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### **SUMMARY**

In April 1993 the National Institute for Occupational Safety and Health (NIOSH) received a request for a Health Hazard Evaluation (HHE) from a representative of the Communication Workers of America, District 1. The request concerned the potential risk of tuberculosis transmission to employees of the Essex County Division of Welfare. The request asked NIOSH to determine: (a) whether employees can reasonably anticipate risk of exposure to tuberculosis, and (b) what engineering and administrative controls should be recommended for social service settings. We were asked to consider three locations in Newark, NJ: the Food Stamp Office (1015 Broad Street), the Investigation Unit (1004 Broad Street), and the Downtown Service Center (1006 Broad Street). In response to this request, NIOSH representatives conducted a site visit on August 31-September 1, 1993. Because of plans to move employees of the Investigation Unit and the Downtown Service Center, the environmental assessment focused on the Food Stamp Office. Employee interviews were conducted at all three sites.

The environmental evaluation included an inspection of the ventilation systems serving the FSO and measurement of carbon dioxide concentrations at various times throughout the day. The visual inspection of the eight air handling units serving the FSO revealed deficiencies in filtration and access to mechanical equipment. The carbon dioxide concentrations ranged from 400 to 1875 parts per million (ppm), with all afternoon measurements exceeding the 1000 ppm guideline recommended by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). This indicates that the air handling units were not supplying sufficient outdoor air (for dilution ventilation) on the day of measurement.

The medical evaluation included confidential interviews with 18 workers, including Family Service Workers, Investigators, and clerical staff, and a review of the methods and results of a voluntary tuberculosis screening offered in August 1992. Overall, the interviewed employees were knowledgeable about some aspects of tuberculosis, but were unaware of all the signs and symptoms of active tuberculosis, and were uninformed about the usefulness and interpretation of tuberculin skin testing. Contact with clients with AIDS was of greater concern to many employees than was the potential for exposure to tuberculosis. Comments about the previous one-time screening made by both participants and nonparticipants concerned confidentiality, cleanliness of the test site, scheduling difficulties, and fear of needles. Eighty-seven employees at the three sites investigated by NIOSH participated in the screening. Twenty-one (24%) of the tested employees had a reaction size of at least 10 millimeters. Because the 87 employees represent only 28 percent of the staff, the results of this screening effort may not represent the actual prevalence of tuberculous infection. Furthermore, a one-time screening cannot be used to assess the extent of work-related risk of tuberculosis among Division of Welfare employees.

Essex County Division of Welfare employees may have an added risk of tuberculous infection because clients served by the Division are considered a high risk group for developing active tuberculosis (all are low income, many are medically underserved, and many are homeless). The client population is drawn from the Essex County area, which includes Newark, a city with one of the highest case rates for active tuberculosis in the nation. In the Food Stamp Office, the building's ventilation system did not meet current recommendations for office ventilation because it did not supply a sufficient quantity of outdoor air to dilute potential air contaminants. Because the client population is considered a high risk group for developing active tuberculosis, efforts should be made to provide as much outside air as is possible to dilute TB-containing droplet nuclei, if present. Recommendations for an employee tuberculosis education and screening program for Division of Welfare employees, and for improvements to the ventilation system in the Food Stamp Office are provided.

**KEYWORDS:** SIC 9441 (Administration of Social, Human Resource and Income Maintenance Programs) *Mycobacterium tuberculosis*, tuberculosis, TB, social service, welfare, indoor air quality, indoor environmental quality.

## **INTRODUCTION**

In April 1993, the National Institute for Occupational Safety and Health (NIOSH) received a request for a Health Hazard Evaluation (HHE) from a representative of the Communication Workers of America, District 1. The request concerned the potential risk of tuberculosis transmission to employees of the Essex County Division of Welfare. The request asked NIOSH to determine: (a) whether employees can reasonably anticipate risk of exposure to tuberculosis, and (b) what engineering and administrative controls should be recommended for social service settings. NIOSH was asked to consider three locations in Newark, NJ: the Food Stamp Office (1015 Broad Street), the Investigation Unit (1004 Broad Street), and the Downtown Service Center (1006 Broad Street). In response to this request, NIOSH representatives conducted a site visit on August 31-September 1, 1993. Because of plans to move employees of the Investigation Unit and the Downtown Service Center, the environmental assessment focused on the Food Stamp Office. Employee interviews, however, were conducted at all three sites.

## **BACKGROUND**

### ***Client Population***

By definition, clients of the Division of Welfare fall into several of the groups considered to be at high risk of tuberculosis, including the homeless and low income populations. Unemployment, low wage work, or low family income is a requirement for the Division's public assistance programs. The head of the household for 93% of households receiving food stamps is black or hispanic.

