussions with persons responsible for maintenance of the heating, ventilating and air-conditioning (HVAC) system; visual assessment of air flow

patterns in the cell block area; and performance of airflow measurements. A TSI model 8370 AccuBalance Flow Measuring Hood was used to measure the airflow at supply diffusers. Ventilation smoke tubes were used to assess pressure relationships. Measurements of CO_2 concentration, temperature, and relative humidity also were made to evaluate general ventilation and occupant comfort indicators. Carbon dioxide measurements were made using a Gastech Model RI-411A portable CO_2 indicator. Temperature and humidity measurements were made with a TSI VelociCalc Plus.

Medical Evaluation

An attempt was made to interview all eleven of the USMS employees who were reported to have a recent positive TST. However, only eight of these employees were available for interview at the time of the NIOSH site visit. These eight employees were privately interviewed, and their medical records were reviewed for TB testing history and results. The occupational health nurse was interviewed for information about the employee TST program, as well as other information pertinent to the request. Health care representatives from local jails were also interviewed.

RESULTS AND DISCUSSION

Industrial Hygiene Evaluation

The USMS Miami facility consists of offices and holding cells on the second floor of an 11-story courthouse complex building. The office building was built in 1981 and occupied in 1983. The USMS space consists of private offices, a squad room with open areas and cubicles, a waiting area, a reception area, four holding cells, three interview rooms, a fingerprint room, and a control room. Two air handling units supply conditioned air to this space. The ventilation systems operate 24 hours per day, and reportedly deliver a minimum of 20 percent outside air. Air is supplied to the office space and prisoner areas through ceiling diffusers, with the space above the false ceiling acting as the return air plenum (there are no return air ducts). Room air exits through returns located around the ceiling lights. In addition, a few open grilles are present in ceiling panels throughout the facility. Electric heat strips located in the ducts are used infrequently. AHU # 2 supplies air to the cell block area, interview rooms, fingerprint room, control room, west end of the squad room, and the 2nd floor lobby area, while AHU #12 supplies air to the remainder of the USMS office, as well as the North section of floors 1, 2, and 3. A package-style air-conditioning unit supplements the mechanical ventilation system in the control room.

AHUs #2 and #12 were clean and appeared to be well maintained. The condensate pans were draining properly, and the fiberglass panel filters had recently been changed. The maintenance personnel indicated that the units are visually inspected every month, the filters are changed every two to three months, and the cooling coils are cleaned yearly. Disinfection tablets placed in the condensate drain pans are replaced about every two months. The package A/C unit in the control room was not evaluated.

The ventilation systems are variable air volume (VAV) systems, meaning that the amount of air

delivered to the space varies depending on the temperature setpoints and thermostat readings. At least for the evaluated areas, when the thermostat was satisfied, no airflow was delivered to the space. Thus, in order to make airflow measurements, it was necessary for us to adjust the thermostats so that they were calling for cooling.

The results of the temperature and relative humidity measurements made throughout the day of the survey are shown in Table 1 (see pages 15-16). The temperature in the prisoner areas (cell block, interview rooms, and fingerprint room) ranged from about 70 to 77° and the relative humidity ranged from 47 to 52%. For the remainder of the USMS facility, the temperature ranged from 70 to 76°, and the relative humidity ranged from 49 to 54%. These values are within the acceptable ranges of operative temperature and humidity recommended by ASHRAE.[12]

Carbon dioxide concentrations are listed in Table 1 and are graphically displayed in Figures 1 and 2. The CO_2 concentrations generally increased during the day, ranging from 375 parts per million (ppm) to 2000 ppm. NIOSH has recommended that 800 ppm CO_2 be used as an indication of the need for further assessment of the ventilation system. Concentrations of CO_2 in excess of this guideline, but below the recommended exposure limit of 5000 ppm, do not represent a health hazard; rather they indicate the possibility that the ventilation system may not be adequately removing other contaminants.

