NIOSH HEALTH HAZARD EVALUATION REPORT

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City of Altus Police Department and Jail
Altus, Oklahoma

June 2004

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

PREFACE

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ACKNOWLEDGMENTS AND AVAILABILITY OF REPORT

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Health Hazard Evaluation Report 2002-0165-2938
City of Altus Police Department and Jail
Altus, Oklahoma
June 2004

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SUMMARY

On February 27, 2002, the National Institute for Occupational Safety and Health (NIOSH) received a request from the City of Altus to conduct a Health Hazard Evaluation (HHE) at the City of Altus Police Department (PD) and jail, Altus, Oklahoma. The request concerned potential occupational exposure to *Mycobacterium tuberculosis* (*M. tuberculosis*) among employees having contact with a prisoner with infectious tuberculosis (TB) who was incarcerated in the Altus city jail during June 2001. NIOSH responded to the request by conducting a site visit in March 2002. This site visit consisted of confidential medical interviews with staff and employees of the Altus PD and jail, a review of tuberculin skin test (TST) records, and a formal ventilation assessment of the work site.

At the time of the site visit, 63 persons were employed by the Altus PD and jail. Fifty-eight (of the 63) were working at the Altus PD and jail between June 4, 2001, and June 25, 2001, the period of incarceration of the infected prisoner. All 58 were considered to be potentially exposed to the prisoner (index case). Approximately two months after the release of the index case from the Altus PD jail (and one month after it became known that the index case had active TB disease), the Jackson County Health Department (JCHD) undertook comprehensive TST screening of the employees of the Altus PD and jail. The only employees excluded from testing were those known to be previously TST positive. A total of 55 employees participated in tuberculin skin testing in August 2001. Twelve persons were identified by the JCHD as having TST readings greater than or equal to (≥) 5 millimeters (mm) induration; 4 of 12 (33%) were documented skin test conversions. One employee was diagnosed as having active TB disease. Three months later, in November 2001, 39 employees participated in tuberculin skin testing. At this time, 9 employees were identified as newly TST positive; 3 of 9 (33%) were documented skin test conversions. All nine TST positive employees underwent chest radiography; none were identified as having active TB disease. In January 2002, 5 employees were tested and 1 was identified as newly TST positive. In March 2002, 30 employees who had remained TST negative were tested; 2 were identified as being TST converters at that time.

The ventilation assessment conducted by NIOSH investigators revealed that at the time of the site visit, no outdoor air was being supplied to the building through any of the existing heating, ventilation, and air conditioning (HVAC) systems. Coupled with an insufficient fresh air supply, the air within the PD and jail was not being properly vented outside the building. Given the design and operation of the ventilation system in place at the time of this HHE, there were no areas within the building that would have provided adequate isolation for an inmate with infectious TB.

NIOSH investigators have determined that there was a health hazard present to the employees and staff of the Altus City PD and jail in 2001 due to occupational exposure to an inmate with unidentified active tuberculosis. The number of employees who developed TB infection as a result of this exposure cannot be completely characterized due to insufficient TST data. Recommendations are included in this report to establish a TB control plan for the City of Altus PD and jail and to make needed renovations to the building's ventilation system.

Keywords: SIC Code 9223 (Correctional Institutions) Police, Police Officer, Police Department, Jail, Prisoner, Inmate, Tuberculosis

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INTRODUCTION

On February 27, 2002, the National Institute for Occupational Safety and Health (NIOSH) received a request from the City of Altus to conduct a Health Hazard Evaluation (HHE) at the City of Altus Police Department (PD) and jail due to concerns over ongoing spread of tuberculosis (TB) infection among the employees. On March 18, 2002, NIOSH investigators traveled to Altus, the county seat of Jackson County, Oklahoma. Following an opening conference attended by NIOSH investigators and representatives of both the City of Altus and its police force, NIOSH investigators conducted an evaluation at the Altus PD and jail.

The investigation conducted by NIOSH consisted of a medical evaluation and an industrial hygiene / ventilation engineering evaluation. The NIOSH medical officer reviewed the results of the tuberculin skin test (TST) screening program and pertinent personnel records, held confidential interviews on-site with all staff members who agreed to be interviewed, and met with local public health officials. The NIOSH industrial hygiene team completed a visual inspection of the ventilation systems and, where ventilation systems were operating, airflow measurements from supply and exhaust diffusers were made. Smoke tube traces were used to determine room-to-corridor pressure relationships.

BACKGROUND

Jackson County is located in the southwestern corner of Oklahoma. Records indicate that rates of TB in Jackson County historically have been low compared to Oklahoma and the United States. Between 1997 and 1999, according to the Oklahoma State Department of Health (Tuberculosis Division) there was a single case of TB in Jackson County.[1,2,3] This represented a rate of 3.5 cases per 100,000 population for the county. This compares favorably to state rates which fluctuated between 6 and 7.5 cases per 100,000 during that same period, and U.S. rates that were as high as 8.7 cases per 100,000 in 1997, decreasing to 6.4 cases per 100,000 in 1999. In 1999, the TB rate for Jackson County was 43% lower than for the state as a whole.[3]

In 2001 and 2002, however, 13 cases and 18 cases of TB, respectively, were reported in Jackson County, a significant increase over the preceding 4 years. The source for this TB outbreak is believed to be an index case who remained undiagnosed with active disease for a period of 8 months. During this time, the index case lived in 3 counties in southwestern Oklahoma (including the Altus PD jail) and had direct contact with over 600 persons. Exposure to the index case resulted in 27 cases of active TB disease across three counties in southwestern Oklahoma.[4]

The index case was incarcerated at the Altus city jail beginning on June 4, 2001, and was released on June 25, 2001. During the period of his incarceration, the index case was noted by employees of the Altus PD and jail to be ill but despite receiving a medical evaluation was not diagnosed as having active TB disease. Approximately one month after his release from jail, this individual was diagnosed with active pulmonary TB. Upon receipt of this information, the JCHD initiated a comprehensive TB screening program among the general population of Jackson County to determine if individuals exposed to the index case had been infected with *M. tuberculosis*. The screening program, which included all employees of the Altus PD and jail, used a single-step TST protocol to identify persons infected with *M. tuberculosis*.