In 1992, New Jersey ranked seventh among states in the nation in the rate of active tuberculosis, with a rate of 12.6 cases per 100,000 population. Among cities with a population of 250,000 or greater, Newark ranked second, with a case rate of 68.3 per 100,000.

### ***Facilities and Client Services***

**Downtown Service Center (DSC):** The DSC oversees three welfare programs, including Aid to Families with Dependent Children, Food Stamps, and Supplemental Security Income emergencies, for residents of two areas of Essex County (Irvington and the south part of Newark). The DSC occupies three floors of a 3-story office complex. Clients are restricted to the first floor, which contains a waiting area and office cubicles for client interviews. Staff of the DSC also occupy office space on the third floor.

Approximately 120 employees work in the DSC. Employees with extensive client contact include 72 Family Service Workers (social workers) and their supervisors, three receptionists, one clerical worker who distributes food stamps and welfare checks, and two security guards. Client visitors register with one of the receptionists who sit at the back of the waiting room behind a counter faced with a plexiglass window. Clients typically wait about one hour before being called for their interview. Interviews can last from a few minutes (for clients who are making simple changes in their status, such as change of address) to about an hour (for intake of new clients). Approximately 250-300 client interviews are conducted each day. Most Family Service Workers spend three and one-half days per week in the office and one and one-half days per week in the field visiting clients' homes.

**Investigations Unit (IU):** The IU is responsible for conducting investigations of alleged welfare fraud and abuse. The photo identification (ID) unit is located in the same office as the IU. (For

the remainder of this report, staff of the ID unit will be considered as part of the IU.) Both are located on the third floor of a 3-story office building built approximately 100 years ago.

Approximately 53 employees work in the IU. Employees with extensive client contact include 20 Investigators, two receptionists, three clerical workers who interview clients for IDs, and one security guard. Family Service Workers in the IU also have some client contact, but spend most of their time checking and reviewing records. All clients reach the third floor via one elevator, which is run by an operator employed by the building owner. Client visitors register with one of the receptionists who sit at the front of the waiting area behind a counter faced with a plexiglass window. Clients typically wait one-half hour before being called for the interview and photo. Clerical staff conduct up to 400 interviews for IDs per day, each lasting two to three minutes. These interviews are conducted in 5'x8' partitioned areas. Clients visiting an Investigator are interviewed at the Investigator's desk in an open office area. Investigators typically conduct one or two interviews in the office in the morning and make two or three home visits in the afternoon.

**Food Stamp Office (FSO):** The FSO oversees several programs, including Food Stamps and City of Newark Welfare, for residents of four areas of Essex County (Nutley, Newark, Irvington, and Belleville). The FSO occupies a two-story structure built in the 1940s. The FSO has occupied the building for 15 years. Clients are restricted to the first floor, which contains a waiting area and open office areas. The second floor (mezzanine) houses data entry operations.

Approximately 134 employees work in the FSO. Employees with extensive client contact include 57 Family Service Workers (social workers) who see clients daily, four receptionists, one clerical worker who distributes food stamps and welfare checks, and two security guards. Usually, about 350 clients register each day with one of the receptionists who sit adjacent to the waiting area behind a counter faced with a plexiglass window. For two to three days at the beginning and end of each month, up to 1,000 clients register to collect food stamps. Clients typically wait in line to register and then wait to be called by the Family Service Worker for a new application or recertification interview; waiting times can last 30 minutes to two hours. Family Service Workers conduct five to 10 interviews per day, each lasting 20 to 60 minutes. Interviews are conducted at the Family Service Workers' desks, which are located in an open office area about two to three feet apart from each other.

The FSO is housed in two adjacent buildings (1015 and 1013 Broad Street). There is free access between the two buildings as a result of the many openings in the common dividing wall. A mezzanine level is located above the first floor in the southern building (1015 Broad Street). At the time of our site visit the FSO was served by seven air handling units, all but one of which had provisions for supplying outside air to the serviced areas. There were several different types of units present, including free standing units located in the work area, two units located above the false ceiling, and one roof-top package unit. These air handling units have varied airflow and air conditioning capacity. Heating is provided by a perimeter hot water heating system (no mechanical ventilation) and by reheat coils located in the outside air ducts for the AHUs which supply outside air. Two of the freestanding units serving the front of the building discharge air directly to the work area, other units have a ducted supply of air to the workspace. Results of an indoor air quality survey performed by a contractor in October 1992 indicated problems with thermal comfort and elevated carbon dioxide levels (up to 1600 parts per million), suggesting inadequate ventilation. Over the past few years many ventilation changes have been made in this office to improve air quality,+ including the replacement of two AHUs serving the rear of the facility, the provision of additional outside air (OA) to the office space, the redistribution of the discharged air for the two units serving the front of the building and the waiting area, the addition of supply air ductwork and ceiling diffusers in the rear portion of the building, and the addition of electric reheat coils in the OA ducts to provide conditioned outside air year-round.