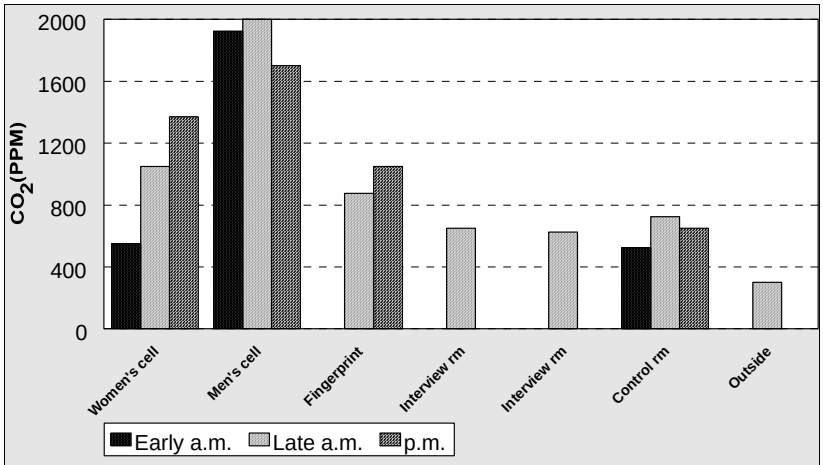

Figure 1S Carbon dioxide concentrations in the prisoner areas and control room, December 15, 1994.

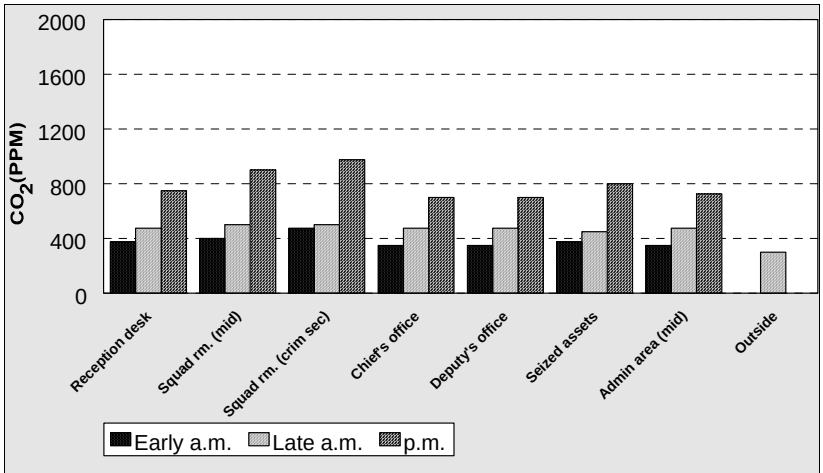

Figure 2 S Carbon dioxide concentrations in the general office areas, December 15, 1994.

The highest concentrations of CO_2 were measured in the cell blocks. This is not surprising, given that there were about 50 prisoners in these holding cells. With the exception of the squad room area (which is served in part by the

ventilation system which serves the cell block area), the CO_2 concentrations in the office areas were all at or below 800 ppm.

Table 2 (see pages 17-18) presents the results of the airflow measurements. Comparisons were made between the measured values and those listed on the design plans dated December 1980. As can be seen from the table, some of the measurements were very similar to those listed on the design plans, while others varied considerably, with the measured values being either much higher or much lower than the design values. Management indicated that the system had been balanced about five years ago, thus some airflow adjustments may have been made at that time. If so, this could account for some of the variations between the measured and design airflows. There was no supply air delivered to two of the three interview rooms. It was clear from the airflow measurements in the cell block area that a sufficient amount of outdoor air was not being provided to this space. ASHRAE recommends that 20 CFM of outside air per person be provided to cells. Considering the number of prisoners present (about 50), this area would need to be provided with 1000 CFM of outside air to dilute normal contaminants (including CO_2). This area is receiving only about 405 CFM of total supply air, and only 20% of it is reported to be outside air. In addition, there are times when no air is being supplied due to the design of the ventilation system.

It was not possible to get access to the space above the false ceiling in the cell block area as the diffusers and lights were sealed for security reasons. However, based on discussions with the ventilation maintenance personnel and a review of the ventilation plans, it appeared that there was air mixing between the prisoner areas and general offices areas in the return air plenum. In addition, the smoke tube traces indicated that the cell block area was under positive pressure with respect to the control room.

Medical Evaluation

Of the eleven employees reported in the HHE request to have a "positive" TST, one was not employed at the Miami office. Three had no record of a positive test, but had given histories of positive TSTs prior to their employment with the USMS. These four employees were not included in the epidemiologic analysis of TST results for the purpose of this investigation.