METHODS

Tuberculin Skin Testing (TST) Program Review and Employee Interviews

Following the NIOSH HHE opening conference on March 18, 2002, confidential interviews were conducted on-site with all staff members who agreed to be interviewed. Initially, we

hypothesized that categorization of risk of infection or disease among Altus PD and jail employees would be largely dependent upon whether or not they came into direct contact with the index case or his immediate environment (for example, the jail). Personnel records were reviewed to identify all current employees who were working for the Altus PD and jail during the incarceration of the index case. The NIOSH team then spoke with each consenting employee to identify his or her level of contact with the index case. In addition, we attempted to address all pertinent questions and concerns of the interviewed staff members during the confidential interviews.

In addition to the confidential interviews, the NIOSH medical officer obtained the records of the JCHD TST program dating back to its inception (January 1997). The information obtained from the JCHD TST program logs (that is, the past and current TST status of Altus PD and jail employees) was combined with the personnel record information and entered into a database. Two current employees identified as TST positive during military service (prior to being hired by the Altus PD and jail) never participated in JCHD-sponsored skin testing. They were thus excluded from NIOSH analysis of the JCHD TST program.

Definitions of Employee Exposure to the Index Case

Indirect contact

NIOSH investigators determined that exhaust air from the Altus PD and jail may have been mixing with the building's "fresh" air supply. This situation theoretically allowed for air to be shared between the occupants of the jail (that is, inmates) and employees within all areas of the Altus PD and jail. Therefore, all employees of the Altus PD and jail working in the police department (and not on vacation or on medical or administrative leave) between June 4, 2001, and June 25, 2001, were considered to have had at least indirect contact to the index case by "sharing air."

Direct contact

Any employee of the Altus PD and jail who entered the jail between June 4, 2001, and June 25, 2001, was considered to have had direct contact with the index case. Personnel not entering the jail but coming into face-to-face contact with the index case in some other manner were also categorized as having had direct contact.

No contact

An employee was considered to have had no contact with the index case if he or she was absent from the Altus PD and jail building during the period of incarceration of the index case, between June 4, 2001, and June 25, 2001.

Ventilation Assessment

The Altus city jail consists of a U-shaped cellblock containing six cells (including an observation cell) and an additional two-cell wing where female inmates can be held. The two-cell wing is separated from the main cellblock by a door. The jail is housed within the Altus PD/courthouse complex. In the attic of the PD/courthouse complex are five ventilation systems. One system serves the jail and property rooms/vault in the southwest (SW) corner of the building. This system includes an emergency smoke evacuation fan coupled to a motorized, parallel-blade, relief damper. The relief damper is located in the wall of a corridor that runs from an interior garage entrance to past the female detention cells. The dispatch center, located just inside the main door of the PD on the east side of the building, has its own self-contained HVAC unit with all air supply and return located within the same room. The room exchanges only a small amount of air with the adjacent corridor and main lobby when the sliding glass windows are open. A third system serves the planning and operations office and also an adjacent booking room located just inside a second interior entrance to the garage. A fourth system serves the break room, administrative offices, the east entrance lobby, and other offices in the central portion of the building's east side. The Municipal Courtroom, the north entrance lobby,

and the offices in the north end of the building are ventilated by the fifth system.

To evaluate the air distribution provided by each of these five systems, NIOSH investigators obtained airflow measurements at the supply air diffusers and return or exhaust grilles using a TSI Model 8370 AccuBalance Flow Measuring Hood. A TSI VelociCalc Plus Model A-8386 anemometer was used to measure air velocity in locations that were inaccessible with the flow hood. Real-time carbon dioxide (CO_2) measurements were collected using a TSI Model 8550 meter. Ventilation system drawings were not available for the building.

EVALUATION CRITERIA

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for the assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects even though their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or hypersensitivity (allergy). In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: (1) NIOSH Recommended Exposure Limits (RELs),[5] (2) the American Conference of Governmental Industrial Hygienists' (ACGIH®) Threshold Limit Values (TLVs®),[6] and (3) the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs).[7] Employers are encouraged to follow the NIOSH RELs, the ACGIH TLVs, the OSHA PELs or whichever are the more protective criteria.

OSHA requires an employer to furnish employees a place of employment that is free from recognized hazards that are causing or are likely to cause death or serious physical harm [Occupational Safety and Health Act of 1970, Public Law 91–596, sec. 5(a)(1)]. Employers should understand that not all hazardous chemicals have specific OSHA exposure limits such as PELs and short-term exposure limits (STELs). However, an employer is still required by OSHA to protect their employees from hazards, even in the absence of a specific OSHA PEL.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8- to 10-hour workday. Some substances have recommended STEL or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from higher exposures over the short-term.

Tuberculosis

TB is an infectious disease caused by the bacterium *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 (1 – 5 microns in size) 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 of the lungs and spread throughout

the body. Within 2-10 weeks, the immune system of a person infected with *M. tuberculosis* usually acts to prevent further multiplication and spread of the bacteria; however, some of the bacilli (*M. tuberculosis* bacteria) remain dormant and can survive for many years. At this point, a person will usually have a positive 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 TB during their lifetimes, but the risk is considerably higher for persons who are immunosuppressed, especially those with HIV infection.[8] 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.[9]

Characteristics of the TB patient that enhance transmission include: disease in the lungs, airways, or throat; presence of cough; presence of M. tuberculosis in the sputum; presence of cavitary lesions ("holes" in the lungs) seen on chest x-ray; insufficient treatment; failure to cover the mouth and nose when coughing or sneezing; and undergoing procedures that can induce coughing or the production of aerosols of *M. tuberculosis* 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.

Infection, Disease & Demographics

TB infection progresses to TB disease only after *M. tuberculosis* bacteria begin to multiply within the body. Bacterial multiplication may occur many years after infection but in some instances can take place within only a few weeks. In the majority of situations, however, TB disease never occurs. In the United States, for example, approximately 5% of people who become infected with *M. tuberculosis* go on to develop TB disease within the first one to two years after infection. An additional 5% of Americans who are infected with *M. tuberculosis* develop TB disease later in their lives. The remaining 90% stay infected, but disease-free, for the rest of their lives.[10]

Although TB infection rates in the United States rose during the 1980s and 1990s, due in large part to the Acquired Immune Deficiency Syndrome (AIDS) epidemic, recently the number of TB cases and case rates has begun to decline. In 2002, the CDC received reports of just over 15,000 TB cases from the 50 states and the District of Columbia. This compared favorably to the previous year (2001) when there were nearly 16,000 cases, and in 1992, when there were over 26,600 TB cases.[11]

Within Oklahoma, the number of TB cases has generally decreased over the past several years. In 1999, for example, 208 TB cases were reported to the CDC by Oklahoma.[12] In 2001 and 2002, there were 194 and 190 cases of TB reported, respectively.[13] Of the 190 cases reported in 2002, 4.8% were identified as being residents of correctional facilities within the state.[14] In that year, for all states reporting more than 100 cases of TB, Oklahoma ranked 6th in terms of percentage of persons with TB who were incarcerated at the time of their diagnosis.