## **EVALUATION CRITERIA**

### ***Tuberculosis***

Over 25,000 cases of active tuberculosis are reported annually in the United States.<sup>1</sup> The transmission of tuberculosis is a recognized risk in prisons, homeless shelters, and health care institutions.<sup>2,3,4,5,6</sup> Recent outbreaks in hospitals and a New York state correctional facility have raised concerns over the possibility of further spread among the general population.<sup>7</sup> Several recent outbreaks of tuberculosis involving multidrug-resistant strains of *M. tuberculosis* have heightened concern about transmission of the disease. In addition, active tuberculosis is increasing among persons infected with the human immunodeficiency virus (HIV). Because HIV infection weakens the immune system, persons with HIV infection are at high risk of developing active tuberculosis if infected.<sup>3</sup>

Certain groups are at increased risk for developing tuberculosis. These groups include medically underserved low-income populations, including racial or ethnic minorities (African Americans, Hispanics, and Asians/Pacific Islanders, Native Americans/Alaskan Natives); residents of long-term care facilities, correctional institutions, mental institutions, nursing homes, and other long-term residential facilities; persons living under crowded conditions; alcoholics and intravenous drug users; the homeless; the elderly; foreign-born persons from areas of the world with a high prevalence of tuberculosis; and persons living in the same household as members of these high risk groups.<sup>7,8,9</sup> Workers who have close contact with individuals with unsuspected tuberculosis may have an increased risk of acquiring tuberculous infection, but the extent of the risk is unknown for most work settings.<sup>3,4</sup>

*M. tuberculosis*, a rod-shaped bacterium, is transmitted by airborne droplets generated when persons with pulmonary or laryngeal tuberculosis sneeze, cough, or speak.<sup>3,10</sup> The droplet nuclei are so small (1-5 microns in diameter) that normal air currents keep them airborne and can spread them throughout a room or building. When a susceptible person inhales droplet nuclei, the organisms can lodge in the alveoli of the lungs and spread throughout the body, causing infection. The dose required to initiate infection is not known. Two to ten weeks after the initial infection, the body's immune response usually limits further multiplication and spread of the organisms. However, in approximately 1% of newly infected persons, the initial infection rapidly progresses to active tuberculosis. Another 5 - 10% of those infected will develop active tuberculosis over a period of months, years, or decades. The risk of progression to active disease is markedly increased for persons with HIV infection.<sup>3,11</sup>

Infection with *M. tuberculosis* usually can be identified through tuberculin skin testing. The Mantoux technique, the preferred test, involves intradermal injection of 0.1 milliliters of purified protein derivative [PPD] containing 5 tuberculin units.<sup>3,12</sup> If an individual has been infected with *M. tuberculosis*, preventive drug therapy can greatly reduce the chance of developing active tuberculosis. Questions about the effectiveness and reliability of the tuberculosis vaccine (Bacillus of Calmette and Guerin [BCG] vaccine) have limited its use in the United States.<sup>13</sup>

### ***Tuberculosis Guidelines***

In October 1993, the Occupational Safety and Health Administration (OSHA) issued enforcement guidelines concerning occupational exposure to tuberculosis.<sup>14</sup> The workplaces covered by the OSHA guidelines are those where CDC has identified workers as having a greater incidence of TB infection, including health care settings, correctional institutions, homeless shelters, long-term care facilities for the elderly, and drug treatment centers. The OSHA guidelines require: protocols for early identification of persons with active TB; medical

surveillance of employees; evaluation and management of workers with TB infection or disease; placement of persons with suspected or confirmed TB in isolation rooms; and training of employees on the hazard of TB transmission, signs and symptoms of the disease and procedures for preventing TB transmission. The OSHA guidelines are based on the CDC guidelines published in 1990 entitled, "Guidelines for Preventing the Transmission of Tuberculosis in Health-Care Settings, with Special Focus on HIV-Related Issues".<sup>3</sup> CDC is in the process of revising the 1990 guidelines and has published a draft document for public comment.<sup>15</sup> OSHA has indicated that future compliance directives on TB will be based on the final revision of the CDC guidelines. At the time of this writing, the New Jersey Public Employees Occupational Safety and Health Program was in the process of preparing enforcement guidelines for tuberculosis which will apply to public employees working in high risk settings.

