



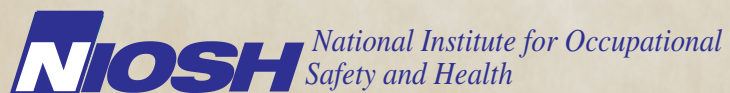
Evaluation of Tuberculin Skin Test Conversions at a Mississippi Fire Department

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Health Hazard Evaluation Report
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Meridian, Mississippi
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DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention



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ABBREVIATIONS

BCG	Bacillus Calmette-Guerin
CDC	Centers for Disease Control and Prevention
EMS	Emergency medical services
HHE	Health hazard evaluation
LTBI	Latent tuberculosis infection
mm	Millimeter
NAICS	North American Industry Classification System
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
TB	Tuberculosis
TST	Tuberculin skin test

HIGHLIGHTS OF THE NIOSH HEALTH HAZARD EVALUATION

The National Institute for Occupational Safety and Health (NIOSH) received a management request for a health hazard evaluation (HHE) at the Meridian Fire Department in Meridian, Mississippi. The Fire Chief submitted the HHE request because 12 firefighters tested positive for latent tuberculosis infection on their tuberculin skin tests (TST) from 2005–2006. NIOSH investigators conducted an investigation in October and December 2006.

What NIOSH Did

- We talked with firefighters about their risk factors for tuberculosis infection.
- We interviewed management, union officials, district health officials, and medical staff at a local hospital that provides the Department's medical exams.
- We did blood tests for tuberculosis infection on the 12 firefighters with positive skin tests.
- We repeated skin tests on 10 firefighters with a different brand of tuberculin solution.

What NIOSH Found

- All 12 firefighter's blood tests were negative for tuberculosis infection.
- Firefighter risk for tuberculosis infection was low according to Centers for Disease Control and Prevention (CDC) guidelines.
- The local hospital's tuberculosis testing program did not follow CDC guidelines.
- Many firefighters missed appointments for skin test result reading, which contributed to program discrepancies.

What Meridian Fire Department Management Can Do

- Ensure trainees and new employees receive two-step tuberculosis skin testing or QuantiFERON®-TB Gold blood testing when hired.
- Continue to provide training on tuberculosis and other infectious diseases to firefighters.
- Continue to provide N95 respirators for firefighter use and provide training and fit-testing for all firefighters.

What Meridian Firefighters Can Do

- Know the signs and symptoms of tuberculosis infection, and wear N95 respiratory protection on EMS calls when indicated.
- Attend scheduled medical appointments to prevent increased costs associated with re-scheduling and to prevent getting more tuberculosis skin tests than necessary.
- Report exposures to people with potential tuberculosis infection to your supervisors.

Firefighters were not infected with *Mycobacterium tuberculosis*. Discrepancies in TB testing procedures led to false-positive results.

In October 2006, NIOSH received a management request for an HHE at the City of Meridian Fire Department in Meridian, Mississippi. The Fire Chief submitted the HHE request because 12 firefighters tested positive for latent tuberculosis infection from 2005–2006. On October 24–26, 2006, NIOSH medical investigators conducted a site visit. We held an opening conference with management and union representatives to discuss the HHE request. We conducted employee interviews and collected blood samples for TB testing. Individuals were mailed their blood test results on October 31, 2006.

A follow-up site visit was conducted on December 11–13, 2006. NIOSH medical investigators, in conjunction with State of Mississippi District 6 Tuberculosis Program staff, conducted follow-up TSTs for participants to determine their eligibility for future TST as part of their medical surveillance program and to help confirm the results of our investigation. Individuals were verbally notified of their test results at the time of TST interpretation, and written results were mailed to participants on December 15, 2006.

Interviews with Fire Department management, firefighters, District 6 Tuberculosis Program personnel; and an evaluation of the department's EMS procedures (no patient transport) found the department to be at low risk for TB, using CDC guidelines.

All twelve participants' blood samples were tested for evidence of TB infection using QuantiFERON®-TB Gold methodology; all twelve samples tested negative, indicating that these firefighters were not infected with *Mycobacterium tuberculosis*.