Risk of Infection

People spending significant amounts of time with a person who has infectious TB disease are at greatest risk for developing TB infection. A person's risk for infection increases with increased exposure to the respiratory droplet nuclei that contain *M. tuberculosis*. Four factors determine the likelihood of transmission of *M. tuberculosis*: (*1*) the number of organisms being expelled into the air, (*2*) the concentration of organisms in the air determined by the volume of the space and its ventilation, (*3*) the length of time an exposed person breathes the contaminated air, and (*4*) presumably the immune status of the exposed individual.[15]

A paper by Barnhart, et. al., (1997) attempted to quantify the risk of TB infection to health care workers exposed to patients with TB disease. (Although this paper dealt specifically with exposures in a hospital setting, the concepts can be applied to the PD and jail in Altus.) The authors of the article estimated that under "average" conditions of exposure, unprotected workers would develop one skin-test conversion (that is, one TB infection) for every 2650 person-hours worked.[16] Under "high" exposure conditions, however, the authors of the paper estimated that a skin-test conversion might occur in as few as 3 person-hours of exposure. Those persons with TB disease who are not yet on treatment (as was the case with the incarcerated index case in Altus), or persons who have drug-resistant TB are likely to generate more infectious particles and/or generate them for a longer period of time. Either factor would increase the risk of infection among unprotected workers.

Criteria for tuberculin positivity

CDC recommends three cut-points to define a positive TST reaction: ≥5 mm, ≥10 mm, and ≥15 mm of induration.[17,18] These cut-points depend on an individual's risk factors for developing active disease and include such criteria as age, immune status, and likelihood of exposure to an individual with infectious TB. For the purposes of this HHE, positive TST reactions for various high and low level risk group populations are defined by criteria listed in Table 1.

Latent Tuberculosis Infection (LTBI)

Active TB disease, infection with *M. tuberculosis*, infection with a nontuberculous Mycobacterium species, or past vaccination against TB are four different causes of a positive TST. It is important to distinguish among them since treatment options and outcomes are highly dependent on the cause of the positive TST. Persons who are specifically determined to be infected with *M. tuberculosis*, and who do not have active TB disease, have a condition known as latent tuberculosis infection (LTBI).[10] Although persons with LTBI cannot spread their infection to others, it is recommended that they receive treatment for their infection and also counseling about their risk for developing active TB disease. Because of the risk of developing active disease once infected, the Centers of Disease Control and Prevention (CDC) recommends that such persons be evaluated for preventive drug therapy, to prevent progression from infection to active TB disease.[19] The risk for developing active disease is greatest during the first two years after infection.

Two-Step Testing [20]

People infected with *M. tuberculosis* should react to tuberculin proteins for the rest of their lives. Over time, though, some people infected with *M. tuberculosis* may not react as strongly to tuberculin proteins and will, ultimately, no longer show a response to a single TST. In those cases, a single TST can serve to stimulate or "boost" the body's immune system so that a positive reaction will occur upon subsequent skin testing. In persons who have no knowledge of a pre-existing infection with *M. tuberculosis*, the subsequent positive reaction may incorrectly be interpreted as a new infection. Although the booster phenomenon tends to occur in older persons, it may also be seen in young persons.

To ensure the proper interpretation of TST results in adults for whom regular, periodic testing is recommended, a process known as a "two-step test" should initially be used. Two-step testing should also be employed when a person is unsure or unaware of their previous TST status or if they have not been tested within two years prior to the testing date. To perform a two-step test, an initial TST is placed; if there is a negative reaction to the test based on CDC criteria (see Table 1), a second test should be placed 1 to 3 weeks after the first. If there is a negative reaction to the second test, the person should then be classified as uninfected. In persons with a negative two-step TST, a positive reaction to any subsequent test is likely to represent new infection with *M. tuberculosis*. The phenomenon of becoming TST positive

after having an established negative baseline skin test is referred to as "skin test conversion."

If, however, in response to the second step of a two-step test a person develops a positive response, it may be interpreted as a "boosted reaction" – meaning either there was a previously unknown or unremembered infection, or the person received a vaccination against TB in the past. The positive test should not be considered as evidence of skin test conversion. On the basis of this second test result, the person should be classified as previously infected and receive appropriate treatment as necessary.

Why is two years significant for the diagnosis of TST conversion? [21]

In workers who undergo repeat tuberculin skin testing, a skin test conversion is defined as an increase in TST reaction size of ≥10 mm within a period of 2 years. If there is exposure to a known TB patient, however, a skin test conversion is defined as an increase in TST reaction size of ≥5 mm within two years of the previous test. In a previously TST negative individual, these results are suggestive of a recent infection with *M. tuberculosis*.

Jails and Prisons

There are two principal categories of correctional facilities: prisons and jails. Jails are locally-operated correctional facilities that fulfill an important role within the justice system in this country.[22] Specifically, jails confine persons who are pending arraignment, prior to a trial or a hearing before a judge, and while awaiting conviction or sentencing.[23,24] Jails also typically hold inmates serving sentences of one year or less. Because of over crowding within the federal or state prison system, however, some prison inmates are transferred to and subsequently serve their sentences in local jails.[23,25] Prison terms, regardless of where they are served, are generally longer than one year in length.

Jails may also house probation, parole, and bail-bond violators; juveniles awaiting transfer to juvenile authorities; mentally ill persons awaiting transfer to appropriate health facilities. Jail personnel may supervise community-based programs involving home detention and electronic monitoring. When necessary, jails can and do relinquish custody of temporary detainees to appropriate medical authorities.[25]

Jails and TB

It has been estimated that residents of jails and prisons have an incidence rate of tuberculosis four times greater than that of the community at large.[23] Groups at higher risk for developing TB infection and disease, including ethnic minorities, alcoholics, injecting drug users, homeless persons and persons infected with the human immunodeficiency virus (HIV) and/or AIDS are disproportionately represented among the incarcerated population.[23,26] The clustering of these high risk groups within correctional facilities has contributed to increasing rates of TB in jails and prisons at the same time that the national rates of tuberculosis have been declining.