Criteria for evaluating the risk of tuberculosis transmission in office buildings, including social service settings, do not exist. Additionally, effective and practical control techniques for reducing risk or preventing exposures to tuberculosis have not been determined or thoroughly evaluated. Because the control measures discussed below were developed primarily for health care settings, they may not all readily apply to other workplaces. A discussion of these measures is included because it is useful in understanding the range of options available to control tuberculosis transmission.

The following basic approaches have been recommended to reduce the risk of tuberculosis transmission: (1) prevent infectious particles from entering the air by providing rapid identification, isolation, and treatment of persons with active tuberculosis, (2) reduce the number of infectious particles entering the air by containing them at their source and using directional airflow and dilution ventilation, (3) use appropriate respiratory protection in areas where there is still a risk of exposure to M. tuberculosis, such as in patient isolation rooms; and (4) use tuberculin skin test screening to identify persons with tuberculous infection, and provide preventive treatment (or treatment of active TB) when appropriate.

When infectious particles cannot be controlled at their source and they enter room air, ventilation, both local and general, can be used to reduce the concentration of particles. The goal of local exhaust ventilation is to capture and remove the infectious agent from the air before it comes in contact with susceptible individuals. It is most effective when the infection source is at a fixed location (such as when handling laboratory specimens in a lab hood or when performing aerosol generating procedures on a person with active TB in a treatment booth). General ventilation, which provides air flow to larger areas, reduces the concentration of infectious agent and/or moves the infectious agent away from susceptible individuals.

For many years, ventilation has been the primary environmental control method for tuberculosis. Ancillary control measures have included the use of air cleaning techniques such as high efficiency particulate air filtration and germicidal ultraviolet radiation, as well as the use of respiratory protection. All of the control measures discussed above may reduce exposure to tuberculosis; however, there is presently no reliable method for measuring the reduction achieved by each control measure. In addition, none of the control methods used alone or in combination can completely eliminate the risk of tuberculosis transmission.<sup>3</sup>

### ***Ventilation in Office Buildings***

The probability of tuberculosis transmission is affected by the number and infectiousness of persons with active TB, the susceptibility and proximity of uninfected persons, and building ventilation. Ventilation recommendations exist for minimum outside air intake and temperature control in office buildings.<sup>16,17</sup> The American Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE) standard 62-1989, "Ventilation for Acceptable Indoor Air Quality," recommends outdoor air supply rates of 20 cubic feet per minute per person

(CFM/person) for office spaces and conference rooms, 15 CFM/person for reception areas, and 60 CFM/person for smoking lounges.<sup>16</sup> These guidelines were established for comfort and odor control and do not address infectious disease transmission. This is of concern in the control of tuberculosis, because even the most dilute concentration of the infectious agent may present some risk of infection.<sup>18,19</sup>

The state of New Jersey has recently adopted a standard for ventilation in office buildings entitled, "Indoor Air Quality - Standards and Procedures for Buildings Occupied by Public Employees."<sup>20</sup> This standard relates to indoor air quality in existing buildings occupied by public employees, and includes procedures for reporting and responding to complaints of indoor air quality in accordance with the Public Employees Occupational Safety and Health Act (PEOSHA). The ASHRAE standards listed above were adopted as an objective measurement tool for the evaluation and retrofit of buildings or areas within a building that have indoor air quality deficiencies. A formal complaint procedure is established by this standard, with initial complaints being made to the employer. If the condition persists, or if the employer fails to respond to the complaint, the employee may request further action by notifying the Department of Health, for health related complaints, or the Department of Community Affairs (DCA), for building-related problems. The building owner or employer may be required to perform a comprehensive ventilation and temperature evaluation and/or to investigate whether sources of contaminants are present. They may also be required to submit a report of their findings and appropriate corrective actions to the DOH or DCA. The indoor air quality standard also has a requirement for periodic maintenance of heating, ventilating and air-conditioning (HVAC) systems.