We found discrepancies in the TB screening program at the hospital that administered the Fire Department's occupational medical screening program, when compared to CDC recommendations. These discrepancies led to the false-positive TST results that were confirmed by the blood test and subsequent follow-up TST performed in December 2006.

We recommend two options concerning future tuberculosis screening for Meridian Fire Department firefighters. If management decides to continue annual tuberculosis screening, it should be conducted following CDC guidelines. If management decides to conduct an annual TB risk assessment for department

SUMMARY (CONTINUED)

firefighters to determine testing frequency, this assessment should be conducted with the assistance and close cooperation of the State of Mississippi District 6 Tuberculosis Program staff.

Management and union officials should emphasize the importance of attending all medical appointments, continue periodic refresher training on tuberculosis and bloodborne pathogens, and incorporate N95 respirator training and fit-testing into their respiratory protection program.

Keywords: NAICS 922160 (Fire Protection), firefighters, tuberculosis, tuberculin skin test, emergency medical services, healthcare workers

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INTRODUCTION

In October 2006, NIOSH received a management request for a HHE from the Fire Chief at the City of Meridian Fire Department in Meridian, Mississippi. This request was prompted by the finding that nine firefighters tested positive (≥ 10 mm induration) on TST during routine physical exams in the summer of 2006. Additionally, three firefighters tested in 2005 had positive TSTs. Before 2005, testing was conducted sporadically among limited numbers of firefighters with no positive results. An investigation was conducted by the State of Mississippi Department of Health District 6 Tuberculosis Program personnel. No firefighters were diagnosed with active tuberculosis disease; however, they were considered to have LTBI and evaluated for drug therapy. Their investigation did not identify a source of exposure to a known active tuberculosis case.

The City of Meridian Fire Department is located in Meridian, Mississippi (population 40,000), in Lauderdale County in the east-central part of the state. The fire department consists of seven stations and has approximately 104 firefighters. Personnel are divided among three shifts (A, B, and C shifts). Each shift is typically on duty for 24 hours, and off duty for 48 hours. In addition to fire suppression duties, the firefighters respond to EMS calls. Firefighters do not transport patients; all patient transport is provided by private ambulance services. Approximately 80% of calls involve EMS duties; in 2004, the Department responded to 3,000 total calls for assistance.

On October 24–26, 2006, NIOSH medical investigators conducted a site visit. We held an opening conference with management and union representatives to discuss the HHE request. We conducted employee interviews and collected blood samples for TB testing. Individual blood test results were mailed to participants on October 31, 2006.

A follow-up site visit was conducted on December 11–13, 2006. NIOSH medical investigators, in conjunction with District 6 Tuberculosis Program staff, conducted follow-up TST for participants. Participants were verbally notified of their test results at the time of TST interpretation, and written results were mailed to participants on December 15, 2006.

Interviews conducted among the 12 firefighters with positive TSTs covered employment, medical, and travel history; place of birth; hobbies; and potential association with specific groups considered at increased risk for tuberculosis infection, such as those found at homeless shelters and prisons. Additionally, we asked questions about historical exposure to a known or suspected case of active tuberculosis, including both occupational and non-occupational exposure. After obtaining written informed consent, blood samples were collected in green-top lithium heparin tubes for testing at a contract laboratory utilizing QuantiFERON®-TB Gold, an enzyme-linked immunosorbent assay test more specific for *Mycobacterium tuberculosis* diagnosis [CDC 2005a]. Blood samples were delivered to the contract laboratory in a neighboring state by NIOSH personnel to ensure adherence to the 12-hour time requirement from blood draw to sample processing as required in the QuantiFERON®-TB Gold package insert [Cellestis 2007]. NIOSH investigators interviewed medical personnel at a local hospital that administers the fire department's medical surveillance program. We reviewed TST historical records for all 104 firefighters, and evaluated TST program procedures performed by hospital staff.

We also met with State of Mississippi Department of Health District 6 Tuberculosis Program personnel to discuss the results of their investigation and to learn about the incidence and prevalence of tuberculosis in Meridian, Lauderdale County, and the state. Officials at the Mississippi Department of Health in Jackson were consulted for background information on tuberculosis in Mississippi and testing and treatment policies at the state level.