In the United States, the absolute number of people in jail as well as the population density of incarcerated persons has been steadily increasing each year over the past decade.[22] Thus, the risk of transmission of TB among jail inmates has been likened to that of a household situation, albeit on a much larger scale.[27] While the number of jail inmates has increased, the total number of correctional staff and correctional officers has also increased. Jail and prison personnel have been identified as workers with an increased level of risk for exposure to communicable diseases such as TB.[25]

TB Screening – Jails

In 1999, of the 391,580 inmates residing in jail jurisdictions that reported on TB, 4294 (1.1%) were suspected of having TB infection or disease.[28] However, screening actually identified a significantly larger population of 9791 (2.5% of inmates) as being skin test positive and another 584 (0.15%) with confirmed TB disease.

Within the state of Oklahoma during that same time period, 18 inmates (of 3,724) were suspected of having TB infection or disease.[28] Thirty-four were determined by skin testing to have TB infection and another 7 had confirmed TB disease. Thus, both within the state of Oklahoma, as well as nationally, screening of inmates at the time of incarceration revealed larger numbers of infected or diseased persons than was initially suspected.

To prevent the transmission of TB within correctional facilities, protocols to detect active TB among inmates at screening must be implemented.[23,24,29] Failure to isolate and properly treat incarcerated individuals with TB disease has resulted in the transmission of *M. tuberculosis* to other inmates and to correctional staff. Released prisoners or correctional staff may then, in turn, unknowingly facilitate the spread of the disease into the community.

Given the high turnover of inmates within any given correctional facility, the staff is repeatedly at risk for exposure to persons with active TB disease. Despite this risk, of all jails in the United States in 1999, approximately one-third had no policy for testing either incoming inmates or personnel at the time of hiring.[30] Fewer than half of all jails had policies for TST screening of newly hired staff; fewer still had policies in place for regular screening of their employed staff (e.g. annually). Only 26 jails reported having policies for pre-termination testing. As was observed in one New York county jail, the absence of reliable pre-employment TST testing results renders documentation of skin test conversion among jail staff "not possible."[26] The lack of regularly scheduled TST screening over the course of a correctional officer's duty similarly impedes one's ability to accurately determine the chronology of skin-test conversions among jail personnel.

Ventilation Criteria for Cells and Offices

The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) recommends a ventilation rate for a correctional facility cell of 20 cubic feet per minute (cfm) of outdoor air per person with a maximum occupancy of 20 inmates per 1,000 square feet (ft^2). Other areas for which 20 cfm/person is recommended include offices and conference rooms. These other areas have different maximum occupancy restrictions of 7 persons per 1,000 ft^2 and 50 persons per 1,000 ft^2, respectively. Lobby areas have a reduced outdoor air requirement of 15 cfm/per person based on a maximum occupancy of 60 persons per 1,000 ft^2. Restrooms should be supplied with 50 cfm of outdoor air for each toilet.[31] In comments on an interpretation of ASHRAE Standard 62-1999, the ventilation requirement for a "wet" cell, which is a cell with a toilet and/or shower, was specified as 50 cfm of exhaust for each toilet fixture, or 35 cfm of exhaust if the cell contains a shower but no toilets, in addition to the 20 cfm/person of outdoor air for cell occupants. The make-up air may be provided by a combination of ducted supply from a ventilation system, outdoor air supplied directly to the cell, and transfer air from an adjacent space such as a corridor or common area.[32]

Measuring a ventilation indicator such as CO_2 is useful in the early stages of an investigation to provide information concerning the proper functioning and control of HVAC systems. CO_2 is a normal constituent of exhaled breath and monitoring for this gas may be useful as a screening technique to evaluate whether adequate quantities of fresh air are being introduced into an occupied space. Indoor CO_2 concentrations are normally higher than the generally constant ambient (outdoor) CO_2 concentrations [range 300-400 parts per million (ppm)]. According to NIOSH, a level of 800 ppm should trigger inspection of ventilation system operation.[33] This level of CO_2 is an appropriate marker of potentially inadequate ventilation. Research findings show that 15 cfm of outdoor air per person will adequately dilute odors from human bioeffluents. This ventilation rate corresponds to a steady-state CO_2 concentration of 700 ppm.[34] Elevated CO_2

readings suggest that indoor air contaminants may also become more concentrated in these areas.

RESULTS

Exposure Categorization

Employee interviews and a review of personnel records revealed that all 58 persons (of the persons who had been hired and employed by the Altus PD and jail prior to release of the index case) had either direct or indirect contact (as defined above) with the index case. Personnel coming into direct contact with the index case included his arresting police officers, rank and file police officers who visited the jail during the 21 days that the index case was incarcerated, all jailers who made rounds within the jail during that same period, and support staff to the police department and court. Employees classified as having indirect contact with the index case included supervising police officers, police detectives, some dispatchers, animal control officers, and support staff to the police department and court. Personnel having indirect contact with the index case worked within or regularly visited the Altus PD and jail building but did not enter the jail area or otherwise come into direct contact with the index case during his period of incarceration.

Altus PD and Jail Employee Screening Procedures

Review of the TST data collected by the Jackson County Health Department revealed that of the 58 employees working at the Altus PD and jail prior to the incarceration of the index case, 44 (76%) had participated at least once in tuberculin skin testing conducted by the JCHD prior to July 2001. In January 1997, during the first round of tuberculin skin testing, 2 Altus PD and jail employees were identified as TST positive by the health department. Between January 1997 and July 2001, four other employees had baseline TST screens placed that were reportedly never read. Thus, effectively, 38 of 44 employees had at least one documented negative TST result in the JCHD database.

Twenty-one (55%) of the thirty-eight employees identified as having at least one negative TST result prior to August 2001 had no documented results between June 1999 and July 2001; those 21, therefore, had tuberculin skin testing completed more than 2 years prior to the potential exposure to the index case. Seventeen (45%) of the 38 employees participated in single-step TST screening between June 1999 and July 2001. These 17 employees, therefore, formed the group of Altus PD employees among whom it was possible to determine whether TST conversion had occurred.