Of 63 Miami USMS employees who were enrolled in an employee TB screening program because of their potential contact with prisoners, 49 (78%) received a TST between May 1993 and February 1995. However, three employees did not return within 48-72 hours to have their TST evaluated. Of the 46 (73%) employees who had documented TST results, seven (15%) had a reaction size of at least 10 mm. None of these had a prior negative TST result documented in their medical records. Six of the seven were Marshals and one was an administrative assistant. Three of the Marshals reported having had contact with a prisoner who had been diagnosed with active TB while at the Miami USMS facility. However, only one Marshal's positive TST occurred at least two weeks *after* exposure to this prisoner. Of the other two exposed Marshals, one tested positive four days after his exposure to this prisoner, and the other had tested positive eight months *prior* to this exposure.
The prisoner arrived at the USMS Miami facility as a new arrestee on April 25, 1994. He was again brought to the USMS facility three days later for a court appearance, and remained at the

facility from 6:30 AM to 3:45 PM. The prisoner was admitted to a hospital on April 29, 1994, and diagnosed with pulmonary tuberculosis.

Health care representatives from Dade County Jail, North Dade County Jail, and the Metropolitan Correctional Center (where most of the federal prisoners and detainees are held) reported that incoming prisoners are not always screened for TB infection and disease. Jail representatives reported that prisoners have the right to refuse TB skin testing, and it is estimated that over 50% exercise this right and are never tested. Of those who are tested, many do not receive an evaluation of their skin test at 48-72 hours because they are released less than 48 hours after the TST has been placed. Prisoners may also be transported by Marshals for a court appearance or to a medical facility prior to evaluation of their TST. Dade County Jail representatives reported that, in 1993, 12,677 prisoners had TSTs placed. Out of these, 9216 (73%) were read and 1675 (18%) were positive. They also reported 16 cases of active TB that year. However, none of the 16 were Federal prisoners.

CONCLUSIONS

Correctional facilities are considered high risk settings for the spread of TB infection because of overcrowding and often poor ventilation. Inmates are considered more likely to have TB due to their greater likelihood of pre-incarceration risk factors such as inadequate access to health care services, and increased prevalence of HIV infection.[13] Because USMS employees have contact with U.S. and foreign prisoners who may not be adequately screened for TB, the USMS employees may be at an increased risk for exposure to *M. tuberculosis.* The data available at the time of our site visit showed that 15% of the Miami USMS employees tested for TB exhibited a positive TST (reaction size at least 10 mm). Because only 73% of the USMS employees were tested, these results may not reflect the prevalence of TB infection among *all* USMS employees who come into contact with prisoners at this facility. In addition, documentation of results of previous testing was not complete. Without baseline data (i.e., status of TST upon first employment at the USMS), it is difficult to assess whether a positive test result indicates a possible work-related TST conversion or a prior infection. Therefore, results of this screening effort cannot be used to assess the extent of work-related risk of TB infection among USMS employees.

Once a person is exposed to *M. tuberculosis*, it takes at least two weeks for the immune system to mount a detectable response and react positively to a TST. Therefore, it is unlikely that the Marshal who tested positive four days after being exposed to the prisoner with active TB had a positive skin test response as a result of that particular exposure.

Administrative controls remain the most effective controls for preventing TB transmission. These include the early recognition, evaluation, isolation, and treatment of persons with active TB, and the early identification of persons with TB infection for whom prophylactic treatment may be appropriate. USMS personnel have been actively working with the Federal Bureau of Prisons and contract correctional facilities to improve TB screening of inmates and to provide financial support for the purchase of portable minifilm chest x-ray equipment. This would substantially improve TB screening efforts at these facilities. The USMS is considering the purchase of portable high efficiency particulate air (HEPA) filtration units and germicidal ultraviolet radiation lamps for the cell block area. These devices can be used to supplement the mechanical ventilation system by removing or inactivating airborne *M. tuberculosis*.

Recommendations are made below to further reduce the potential for exposure to *M. tuberculosis* through improvements in the employee TST screening program and general ventilation. Deficiencies were found with respect to the amount of outside air provided and the delivery of air to the occupied space. These deficiencies minimize the ability of general ventilation and directional airflow to dilute or remove contaminated air.

RECOMMENDATIONS

1. The following recommendations were adapted from those published by the CDC for employees in health-care settings and correctional institutions.[6,7]

    - A TB screening policy and program that follows the 1994 CDC Guidelines should be established for USMS employees who have direct contact with prisoners. This program should be developed in consultation with qualified medical and/or public health personnel. Data collected through the recommended TB screening program will help establish the magnitude of the risk for TB infection and the need for changes in control measures. Employee representatives should be involved in the development of the policy and program. The program should be offered at no cost to employees.