Based on the results obtained from our initial investigation, we conducted a second site visit in order to conduct TST among available participants, utilizing tuberculin from a different manufacturer than was used in 2006 by the contract hospital. These tests were administered by a District 6 health department nurse in charge of the tuberculosis program, and results were read and documented 48–72 hours after placement. This testing was conducted to determine the eligibility of firefighters for inclusion in future departmental tuberculosis testing programs and to help confirm the findings of our investigation.

RESULTS AND DISCUSSION

We interviewed 12 firefighters who had a positive TST. Length of employment at the fire department ranged from 1.5 to 20 years, with a median length of 7 years. Participants had worked for varying periods of time in several of the department's seven fire stations; no common work pattern was found. Firefighters with a positive TST were found on all shifts (A-6, B-3, and C-3). Eleven of twelve participants were born in Mississippi; one participant was born in Louisiana. A history of foreign travel was reported by 6 of 12 participants; travel was associated with military service or vacations in 5 of 6 participants; travel had either occurred years in the past or involved limited contact with local populations in most cases. Although 6 of 12 participants reported either past or current employment involving EMS work at other locations, such as volunteer fire departments, none reported involvement in patient transport in other than rare occasions. In summary, no common source or risk factors for exposure to an individual with active tuberculosis were found.

All 12 participants consented to having a blood sample collected, and these samples were tested using QuantiFERON®-TB Gold methodology. All twelve samples tested negative, indicating that these firefighters were not infected with *Mycobacterium tuberculosis*.

Based on these initial results we conducted a follow-up site visit on December 11-13, 2006. NIOSH medical investigators, in conjunction with District 6 Tuberculosis Program staff, conducted follow-up TST for participants, using Tubersol® tuberculin. Out of the original 12 participants, 10 were available for this subsequent testing: 9 of 10 tested negative. One individual tested positive with a result of 14 mm induration. This individual's result was likely due to past exposure to a non-tuberculosis species of mycobacteria, commonly found in the Southeastern United States, and not detected by QuantiFERON®-TB Gold testing. We recommended this individual be deferred from future TST, following CDC guidelines [CDC 2005b]. Individuals who test positive on TST will likely also be positive if tested in the future, and may have a serious reaction to TST or inappropriately be diagnosed as newly infected and placed on drug therapy. We recommended the other nine people could be included in future routine employee screening using Tubersol® brand tuberculin or other FDA-approved tests such as QuantiFERON®-TB Gold.

RESULTS AND DISCUSSION

(CONTINUED)

NIOSH investigators evaluated the fire department's occupational health and medical screening program at the local hospital. All prior TST records were reviewed for the 104 firefighters in the department. This hospital had provided medical screening services for the department for approximately 8 years. We reviewed past TST records and found no consistent TST program. Prior to 2005, testing involved only a few firefighters per year and two-step TST was not employed in accordance with CDC recommendations [CDC 2005c]. In 2005, at the recommendation of the occupational medicine staff at the hospital, the department decided to implement tuberculosis screening following the NFPA "Standard on Comprehensive Occupational Medical Programs for Fire Departments" also known as NFPA 1582 [NFPA 2007]. This document recommends tuberculosis screening annually or more frequently, according to CDC guidelines. Two-step TSTs were implemented for 33 firefighters on B shift; three were positive according to the State of Mississippi guidelines, which use ≥ 10 mm induration at the upper cut-off level for most populations. These individuals were evaluated for active disease and prophylactic therapy. In 2006, 101 eligible firefighters were tested, with two-step TST administered to A and C shifts. An additional nine firefighters were identified with induration ≥ 10 mm and medically evaluated by District 6 Tuberculosis Program personnel.