Oklahoma State Jail Standards (Section Number 310670-5-9; Paragraph 8.19) mandate TB skin testing as follows: "*Jail staff* shall receive a TB skin test as a part of their pre-employment and annually as long as the tests are negative. Individuals with new positive skin test results will be referred to the County Health Department or their doctor of choice for evaluation." *Jail staff* has been interpreted in the Oklahoma State Jail Standards to mean those employees who work as jailors, that is, those who are charged with the responsibility of monitoring jailed inmates. Thus, there exists a legal requirement only for persons who monitor jailed inmates to undergo pre-employment tuberculin skin testing. Of the 63 persons employed at the Altus PD and jail at the time of this site visit, 12 (including a supervisor) were employed as '9-1-1 dispatch staff' whose job description includes the monitoring of jailed inmates. Of these 12, 9 were hired and working there prior to the release of the index case from jail. Eight were TST negative and one had a documented previously positive skin test prior to the incarceration of the index case.

Post-exposure TST Results

August 2001: First Round of TST

In August 2001, 55 employees underwent tuberculin skin testing. Two persons who participated in the testing were not yet employed by the Altus PD and jail during the incarceration of the index case and thus were excluded from

analysis. A third employee was excluded from analysis due to misclassification. This individual had a documented TST reading by the health department of 4 mm induration and thus did not satisfy CDC criteria for being TST positive. Nonetheless, this individual was referred for anti-tuberculosis treatment. This result, therefore, is not being included in data analysis.

Forty (77%) of the remaining fifty-two tested employees were found to have less than (<) 5 mm induration at this time. Twelve (23%) of the eligible, participating employees were identified by the JCHD as TST positive (≥ 5 mm induration). Those identified by the health department as TST positive were referred for treatment for latent TB infection. All 12 employees were determined to have been in direct contact with the index case.

Skin Test Conversions

Four of twelve employees identified as TST positive had a documented negative TST result between June 1999 and July 2001; therefore, the August 2001 testing identified 4 TST conversions, including an individual later determined to have active disease. Three of the remaining 8 had at least one prior documented TST result of <10 mm induration between January 1997 and June 1999. Five of the 8 employees without documented TST results between June 1999 and August 2001 had, in fact, never participated in tuberculin skin testing or had never had a reading of their TST results.

Clinical Evaluation

All employees identified as TST positive in August 2001 underwent chest radiography to look for evidence of active TB infection; one of the 12 (21 mm induration) was thereby determined to have active TB disease (primary pulmonary TB). The radiograph of this individual identified a right lower lobe infiltrate as well as a possible left lower lobe infiltrate. No upper or middle lobe infiltrates were identified. Three sputum smears from this individual were all negative for acid fast bacilli (that is, mycobacteria species). Culture of a sputum sample from this individual, however, identified *M. tuberculosis* complex. Deoxyribonucleic acid (DNA) fingerprinting of the bacterial isolate revealed this employee to be infected with the identical strain as that found in the index case. This individual was started on and subsequently completed a 9-month course of isoniazid and rifampin therapy. No other newly identified TST positive employees had evidence of active disease; each was started on a course of prophylactic therapy for presumed LTBI.

Based on the records compiled by the JCHD, 4 (7%) of the 58 employees who had either direct or indirect contact with the index case were known to be TST positive prior to the incarceration of the index case. Each of the four persons provided a history of having completed an appropriate course of therapy with an accepted anti-tuberculosis prophylactic drug regimen when initially identified as TST positive. Prior to our arrival in March 2002, however, none of these four had received any medical evaluation following their exposures to the index case (as per information collected during the NIOSH conducted medical interviews).

November 2001 / January 2002: Second Round of TST

It may require up to 10-12 weeks for an individual newly infected with *M. tuberculosis* to manifest a positive TST. The JCHD thus undertook a second round of tuberculin skin testing in November 2001, (with follow-up in January 2002) to identify individuals who may have been infected following exposure to the index case in June 2001, but who had not yet developed a positive skin test at the time of the first round of tuberculin skin testing in August. Between November 2001 and January 2002, 38 of 40 employees who were found to be TST negative in August underwent a second round of TST. Twenty-eight (74%) of the thirty-eight employees were found to have <5 mm induration at that time; of the 10 (26%) employees identified as TST positive (≥ 5 mm induration), eight had had direct contact with the index case and two had indirect contact.

Skin Test Conversions

Three of the ten employees identified as TST positive in November 2001 / January 2002, had a negative TST result documented between June 1999 and July 2001; therefore, the November 2001 / January 2002, testing identified three TST conversions. Three of the remaining seven had either never participated in tuberculin skin testing or had no documented reading of their TST result(s); four of the seven had at least one prior documented TST result of <10 mm before June 1999 and could thus be considered as possible skin test converters.

Clinical Evaluations

All employees identified as TST positive in November 2001 / January 2002 subsequently underwent chest radiography to look for evidence of active TB disease. None had evidence of active pulmonary TB; each was started on a course of prophylactic therapy for presumed LTBI.

TST Summary Results

In total, the August 2001 and November 2001 / January 2002, testing identified 22 employees with induration of ≥5 mm, indicating a positive TST. Of the 22 positive TSTs, there were 7 documented TST conversions and 15 persons newly identified as TST positive who may have had recent skin test conversions but who could not be completely characterized due to inadequate testing. A total of 34 employees had direct contact and 19 employees had indirect contact with the index case as defined in the Methods section. Twenty of the twenty-two employees who were TST positive (including all 7 TST converters) provided a history of having had direct contact with the index case. Two of nineteen persons with indirect contact with the index case were newly identified to be TST positive.

Employee Interviews

Fifty-four (86%) of the sixty-three employees of the Altus PD and jail participated in NIOSH-conducted medical interviews. Interviewees included police officers and detectives, jailers, dispatchers, animal control officers, and support staff to the PD and court.

In addition to concern about exposure to the index case, employees expressed concerns about exposure to *M. tuberculosis* bacteria from persons with undiagnosed TB disease. It was widely known among the workforce, for example, that two employees had been identified as newly TST positive in March 2002, when another round of tuberculin skin testing was conducted by JCHD. Both of these employees had participated in JCHD TST screening in August 2001 and November 2001 / January 2002, and both had had negative tuberculin skin tests at those times. Since a TST is known to take at most 10-12 weeks to become positive following TB infection, it is unlikely that the index case was the immediate source of infection for the two TST conversions within the Altus PD and jail that were detected in March 2002. Several persons within the workforce expressed concern that the source for ongoing *M. tuberculosis* exposure might be a fellow employee with undetected active disease.

Ventilation Assessment

General

The Altus PD and jail received an insufficient supply of outdoor air when compared with ASHRAE guidelines. Visual inspection of the ventilation systems revealed that no outdoor air was being supplied to the building through the 5 HVAC systems. CO_2 concentrations ranged from 810 ppm to 1,755 ppm throughout the Altus PD. Overall, these levels indicated that inadequate amounts of fresh air were being supplied to the building. The only regular source of outdoor air to the building was infiltration through open doorways and during the movement of people through outside doors to enter or leave the building.