The measurement of ventilation and comfort indicators such as carbon dioxide (CO<sub>2</sub>), temperature and relative humidity, has proven useful in providing information relative to the proper functioning and control of ventilation systems in office environments. Carbon dioxide is a normal constituent of exhaled breath and, if monitored, can be used as a screening technique to evaluate whether adequate quantities of outside air are being introduced into an occupied office space. Indoor CO<sub>2</sub> concentrations are normally higher than the generally constant ambient CO<sub>2</sub> concentrations (range 300-400 ppm). The current ASHRAE recommendation of 20 cfm/person of outside air (for most office environments) corresponds to a CO<sub>2</sub> concentration of 1000 ppm. When indoor CO<sub>2</sub> concentrations exceed 1000 ppm in areas where the only known source is exhaled breath, inadequate ventilation is suspected.<sup>21</sup> Elevated CO<sub>2</sub> concentrations suggest that the concentration of other indoor contaminants may also be increased. Building occupants produce water vapor, particulates, biological aerosols, and other contaminants in addition to CO<sub>2</sub>.

The perception of comfort is related to one's metabolic heat production, the transfer of heat to the environment, physiological adjustments, and body temperatures. Heat transfer from the body to the environment is influenced by factors such as temperature, humidity, air movement, personal activities, and clothing. ANSI/ASHRAE Standard 55-1992 specifies temperature and humidity conditions in which 80% or more of the occupants would be expected to find the environment thermally comfortable.<sup>16</sup>

## **METHODS**

### ***Environmental***

The environmental evaluation included walk-through surveys of the Food Stamp Office, the Downtown Service Center and the Investigations Unit. A more in-depth evaluation of the FSO was performed to determine the condition of building ventilation systems. Further on-site evaluation of the DSC and IU offices was not performed by NIOSH because employees were scheduled to move into a new building in the near future. Ventilation plans and specifications for

the new offices were reviewed, along with results of indoor air quality surveys performed by an outside consultant for all three Department of Welfare offices included in this health hazard evaluation.

On September 1, 1993, CO<sub>2</sub> concentrations were measured in the FSO using a Gastech Model RI-411A, portable CO<sub>2</sub> indicator. This portable, battery-operated instrument uses a non-dispersive infrared absorption detector to measure CO<sub>2</sub> in the range of 0-4975 ppm, with a sensitivity of ±25 ppm. Instrument zeroing and calibration were performed prior to use with zero air and a known concentration of CO<sub>2</sub> span gas (800 ppm). Temperature and relative humidity (RH) measurements were made using a Vaisala, Model HM 34, battery-operated meter. This meter is capable of providing direct readings for dry-bulb temperature and RH. Instrument calibration is performed monthly using primary standards.

The air handling units serving the FSO were visually inspected for microbiological growth, particulate filter condition, and presence of standing water.

### *Medical*

Confidential interviews were conducted with workers at all three sites. Using a list of employees and their job titles provided by the Division of Welfare, a random sample of Family Service Workers and Investigators was selected. Additionally, an administrative supervisor at each location was asked to identify the clerical workers who spent the most time with clients. (Usually, these were the receptionists.) The interview included questions about the worker's job, knowledge of tuberculosis, previous tuberculosis testing, and concerns about tuberculosis and other potential work-related health risks. Methods and results of a previous one-time voluntary tuberculosis screening also were reviewed.

## **RESULTS AND DISCUSSION**

### *Environmental*

**FSO:** The results of the CO<sub>2</sub>, temperature, and RH measurements made in the FSO are shown in Table 1. Indoor CO<sub>2</sub> concentrations ranged from 475 to 1875 ppm. All afternoon measurements were at or exceeded the ASHRAE limit of 1000 ppm, indicating that the ventilation system was not providing sufficient outside air to dilute indoor air contaminants, including CO<sub>2</sub>. Early afternoon measurements revealed CO<sub>2</sub> concentrations greater than those taken later in the day. This may reflect the fact that more clients visited the FSO early in the day. A review of two prior indoor air quality reports of this area also revealed a build-up of CO<sub>2</sub> concentrations throughout the day (up to 1600 ppm), indicating inadequate ventilation on the days of measurement.

The indoor temperatures ranged from 71 to 81°F, with the highest temperature measured in the client waiting area. Outside temperatures increased from 77 to 95°F during the measurement period, and RH fell from 92 to 41%. The indoor RH ranged from 43 to 64%. The highest humidity levels were obtained in the waiting areas and front portion of the buildings, where the front doors were frequently opened and closed by clients coming and going. ASHRAE recommends that RH be maintained within a range of 30 to 60%; some of the afternoon measurements exceeded 60%. At RH levels between 50 and 60%, the recommended temperature



range is 73 to 79°F. A few of the measurements fell outside this range. During this evaluation several employees voiced concerns of being too hot or too cold at times, and many personal fans were present in the work area.