    - All employees who have direct contact with a prisoner who is known to have, or is highly suspected of having, active TB should receive a TST as soon as possible after exposure occurs. If this TST is negative, then the employee should be retested three months after the exposure to see if infection with *M. tuberculosis* has taken place.

    - At the time of employment, employees should receive a Mantoux TB skin test unless documentation is provided for: (1) a previously positive reaction, (2) completion of or current preventive drug therapy, or (3) current or completed therapy for active TB disease. Individuals who have a history of vaccination with Bacille of Calmette & Guérin (BCG) should receive a TST. Employees with a positive TST should be evaluated for active TB. Employees with negative TSTs should be retested at least yearly to identify persons whose skin test converts to positive.

- Current guidelines for administration and interpretation of TSTs should be followed.[7] Key aspects of these guidelines include the following:

  - Use of a two-step procedure for initial skin-testing. This involves retesting within 1-3 weeks those who are initially negative.

  - Intracutaneous administration of 5 units of tuberculin purified protein derivative (PPD) (Mantoux test).

  - TSTs should be read by a qualified person 48-72 hours after injection.

  - The size of the reaction in millimeters of induration should be recorded for *all* tests, even "negative" tests. This is because the definition of a positive TST reaction varies according to several factors, including age and the immune status of the tested individual and size of prior TST reaction.

- Employees with positive TSTs, skin test conversions, or symptoms suggestive of active TB should be clinically evaluated for active TB.[14] Appropriate therapy should be instituted for those with active TB. Employees with positive TSTs or with skin test conversions, but without active TB, should be evaluated for preventive therapy according to published guidelines. As part of the medical evaluation following a skin test conversion, a history of possible exposure should be obtained in an attempt to determine the potential source of TB infection. This history should include all travel outside the U.S.

- Individual TST results and clinical evaluations should be maintained in confidential employee health records, and should be recorded in a retrievable aggregate data base of all employee test results. Personal identifying information should be handled confidentially. Summary data (e.g., the percentage of positive reactions among all tested) can be reported to management and employees. Individual test results should remain confidential.

- The rate of skin test conversions should be calculated periodically to estimate employees' risk of acquiring new infection and evaluate the effectiveness of control measures. On the basis of this analysis, the frequency of periodic testing may be altered accordingly.

2. Periodic updates should be provided to the ongoing TB education and training program to disseminate new information about TB and to share summary information about the extent of TB infection among employees and the effectiveness of the control measures.

3. The airflow measurements and high carbon dioxide concentrations indicate a need for additional outside air in the cell block area (including the fingerprint room and interview rooms). ASHRAE recommends that cells in correctional facilities be supplied with 20 CFM of outdoor air per person.[10] While this recommendation is not based on preventing infectious disease transmission, good general ventilation will aid in diluting the concentration of airborne contaminants such as *M. tuberculosis*.

4. A minimum amount of outdoor air should be provided at all times in the cell block and office areas. (The airflow measurements indicated that the VAV systems did not supply a minimum amount of outdoor air when the thermostats were satisfied.)

5. To further reduce the potential for dissemination of air containing *M. tuberculosis* from prisoners with unsuspected active TB, air mixing between the prisoner areas and general office areas should be prevented. Placing the cell block area under negative pressure will also help to minimize air mixing between these areas.

6. Prisoners who are frequently coughing should spend a minimum amount of time in common areas; one of the four cells could be used to isolate such prisoners on a temporary basis. Such prisoners should be medically evaluate as soon as possible, without waiting for the results of the TST.

7. If USMS employees must transport prisoners with active tuberculosis (or suspected active TB) in an enclosed vehicle, then respirators must be worn by the employees. HEPA respirators (including disposables) are the only respirators which currently meet the OSHA requirements[9] and recommendations made by CDC.[7] However, effective July 10, 1995, with the revised NIOSH respirator certification requirements,[15] respirator users are able to select from a broader range of certified respirators for protection against *M. tuberculosis*. All of these new (certified) particulate respirators meet the performance criteria recommended by CDC for use in health-care settings for protection against *M. tuberculosis*. Prisoners can be supplied with valveless masks or respirators to minimize dissemination of droplet nuclei.

8. USMS personnel expressed concern that the exhaust fan in the prisoner elevator did not appear to be working. The fan operation should be checked and repairs made if necessary.