The record review and interviews with hospital staff found several discrepancies with program administration, when compared to current CDC recommendations [CDC 2005b]. These are summarized below:

- Two-step testing was not administered in accordance with CDC guidelines, which require interpreting TST results 48–72 hours after test placement. Results were not read for the first TST for up to 3 weeks after placement in some individuals due in part to poor compliance in keeping appointments. Another contributing factor was the 2005 State of Mississippi Tuberculosis Skin Testing Certification course materials, which allow for an alternate schedule of reading the first TST one week after placement, then immediately placing the second TST with interpretation of results of this second test in 48–72 hours [Mississippi 2005]. In October 2006, conversations with State of Mississippi public health officials clarified that this alternate schedule is intended primarily for nursing homes and home health care where costs are a concern and was not

RESULTS AND DISCUSSION

(CONTINUED)

intended to be utilized for routine TST screening programs for populations such as healthcare workers or firefighters [Quilter 2006]. This is not stated in the course materials and should be clarified to avoid confusion. Given the long delay in interpretation of the first TST results, it is not known whether individuals who subsequently test positive on a second TST 2-3 weeks later have recent exposure, or a “boosted” response.

- TST induration was read along the vertical axis of the forearm, instead of along the horizontal axis, as recommended in CDC guidance [CDC 2005b]. Consistently reading TST along the horizontal axis improves standardization of results from one test interpreter to the next.
- Compliance with follow-up appointments was an issue among firefighters, and is a common problem in TST screening programs. Missed appointments result in increased costs for the hospital and fire department, and lead to the administration of multiple TSTs, which may sensitize the patient to the purified protein in the test and cause false-positive results over time.
- Two PPD preparations are available in the United States: Tubersol® (Connaught Laboratories Limited, Toronto, Canada) [Connaught Laboratory 2007] and APLISOL® (Parkdale Pharmaceuticals, Rochester, Michigan) [Parkdale Pharmaceuticals 2004]. The hospital had traditionally used Tubersol®, and in February 2006 purchasing agents in the hospital pharmacy switched to APLISOL® without informing the staff who administered the TSTs. CDC guidelines recommend that TB screening programs should use one antigen consistently and should realize that changes in products might make serial changes in TST results difficult to interpret. In one report, changes in product use resulted in a cluster of pseudoconversions erroneously indicated as a healthcare-associated outbreak [Blumberg 2000].

CONCLUSIONS

Based on our investigation, we concluded that none of the 12 firefighters had LTBI, and their initial TSTs were false-positives. Discrepancies in the contract hospital’s TST program and changes in brand of tuberculin used led to these false-positive results.

RECOMMENDATIONS

The Meridian Fire Department has two options concerning future tuberculosis screening for its firefighters. The advantages and disadvantages of both approaches are outlined here.

Option One: Continue Annual Tuberculosis Screening.

- In order to comply with NFPA 1582 “Standard on Comprehensive Occupational Medical Programs for Fire Departments,” the Meridian Fire Department could continue with annual firefighter tuberculosis screening. This includes baseline tuberculosis screening at the time of employment (either two-step TST using Tubersol® or QuantiFERON®-TB Gold when available) and TST every 12 months for all firefighters. Advantages of this approach include a higher likelihood of identifying a firefighter with LTBI or active tuberculosis earlier in the course of their infection so they can be medically evaluated. Another advantage is this option is easier to implement and maintain, because fire department management does not have to conduct an annual TB risk assessment to determine testing frequency as outlined in option two below. Disadvantages include the greater potential for false-positive TST results, unnecessary drug therapy for LTBI for firefighters, and increased cost to the department in fees for tuberculosis screening and missed duty time for test placement and interpretation.

Option Two: Conduct Annual TB Risk Assessment for Department Firefighters to Determine Testing Frequency.

- Based on current CDC guidelines and the TB risk assessment we conducted during our site visit, the Meridian Fire Department at this time is classified as low risk for TB transmission. For EMS workers classified as low risk, CDC recommends baseline tuberculosis screening at the time of employment (either two-step TST using Tubersol® or QuantiFERON®-TB Gold when available) and deferring annual firefighter TST unless the risk assessment profile changes or a known exposure occurs. If this approach is adopted, fire department management should conduct its own annual tuberculosis risk assessment. This would necessitate close communication with State of Mississippi District 6 Tuberculosis Program personnel to monitor the incidence of tuberculosis in the community. If job duties changed, such as

RECOMMENDATIONS (CONTINUED)

implementation of ambulance transport by the department or an increase in the number of EMS calls to higher-risk populations such as migrant workers or prisons, the program would need to be re-evaluated. An advantage of this option is less potential for false-positive test results among firefighters, because fewer TSTs will be performed. This in turn will lessen the potential for firefighters to be placed on drug therapy for LTBI, and will result in lower occupational medical surveillance costs for the department. Disadvantages include a greater possibility of not identifying a firefighter who has been exposed to TB, either occupationally or during off-duty activities, in a timely manner. Potential consequences could include the development of contagious tuberculosis disease in a firefighter and potential transmission to coworkers and others.