The visual inspection of the eight air handling units revealed low-efficiency fiberglass filters, which were clean and in good condition. However, there were gaps in the filter bank of the rooftop AHU. The HVAC contractor indicated that the filters in the front, freestanding units were changed on a monthly basis, while the other filters were changed every three months. Although the two front units had been redesigned to allow outside air to be brought in, the outside air was not filtered before being mixed with the filtered return air. As a result, the front unit on the 1015 side was dirty inside. The drain pans for the two units located above the false ceiling were not accessible for inspection. The remaining condensate drain pans were clean and did not contain visible evidence of microbial contamination. The drain pans are reportedly disinfected on a yearly basis. Although the ductwork had been cleaned in May 1993, many of the diffusers and grilles were dirty, particularly those in the restrooms. The restrooms on the 1015 side had supply and exhaust ventilation, while the restrooms on the 1013 side, including the clients' restroom, had only exhaust ventilation. Odors were detected in those restrooms that did not have a mechanical supply of air to the space. The contractor was not aware of the difference in ventilation of the restrooms, and neither design specifications nor actual airflow rates were available.

In November 1993, the HVAC contractor made further modifications to the ventilation systems serving the FSO. These modifications included a restriction on the amount of return air to the air handlers in order to increase the amount of outside air brought in. Total and supply airflow measurements were then made for the five units which supply outside air. A total of 2883 cubic feet per minute of outside air is reportedly being introduced into this office. Based on the ASHRAE office space ventilation recommendations, a maximum of 144 persons could be accommodated, assuming proper distribution of outside air to occupied spaces. No further indoor air quality studies have been performed since this change.

**DSC and IU:** As of February 1994, employees of the DSC and IU offices were relocated to a multi-story building on Rector Street, in Newark, New Jersey. The building was built in 1926 and renovated in 1960. DSC and IU employees occupy portions of the 6th, 7th, and 8th floors. The office areas were remodeled to accommodate the Division of Welfare employees and its activities. The existing HVAC system, which serves primarily the perimeter space, was supplemented by numerous freestanding HVAC units which serves portions of the interior space. The office layout includes private offices, partitioned areas for client interviews, enclosed reception areas with safety glass panels, and open waiting areas. A specification was made in the lease that the building comply with the New Jersey Indoor Air Quality Standard adopted in 1992. A review of the HVAC plans and discussion with the architect indicated that the HVAC systems were designed to provide a minimum of 140 CFM of outside air per 1000 square feet (ft<sup>2</sup>) of useable office space. This is in accordance with the ASHRAE guideline of 7 persons/1000 ft<sup>2</sup> of floor area and 20 CFM of outside air/person. According to the information provided by the architect, the total amount of outside air provided on these three floors is 5230 CFM. Assuming proper distribution of air and an even distribution of people, approximately 260 persons could be accommodated. However, these figures should be considered only as rough guidelines. Because the number of clients varies tremendously due to heavy activity at the beginning and end of each month, further evaluation would be needed to determine if client interview and waiting areas are adequately ventilated on these "worst case" days.

### *Medical*

**Employee Interviews:** Eighteen employees were interviewed, including five from the FSO, eight from the DSC, and five from the IU. The interviewed employees had worked at their current location an average of 12 years (range: three months - 25 years). Overall, the interviewed employees were knowledgeable about some aspects of tuberculosis, but were unaware of all the signs and symptoms of active tuberculosis, and were uninformed about the usefulness and interpretation of tuberculin skin testing. Contact with clients with AIDS was of greater concern to many employees than was the potential for exposure to tuberculosis. Employees were misinformed about the relative infectiousness and modes of transmission of these diseases; some reported using disinfectants on their work surfaces and supplies (e.g., pens) after interviews with clients they knew or suspected of having either of these conditions. Employees generally did not discuss a client's health status unless it had direct relevance to their need for welfare services. Six interviewed employees participated in the voluntary screening. Comments about the screening made by both participants and nonparticipants concerned confidentiality, cleanliness of the test site, and fear of needles. Several employees reported that they were unavailable for the test because they were away from the office or were too busy to interrupt their work.

**August 1992 Tuberculosis Screening:** The Division of Welfare and the Communications Workers of America co-sponsored a one-time, voluntary tuberculosis screening in August 1992. Arrangements for the screening were made by Essex County Department of Health, and the screening was conducted at the Food Stamp Office by the University of Medicine and Dentistry of New Jersey (UMDNJ). Information about the screening was distributed prior to its scheduled dates. The screening test was offered to all employees; 87 employees of the three sites investigated by NIOSH participated (Food Stamp Office, n=61; Downtown Service Center, n=20; Investigations Unit, n=6). This represents a participation rate of 28 percent, if the number of employees at that time was the same as at the time of our visit. Overall, 21 (24%) of the tested employees had a reaction size of at least 10 millimeters (mm). Individuals with a positive skin test were referred to their personal physician for follow-up. All skin test results were provided to the Division of Welfare.