Coupled with an insufficient fresh air supply, NIOSH investigators determined that the air within the PD and jail was not being properly vented outside the building. While exhaust air is supposed to be vented outside a building, at the

Altus PD exhaust air was being discharged into the attic space. An examination of the HVAC units within the attic space revealed improperly sealed ductwork and housing. The defects in the ventilation system allowed for exhaust air being discharged into the attic space to be entrained into the "fresh" air supply. Thus, not only was exhaust air not being properly vented outside the building, it was being discharged into the attic where it was mixing with other attic air and then returned to the occupied areas of the building. The occupants of the Altus PD and jail were re-breathing air that had been vented from the occupied areas, including the restrooms, into the attic and then returned to the occupied areas by the HVAC system.

The Cellblock

Within the cellblock area itself, NIOSH investigators found a supply vent in each cell and 4 return vents in the corridors. There were no exhaust grilles. The absence of exhaust and the lack of an outdoor air supply within the jail acts to contain air contaminants and minimize their dilution. On the day measurements were made, the cellblock area pressurization was slightly negative relative to the adjacent areas, meaning that air mostly flowed in from adjacent areas, with little air escaping when people entered or left the cellblock. CO_2 concentrations specifically within the cellblock area ranged from 610 ppm to 760 ppm. Concentrations of CO_2 were much lower in the cellblock area as compared to the building as a whole due to low occupancy (only two inmates were incarcerated at the time of the evaluation). These concentrations would be expected to rise as the number of inmates increased.

A different airflow pattern was found when the smoke evacuation system was turned on. The smoke evacuation system was a manually-operated fan controlled by an on-off switch located in the planning and operations room. In the event of a fire within the cellblock, the fan was designed to exhaust smoke from the area thereby preventing its spread to other parts of the building. However, during the inspection NIOSH investigators found that the fan for this system had been installed backwards. Thus, in the case of a fire, smoke would be blown throughout the cellblock area and into the adjacent areas including the occupied office spaces. This was verified by the airflow measurements collected by NIOSH investigators.

Of particular concern for this investigation is the fact that the smoke evacuation system had been used for other than its intended purpose of controlling smoke. Based on discussions with the jail staff, NIOSH investigators learned that the system was used during the summer months to provide additional airflow to the cellblock area, especially during periods of elevated temperatures. Altus PD and jail staff members confirmed that the fan was used to supplement airflow to the cellblock area during the time that the infectious inmate was incarcerated in the jail. Use of the improperly installed smoke evacuation system fan could possibly have created a situation whereby airborne tuberculosis bacteria, coughed out of the lungs of the prisoner with TB, were carried on air currents throughout the cellblock and into nearby office spaces within the PD.

The Booking Room

Inmates may initially be held for questioning in the booking room for variable lengths of time ranging from several minutes up to an hour or more. Proper ventilation of this area is important because it may be the first interaction an officer has with a potentially infectious individual. This room, with approximately 200 cfm of supply was receiving no outdoor air. This room was under positive pressure with respect to the corridor, where a 370-cfm return was located. Air flowed out of the booking room towards the interview rooms.

Detective Offices, Municipal Court, and the Dispatch Room

Return air registers for the detective offices and municipal court systems, with a total flow of approximately 2000 cfm, were located in the corridor. This configuration resulted in air

flowing out of the detective offices, the court office, the lobby, and the courtroom into the adjacent corridors. The courtroom, with 225 cfm of supply and 0 cfm/person of outdoor air, was of interest because the infectious inmate was taken to this location during his incarceration.

The dispatch room has its own self-contained HVAC unit with all air supply and returns located within the same room. The room exchanges only a small amount of air with the adjacent corridor and main lobby when the sliding glass windows are open. This system recirculates over 800 cfm with 0 cfm/person of outdoor air.

DISCUSSION

In our evaluation, we found that 20 (91%) of 22 Altus PD and jail employees who were found to be TST positive had direct contact with the index case during his incarceration. Among these 22, 7 of 7 persons with documented TST conversions provided a history of direct contact with the index case; one employee with a documented TST conversion and a history of direct contact with the index case developed active TB and DNA fingerprinting of the bacterial isolate revealed this employee to be infected with the identical strain as that found in the index case. Risk for TST conversion among this workforce, therefore, appeared to be primarily related to direct contact with the index case or his immediate environment (for example, entering into the jail). Despite defects in the ventilation system at the Altus PD and jail (and the likelihood that persons working there during his incarceration "shared air" with the index case) none of the documented TST conversions occurred among those employees with indirect contact with the index case. Two employees (11%) of 19 with indirect contact with the index case were identified as TST positive; in neither case, however, could we determine TST conversion status due to a lack of data.

Interpretation of TST Results

Without a well-established baseline and regular screening program, it is not possible to accurately determine the chronology of a person becoming TST positive. In August 2001, for example, 10 employees who were identified as TST positive had no documented skin test results between June 1999 and July 2001. In the absence of a documented negative skin test result prior to exposure to the index case, it is not possible to distinguish whether some previous unknown exposure resulted in their skin test result turning positive (that is, TB infection).

In November 2001 / January 2002, 10 employees had positive TST results. Of the 10, however, only 3 had documented negative TST results between June 1999 and July 2001. A negative TST result sometime within the previous two years coupled with a negative TST result in August 2001 (while not formally a "two-step test") does establish a negative baseline for these individuals. A positive TST in November, then, indicates that these three individuals experienced a skin test conversion.

The remaining 7 employees with positive TST results in November 2001 / January 2002 had no TST results (apart from the TST screen in August) documented between June 1999 and July 2001. It is possible that some of these employees may have been previously infected with TB and now had a waning of their immune response. Some or all of these individuals may then have been exhibiting a "booster effect" wherein a single TST (the August testing) stimulated or "boosted" an immune response, resulting in a positive reaction with the November skin testing.

TB Management – Jails

Specific guidelines for the management and control of TB within correctional facilities may be found in the CDC document *Controlling TB in Correctional Facilities*.[29] Screening, containment, and a program of continuing assessment as to the effectiveness of the control program are the three keys to an effective TB

control program as outlined in the Recommendations section of this current report. Simply put, all incoming inmates should be screened by TST testing and those inmates with positive tuberculin reactions should undergo additional testing (chest x-ray and collection of sputum for culture and microscopic evaluation). Had the index case incarcerated at the Altus city jail been adequately screened at the time of incarceration, the risk of infection among the staff of the PD and jail may have been less.