Regardless of which option is adopted, any tuberculosis testing that occurs should follow CDC guidelines and recommendations. This includes, but is not limited to: (1) administering two-step TST to trainees and/or new hires upon employment, or using QuantiFERON®-TB Gold if available; (2) following established CDC procedures for test administration, administration, and record-keeping; and (3) considering using QuantiFERON®-TB Gold when available due to its advantages previously discussed. CDC guidelines state that using QuantiFERON®-TB Gold is appropriate in all situations where TST has traditionally been used, including employee screening programs.

Fire Department management and union leadership should continue to emphasize the importance of compliance with all medical examinations, tests, and appointments. Such compliance allows the timely recognition of medical problems if they exist, and reduces operating costs for the Department from missed examinations and repeat testing. Additionally, the Department should continue periodic refresher training on tuberculosis and bloodborne pathogens for firefighters. This includes training on the early recognition of patients with potentially communicable diseases such as tuberculosis, so personal protection measures can be implemented on EMS calls. Exposures may be limited by having EMS workers using an N95 respirator or placing a surgical mask on the patient if medically feasible.

Fire Department management should incorporate N95 respirator training and fit-testing into their worksite-specific respiratory protection program, in accordance with OSHA Standard 1910.134 [29 CFR 1910.134].

REFERENCES

Blumberg H, White N, Parrott P, Gordon W, Hunter M, Ray S [2000]. False-positive tuberculin skin test results among health care workers. *JAMA* 283(21):2793.

CDC [2005a]. Guidelines for Using the QuantiFERON-TB Gold Test for Detecting *Mycobacterium tuberculosis* Infection. *MMWR* 54(15):49-55.

CDC [2005b]. Guide for primary health care providers: targeted tuberculin testing and treatment of latent tuberculosis infection. Atlanta, GA: Department of Health and Human Services, U.S. Public Health Service, Centers for Disease Control and Prevention.

CDC [2005]. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care Settings. Atlanta, GA: Department of Health and Human Services, U.S. Public Health Service, Centers for Disease Control and Prevention.

CFR. Code of Federal Regulations. Washington DC: U.S. Government Printing Office, Office of the Federal Register.

Cellestis Corporation [2007]. QuantiFERON-TB Gold Package Insert. [http://www.cellestis.com/IRM/Content/gold/Gold_USAPackageInsert.pdf]. Date accessed: February 2007.

Connaught Laboratories Limited [2007]. Tuberculin purified protein derivative (Mantoux) Tubersol® diagnostic antigen. 1755 Steeles Avenue West, Toronto, Ontario, Canada, M2R 3T4.

Mississippi State Department of Health [2005]. Tuberculosis Update and Skin Test Certification Course Notes. Jackson, MS.

NFPA [2007]. NFPA 1582: Standard on comprehensive occupational medical program for fire departments. Quincy MA: National Fire Protection Association.

OSHA [2006]. Respiratory Protection Standard. [http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=12716]. Date accessed: February 2007.

Parkdale Pharmaceuticals [2004]. APLISOL® (Tuberculin purified protein derivative, diluted [stabilized solution]). Diagnostic antigen for intradermal injection only. Rochester, MI: Parkdale Pharmaceuticals.

REFERENCES (CONTINUED)

Quilter S [2006]. Telephone conversation on November 21, 2006, between S. Quilter, Mississippi State Department of Health, and J. Gibbins, Division of Surveillance, Health Evaluations and Field Studies, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, Public Health Service, U.S. Department of Health and Human Services.

TB Infection

Tuberculosis is caused by infection with the bacteria *Mycobacterium tuberculosis*. Initial infection usually goes unnoticed, with no clinical signs or symptoms. Ninety percent of people with this form of infection, also known as latent tuberculosis infection or LTBI, never develop active disease. People with LTBI are not infectious to other people. However, approximately 10% of people with LTBI will develop tuberculosis disease months to years after initial infection. Tuberculosis disease is characterized by clinical symptoms such as fever, fatigue weight loss, and night sweats. People with tuberculosis disease can be infectious to others.