The results of this screening effort can not be used to assess the extent of work-related risk of tuberculosis among Division of Welfare employees. Perhaps because of inadequate prior education about the potential risk of tuberculosis, and because of concerns about the lack of privacy and confidentiality in the conduct of the test and in the reporting of results, the employee participation rate was low. Summary results for the tested employees may therefore not reflect the prevalence of tuberculosis infection among all Division of Welfare employees. Additionally, without baseline data (i.e., status upon first employment in the Division of Welfare), it is difficult to assess whether a positive test result indicates a possible work-related conversion or a prior infection.

## **CONCLUSIONS**

Essex County Division of Welfare employees at the three sites investigated may have an added risk of tuberculous infection because clients served by the Division are considered a high risk group for developing active tuberculosis (all are low income, many are medically underserved, and many are homeless). The client population is drawn from the Essex County area, which includes Newark, a city with one of the highest case rates for active tuberculosis in the nation. Also, in the Food Stamp Office, the ventilation system did not meet current ASHRAE recommendations for office ventilation. On the day of our evaluation, high carbon dioxide concentrations were measured, indicating that an amount of outside air sufficient to dilute air contaminants was not being supplied. Because the client population is considered a high-risk group for developing active tuberculosis, efforts should be made to provide as much outside air

as is possible to dilute TB-containing droplet nuclei, if present. In the absence of definitive guidelines for the prevention of TB transmission in social service settings, the ASHRAE recommendations for office environments should be used as minimum guidelines.

## **RECOMMENDATIONS**

Early identification and treatment of persons with tuberculosis remains the most effective method of stopping transmission. These medical functions, however, are beyond the control of the Division of Welfare.

The following recommendations were adapted from those published by the Centers for Disease Control and Prevention for employees in health-care settings and correctional institutions.<sup>3,4</sup> These recommendations are specific to the Essex County Division of Welfare and are not necessarily generalizable to other social service agencies in other geographic locations. The high rate of active tuberculosis in the Essex County area necessitates measures that may not be needed in other areas. The precise relationship, however, between the extent of tuberculosis in the community (and thus in the client population) and the risk of transmission to workers in social service agencies is unknown. Data collected through the recommended tuberculosis screening program will help establish the magnitude of this risk, and the need for additional control measures.

1. The Division of Welfare, in consultation with qualified medical or public health personnel, should establish a tuberculosis screening policy and program for employees. Employee representatives should be involved in the development of the policy and program. The program should be offered at no cost to employees.

At the time of employment, Essex County Division of Welfare employees should receive a Mantoux tuberculin skin test unless documentation is provided for: (1) a previously positive reaction, (2) adequate preventive therapy for infection, or (3) adequate treatment for active disease.<sup>3,12</sup> Individuals who have a history of BCG vaccination should receive a tuberculin skin test, even though interpretation of a reaction is more difficult. Employees with a positive tuberculin skin test should be evaluated for active tuberculosis. (More information about administration, interpretation, and follow-up is given below.)

Tuberculin skin test-negative employees should be retested yearly to identify persons whose skin test converts to positive.

Current guidelines for administration and interpretation of tuberculin skin testing should be followed.<sup>10</sup> Key aspects of these guidelines include the following:

- ! Use of a two-step procedure for initial skin-testing. This involves applying an initial skin test and then retesting within 1 to 3 weeks for those initially negative.
- ! Intracutaneous administration of 5 units of purified protein derivative (PPD) tuberculin (Mantoux test) is the best means of detecting infection.
- ! Tests should be read between 48 and 72 hours after injection.
- ! The size of the reaction in millimeters of induration should be recorded for all tests. The definition of a positive test varies from 5 to 15 mm depending on immune status and presence of known risk factors for tuberculosis. The definition of a conversion also varies from an increase of 5 to 15 mm depending on these same factors and age.

Division of Welfare employees with positive tuberculin skin tests, skin test conversions, or symptoms suggestive of tuberculosis should be clinically evaluated for active tuberculosis.<sup>10</sup> Appropriate therapy should be instituted for those with active tuberculosis.<sup>22,23</sup> Division of Welfare employees with positive tuberculin skin tests or with skin test conversions, but without clinical tuberculosis, should be evaluated for preventive therapy according to published guidelines.<sup>8,22</sup>

As part of the medical evaluation following a skin test conversion, a history of possible exposures should be obtained in an attempt to determine the potential source of infection. It may not, however, always be possible to determine the source of infection.