Prisoners confirmed as having active TB disease must be segregated from other inmates and staff until they complete a minimum course of therapy and are determined to be no longer infectious. Inmates who are identified as TST positive and who do not have active TB disease should be referred for preventive therapy provided they have not previously completed an adequate prophylactic course.[26] Given the comparatively brief jail stays of most jail prisoners, provisions must be made before release of a TST positive inmate for the health department to oversee completion of at least 6 months of appropriate therapy.[26]

All staff should also be screened by a process known as 2-step TST skin testing upon hiring. Two-step TST skin testing helps eliminate the possibility that an employee is identified as TST negative, when, in fact, he or she is actually TST positive. As with inmates, employees identified as having positive tuberculin reactions must first be evaluated to determine the presence or absence of active TB disease. New employees found to have active TB disease must be isolated from other persons (family, friends, staff, inmates) until they complete a minimum course of therapy and are determined to be no longer infectious. Family members and other close contacts would likely need to be screened at the discretion of the local health department. Employees who upon screening are identified as being TST positive, and who do not have active TB disease, should similarly be referred for counseling and prophylactic therapy.[26]

Employees found to be TST skin test negative at the time they are hired require follow-up testing at regular intervals. Each year, all employees should undergo one-step TST skin testing. TST skin testing should also be performed in order to identify the chronology of skin test conversions whenever there is an indication. Unprotected exposure to a prisoner with known TB disease, for example (such as what happened at the Altus PD and jail) would be a valid reason for performing TST skin testing of employees in between scheduled regular dates of testing.

Ventilation

NIOSH investigators found that within the Altus PD/courthouse complex, air being supplied by mechanical ventilation flowed into the corridors and was eventually drawn into a return vent. In the corridors, dispersion of air was aided by local pressure and thermal gradients and by the movement of people. Air initially circulated by one ventilation system could be drawn into another ventilation system's return vent. Since air was not being mechanically exhausted from the building, the potential existed for air from any location in the facility to mix with air in adjacent areas and spread throughout the facility. This included all the areas where inmates would spend time while in custody (such as the booking room, the cellblock, and the courtroom). Given the design and operation of the ventilation system in place at the time of this HHE, therefore, there were no areas within the building that would have provided adequate isolation from (or for) an infectious inmate. Any potentially infectious individuals brought into the PD and jail would need to be transferred to a secure facility with rooms providing adequate respiratory isolation.

In addition to the concern about the possible spread of TB bacteria, there was no outside air being brought into the building and no portion of the ventilation being exhausted outside the building, including air from the restrooms. If outdoor air had comprised approximately 25 percent of the mixed supply air, the existing flow rates of ventilation to the individual rooms would have provided adequate outdoor air to

most of the rooms, based on typical occupancy. A few rooms may require an increased supply flow rate, but this can be accomplished by analysis, design, and rebalancing during modification to provide outdoor air to each of the ventilation system air handlers.

CONCLUSIONS

An inmate with active tuberculosis disease was housed in the Altus city jail from June 4 to June 25, 2001. Despite having symptoms of active TB disease (including a productive cough), this individual was not suspected to have TB and was not properly isolated from the Altus PD and jail workforce. This may be attributable to the lack of a TB control plan at the City of Altus PD and jail. It was not until after his release from jail that a diagnosis of active TB in the index case was made.

A TST screening program begun in August 2001 identified 22 Altus PD and jail employees who were skin test positive. One employee was determined to have a work-related case of active TB. Seven of the 22 Altus PD and jail employees represented documented TST conversions. TST data were insufficient for the remaining 15 to accurately determine when the affected persons became infected with *M. tuberculosis*. Despite the inadequate database, however, we conclude that personnel having direct contact with the index case were at a higher risk of infection from *M. tuberculosis* (and thus having a positive TST) than were those who had indirect contact. Among employees who did not have direct contact with the index case, we did not identify any TST converters, although 2 individuals were identified as having TB infection during the post-exposure screening conducted by the JCHD.

While it is possible that the one employee of the Altus PD and jail identified as having active TB disease could have represented a source for infection to co-workers, we believe that this is unlikely. This person did provide a history of a "productive cough" for approximately 2 weeks prior to having a positive TST and a screening chest x-ray. This finding is mitigated by the fact that none of the three sputum samples collected from this individual were positive for acid-fast bacilli (mycobacteria species), including the sample from which *M. tuberculosis* was eventually isolated. In addition, JCHD records revealed that all of this individual's immediate family members underwent tuberculin skin testing; none were TST positive.

Because of defects identified in the ventilation of the building, therefore, we conclude that employees not having direct contact with the index case between June 4, 2001, and June 25, 2001, could have been exposed to airborne TB bacteria. An inmate with infectious TB questioned and processed in the booking room, housed in the cellblock, and led through the corridors of the Altus PD and jail between the cellblock to the Municipal Court, could have exhaled *M. tuberculosis* bacteria in the form of droplet nuclei that could have dispersed throughout the facility for hours, and spread by the ventilation systems before settling out of the air or impacting on a surface. Due to the absence of mechanical exhaust to the outside, *M. tuberculosis* in the building's air would be eliminated slowly.

RECOMMENDATIONS

The Altus PD and jail should follow the recommendations provided in the CDC document: *Controlling TB in Correctional Facilities*.[29] This monograph represents the most current published guidance from CDC on the subject of establishing TB control programs for both inmates and staff of correctional facilities. The recommendations included in the CDC monograph are predicated on the concept that the best way to stop transmission of TB is through (a) early recognition of persons with active TB disease; (b) isolation of persons who have infectious TB; and (c) initiation of effective TB therapy immediately upon recognition of disease. Provided the patient follows the appropriate prescribed therapeutic regimen, infectiousness rapidly declines.[29] Selected

portions of the CDC document are outlined below.

TB Control Plan

Screening

1. Promptly identify persons who have confirmed or suspected TB disease and report all confirmed or suspected TB cases among prisoners to the county health department for potential isolation and further medical management.