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2. Employee Representative
2. OSHA Region IV Office

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Table 1
U.S. Marshals Service
Miami, Florida
HETA 95-0024
December, 1994
Indoor Environmental Quality Data

Location	Time	Carbon Dioxide Concentration (ppm)	Temperature (NF)	RH (%)	Comments
Control room	07:40	525	72.0	49.4	3 persons, A/C package unit and central HVAC system
	10:45	725	74.6	51.7	2 persons present
	11:43	650	76.2	49.7	4 persons present
Receptionist's desk	08:27	375	70.3	51.4	1 person, cubicle
	11:30	475	72.7	50.1	3 persons nearby
	14:14	750	72.6	52.2	1 person
Cell block (women's)	08:05	550	73.0	47.1	1 person
	11:48	1050	77.0	49.8	4 persons
	13:25	1370	72.4	50.0	
Cell block (men's)	08:10	1925	74.0	52.4	46 persons
	11:50	2000	75.5	49.6	40-45 persons
	13:30	1700	72.7	50.0	40-45 persons
Squad room (middle)	08:32	400	70.1	53.1	4 persons nearby, open office space
	11:22	500	71.8	50.0	2 persons
	14:19	900	73.8	51.3	5 persons nearby
Squad room (criminal sec.)	08:42	475	74.7	49.1	2 persons nearby, 3 workstations
	11:19	500	73.4	50.0	1 persons
	14:27	975	74.6	50.7	1 person

Table 1 (continued)
U.S. Marshals Service
Miami, Florida
HETA 95-0024
December, 1994
Indoor Environmental Quality Data

Location	Time	Carbon Dioxide Concentration (ppm)	Temperature (NF)	RH (%)	Comments
Chief Marshal's Office	08:17	375	71.0	51.1	no one present, private office
	11:34	450	72.4	49.7	no one present
	14:08	725	72.7	54.1	no one present
Chief Deputy's Office	08:20	350	71.2	51.6	no one present, private office
	11:36	475	72.4	49.7	2 persons present
	14:10	700	72.6	54.1	no one present
Seized assets	08:30	375	69.6	52.3	no one present, cubicles
	11:27	450	71.9	50.0	no one present
	14:16	800	72.8	51.7	no one present
Administration area (middle)	08:23	350	70.8	51.2	no one present, cubicle, desk empty
	11:32	475	72.8	50.0	no one present,
	14:12	725	72.6	54.0	1 person nearby
Fingerprint room	10:50	875	72.4	50.0	3 persons
	13:33	1050	72.7	49.8	4 persons
Interview rm (prisoner side)	10:53	650	70.2	50.1	no one present
Interview rm (interview side)	11:02	625	69.6	50.9	no one present
Outside	11:40	300	75.0	50.0	by door to courtyard, warm and sunny

Table 2
U.S. Marshals Service
Miami, Florida
HETA 95-0024
December 1994
Airflow Measurements

Distribution Box	Location	Room No.	Design Airflow (CFM)	Measured Airflow (CFM)
2T-6	Squad room	not listed	135	135
		"	135	110
		212	120	110
		not listed	135	125
		219	120	125
2T-7	Control room	218	135	100
		218	135	45
	Fingerprint room	224	250	118
	Interview room, right: interviewer side	214	25	50
	: prisoner side	214	25	0
	Interview room, center: interviewer side	215	25	0
	: prisoner side	215	25	0
	Interview room, left: interviewer side	216	25	0
	: prisoner side	216	25	0
2T-8	Women's cell block	220	100	85
	Cell block corridor	226	60	140
	Men's cell block	221	100	40
		222	100	65
		223	100	75
2N-1	Waiting room	205	160	190
		205	160	180
		205	not listed	110
	Hallway	205	65	145
2N-2	Across from seized assets	not listed	120	220
		"	120	220
	Squad room	"	120	195
		"	120	245
2N-3	Training	206	85	185
		206	90	105
		206	90	100

Table 2
U.S. Marshals Service
Miami, Florida
HETA 95-0024
December 1994
Airflow Measurements

Distribution Box	Location	Room No.	Design Airflow (CFM)	Measured Airflow (CFM)
		206	90	140

Table 2 (continued)
U.S. Marshals Service
Miami, Florida
HETA 95-0024
December, 1994
Airflow Measurements

Distribution Box	Location	Room No.	Design Airflow (CFM)	Measured Airflow (CFM)
2N-4	Conference room	not listed	120	105
		"	120	150
	Seized assets	"	120	125
		"	120	120
	Squad room	"	120	105
		"	120	110
2N-5	Training	206	270	400
		206	270	315
2N-6	Chief Marshal's office	209	160	280
		209	160	275
	Deputy Marshal's office	210	145	185
		210	145	200