Tuberculin Skin Testing

The goal of TST is to identify people with LTBI for drug therapy or surveillance, before they have the potential to develop tuberculosis disease. TST has historically been used to evaluate the close personal contacts of people with contagious TB (contact investigation), screening of higher-risk groups such as foreign-born immigrants, prisoners, or people with immunosuppression, and groups with higher potential for close exposure to potentially contagious TB cases such as healthcare workers and firefighters. However, patients can have false-positive TST reactions for many reasons, including infection with nontuberculous mycobacteria, previous BCG vaccination, incorrect TST administration and/or test interpretation, and sensitization from prior TST. False-positive TST are more likely to occur in populations where the incidence of tuberculosis is low; therefore, CDC guidelines recommend TST administration for occupational exposure be based on a facility risk assessment. These guidelines can be found in “Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Setting, 2005” [CDC 2005].

NFPA Guidelines

The NFPA 1582 “Standard on Comprehensive Occupational Medical Programs for Fire Departments” mandates annual firefighter TB screening [NFPA 2007]. NFPA considers firefighters, especially those performing EMS response and patient transport, are at increased risk for tuberculosis exposure and potential infection when compared to the general population. NFPA Standards are consensus-based guidelines that are intended to provide guidance and recommendations; NFPA has no legal authority to enforce compliance with any NFPA codes, standards, recommendations, or guides that it publishes [NFPA 2007].

QuantiFERON®-TB Gold

An alternative to TST, QuantiFERON®-TB Gold was approved by the FDA in 2005, and is manufactured and marketed by Cellestis. It is an enzyme-linked immunosorbent assay that is more specific for the diagnosis of tuberculosis than TST. This means that QuantiFERON®-TB Gold will have fewer false-positive reactions when compared to TST, especially in populations with a low incidence of tuberculosis. Advantages of QuantiFERON®-TB Gold include: (1) the test is not affected by prior BCG vaccination; (2) it excludes most, but not all non-TB mycobacteria species; (3) results can be available in 24 hours; (4) it requires a single patient visit to draw blood, improving patient compliance, especially if blood is already

APPENDIX: EVALUATION CRITERIA (CONTINUED)

being collected for other required medical tests as part of an occupational health surveillance program; (5) two-step testing is not necessary–booster effect does not occur; (6) it does not boost responses measured by subsequent testing; and (7) it avoids potential errors in interpretation seen with TST.

These advantages mean that fewer false-positive results should be seen when QuantiFERON®-TB Gold is used, as compared to TST. This will save on medical costs from evaluating patients for active tuberculosis infection (interviews, chest x-rays, blood work) drug costs for the treatment of LTBI, and missed work for medical follow-up appointments. More importantly, fewer false-positive results help avoid the psychological effects and worry about being infected with tuberculosis.

Some disadvantages of QuantiFERON®-TB Gold are: (1) blood samples, once collected, must be processed by a qualified laboratory within 12 hours; (2) because the test is relatively new, laboratory availability is limited in some parts of the country; (3) the test is sensitive to the type of blood collection used; (4) in general, cost of the test itself is higher than TST, however, this cost is likely offset by the fact that only one visit is required, which results in less missed work; and (5) data is limited in children under 17 and in immunosuppressed populations.

Additional disadvantages, also seen with TST, include: (1) does not differentiate between LTBI and active disease; (2) negative results do not exclude *Mycobacterium tuberculosis* infection (false-negative reactions); (3) medical evaluation is still needed if test is negative but the patient has signs or symptoms suggestive of tuberculosis infection; and (4) sensitivity is likely less in immunocompromised patients.

References

CDC [2005]. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care Settings. Atlanta, GA: Department of Health and Human Services, U.S. Public Health Service, Centers for Disease Control and Prevention.

NFPA [2007]. NFPA 1582: Standard on comprehensive occupational medical program for fire departments. Quincy MA: National Fire Protection Association.

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ACKNOWLEDGEMENTS AND AVAILABILITY OF REPORT

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