2. Screen staff and long-term inmates for TB infection.
   a. TB screening of correctional facility staff
      i. Obtain a medical history upon hiring
      ii. Skin test all staff, including those with prior BCG (Bacille Calmette-Guérin) vaccination (a vaccination against tuberculosis used in countries outside the United States). Skin tests should be read by a health care provider and the millimeters of induration (even if zero) must be documented in the staff member's medical file.
      iii. Use two-step testing initially when indicated
      iv. Inform all staff of the increased risk of TB among persons with a compromised immune system (e.g. people with cancer, HIV disease, etc.)
      v. Anyone with a previously documented positive TST skin test result should not have a skin test but should instead undergo baseline chest radiography.
      vi. Medical follow-up should be recommended and prophylactic antibiotics should be offered to newly identified skin test converters.
   b. Follow-up screening
      i. Repeat skin testing on an annual basis for all correctional facility staff who have had negative TST results
      ii. Analyze skin test data periodically and investigate further if evidence suggests transmission
      iii. Evaluate symptoms annually for all persons with TB infection who have not completed a course of therapy.
   c. Following unprotected exposure to a person with known TB disease
      i. Perform skin testing for all correctional facility staff who have had historically negative TST results
      ii. Perform chest radiography in all new skin test converters to rule out active disease
      iii. Offer prophylactic antibiotics to treat new skin test converters
      iv. Perform chest radiography in all correctional facility staff who have had historically positive TST results to rule out active disease
      v. Assess level of risk for new infection and offer prophylactic antibiotics to staff who have historically positive TST but a high likelihood of exposure based on risk assessment

3. In a correctional facility that serves a low risk population that is generally incarcerated for only a short period of time, establish a written TB control program to:
   a. Assess the risk of TB infection and disease within facility on an annual basis.
   b. If the facility and/or community being served is characterized by each of the following factors, then more extensive screening may not be indicated:
      i. Minimal risk of TB disease
      ii. No drug-resistant TB disease
      iii. Low prevalence of HIV infection

Containment

1. Promptly isolate all persons suspected of having infectious TB (that is, TB disease).
   a. Place persons with suspected or confirmed TB in a room that meets

recommended standards for an airborne infection isolation room.[35] Criteria for an airborne infection isolation room include requirements for:

i. Greater than or equal to 6 air changes per hour for existing facilities or greater than or equal to12 air changes per hour for new or renovated facilities
ii. Direct exhaust to the outside
iii. Negative pressure with respect to surrounding area

b. Until an area within the Altus PD and jail is identified that may be used safely and reliably as an isolation room, any potentially TB-infected inmates should be immediately transported to an appropriate medical or correctional facility where they can be placed in isolation, and should be required to wear a surgical mask that covers their mouth and nose while in the Altus jail and during transport to the isolation room.
c. Persons should remain in isolation until they are determined not to have TB disease or are no longer infectious

2. Treat all inmates having TB disease with an appropriate drug regimen, using Directly Observed Therapy (DOT)

3. Offer preventive therapy to those inmates who are identified as being TST skin test positive (that is, TB infected) when it is medically indicated and appropriate to do so

4. Respirators should be worn by medical or security staff who:
   a. Care for infectious TB patients in isolation rooms
   b. Are present during cough-inducing procedures
   c. Transport infectious TB patients in a closed vehicle

5. Employees who wear respirators must be enrolled in a formal respiratory protection program that meets the OSHA Respiratory Protection Standard 29 CFR 1910.134.

Assessment

1. Maintain up-to-date, organized records for risk assessment and program review

2. Evaluate skin test data periodically for evidence of disease transmission

3. Assess whether staff have completed therapy and/or preventive therapy

4. Evaluate the success of referrals to the local county health department

5. Specific duties of the correctional facility:
   a. Carry out TB control activities within the facility according to current guidelines
   b. Develop formal agreements with the local county health department for help with:
      i. Contact investigations
      ii. Follow-up with and continuation of treatment for inmates who are released from jail before completion of their therapy
   c. Collaborate and consult with the local county health department for annual training and education

6. Specific duties of the local county Health Department
   a. Designate a specific person within the Health Department whose job it is to coordinate with and serve as the contact person for the correctional facility
   b. Assist the correctional facility in developing, implementing, and updating the following:
      i. TB control policies and procedures
      ii. Training and educational programs
      iii. Tracking and patient record systems
      iv. HIV prevention programs

Ventilation System Renovation

1. Renovate the ventilation systems by adding appropriately located air intake and exhaust. The renovation should include an assessment of heating and cooling loads and maximum occupancy to determine the

proper supply flow rates for the offices and other rooms in the building.

2. Properly reinstall the smoke evacuation system fan as per manufacturer's specifications. When properly installed the system is designed to draw air through the motorized relief damper and to exhaust smoke from the jail cellblock through the attic and outside the building. This is an important health and safety issue.

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Table 1. Criteria for tuberculin positivity, by risk group

MMWR Recommendations and Reports [2000]. Targeted Tuberculin Testing and Treatment of Latent Tuberculosis Infection. 49(RR-6).

Reaction ≥5 mm of induration	Reaction 10 mm of induration	Reaction ≥15 mm of induration
Human immunodeficiency virus (HIV)-positive persons	Recent immigrants (i.e., within the last 5 yr) from high prevalence countries	Persons with no risk factors for TB
Recent contacts of tuberculosis (TB) case patients	Injection drug users	
Fibrotic changes on chest radiograph consistent with prior TB	Residents and employees† of the following high-risk congregate settings: prisons and jails, nursing homes and other long-term facilities for the elderly, hospitals and other health care facilities, residential facilities for patients with acquired immunodeficiency syndrome (AIDS), and homeless shelters	
Patients with organ transplants and other immunosuppressed patients (receiving the equivalent of 15 mg/d of prednisone for 1 mo or more)*	Mycobacteriology laboratory personnel	
	Persons with the following clinical conditions that place them at high risk: silicosis, diabetes mellitus, chronic renal failure, some hematologic disorders (e.g., leukemias and lymphomas), other specific malignancies (e.g., carcinoma of the head or neck and lung), weight loss of ≥10% of ideal body weight, gastrectomy, and jejunoileal bypass	
	Children younger than 4 yr of age or infants, children, and adolescents exposed to adults at high-risk	

* Risk of TB in patients treated with corticosteroids increases with higher dose and longer duration.

† For persons who are otherwise at low risk and are tested at the start of employment, a reaction of ≥15 mm induration is considered positive.

SOURCE: Adapted from Centers for Disease Control and Prevention. Screening for tuberculosis and tuberculosis infection in high-risk populations: recommendations of the Advisory Council for the Elimination of Tuberculosis. MMWR 1995;44(No. RR-11):19–34.

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