Results of tuberculin skin testing and clinical evaluations should be maintained in confidential employee health records, and should be recorded in a retrievable aggregate data base of all employee test results. Identifying information should be handled confidentially. Only summary data (e.g., the percentage of positive reactions among all tested), as opposed to individual test results, should be provided to the Division.

The rate of skin-test conversions should be calculated periodically so that the risk of acquiring new infection can be estimated and the effectiveness of control measures can be evaluated. On the basis of this analysis, the frequency of retesting may be altered accordingly.

2. An in-service tuberculosis education program should be instituted for Division of Welfare employees. This program should be developed in consultation with qualified medical or public health personnel. The program should initially cover the basic concepts of TB transmission, pathogenesis and diagnosis, signs and symptoms of tuberculosis, proper precautions for minimizing risk of infection and active disease, purpose of testing and interpretation of tuberculin skin test results, principles of preventive therapy for tuberculosis infection and of drug therapy for active disease, and followup procedures for skin test conversions and suspicion of active disease. Additionally, periodic updates should be provided to disseminate new information about tuberculosis and to share summary information about the extent of tuberculosis transmission among Division of Welfare employees. Similar education should be provided in the area of HIV/AIDS.
3. Clients who are frequently coughing should spend a minimum of time in common waiting areas. Disposable tissues should be available in waiting and interview areas, and clients should be encouraged to cover their mouths and noses when coughing or sneezing.
4. The Division of Welfare should evaluate administrative procedures for scheduling of client appointments. Whenever possible, appointments should be spaced out evenly throughout the day and month to reduce overcrowding and minimize the time spent in waiting areas.
5. The Division of Welfare should establish on-going lines of communication with appropriate local health agencies regarding tuberculosis prevention. Possible areas of interaction include: (a) establishing referral mechanisms for Division of Welfare clients who report or present to a Family Service Worker with unexplained persistent cough, persistent fever, or unexplained weight loss; and (b) opportunities for disseminating educational information about tuberculosis to Division of Welfare clients.
6. At a minimum, the ventilation systems for Division of Welfare Offices should meet ASHRAE Standard 62-1989 "Ventilation for Acceptable Indoor Air Quality." A minimum of 20 CFM of outside air per person (including employees and clients) should be provided to all occupied areas. The provision of outside air in quantities exceeding these minimum guidelines may help to further reduce the potential for tuberculosis transmission. A follow-

up indoor air quality survey should be conducted in the FSO to evaluate the effectiveness of the recent change in amount of outside air delivered to this office.

7. Management indicated that they are planning to move FSO employees to an office which can better serve their needs. Aside from providing an adequate amount of outside air, consideration should be given to the layout of the office, as has been done for the space recently occupied by DSC and IU employees. Particular attention should be paid to client interview and waiting areas since the number of people present in these areas increases tremendously on certain days of the month. Ideally, the waiting areas should be separately ventilated with no recirculation of air to other areas of the facility. For areas where there is variable or intermittent occupancy, ASHRAE allows the quantity of outdoor air to be adjusted by use of dampers or by stopping and starting the fan system to provide sufficient dilution ventilation at all times.
8. To improve general air quality, ventilation system deficiencies should be corrected. This includes the following:
  - ! The low-efficiency filters in the air handling units should be replaced with higher-efficiency filters. These filters should be upgraded to the maximum efficiency possible without adversely affecting the ventilation system performance.
  - ! The gaps in the filter bank of the roof-top AHU should be eliminated to prevent bypass of air around the filters.
  - ! Outside air entering the two front AHUs should be filtered before it is delivered to the office space.
  - ! The condensate drain pans for the two units located above the ceiling in the rear of the building should be made accessible for inspection and cleaning.
  - ! Records of ventilation system modifications, preventive maintenance, and repairs should be available on-site, along with current ventilation plans and airflow measurements.
  - ! Because odors were detected in the restrooms on the 1013 side, the restrooms should be further evaluated to determine if they meet ASHRAE recommendations (50 CFM of outside air per water closet or per urinal, with local mechanical exhaust and no recirculation of exhaust air).<sup>16</sup>
  - ! To improve occupant comfort, temperature and humidity should be maintained within the ranges recommended by ASHRAE.<sup>17</sup>
  - ! If workers continue to experience drafts as a result of the discharge of air directly from the two front AHUs, further efforts should be made to redistribute the supply air or to relocate employees.
9. General cleanliness of the restrooms and storage/eating areas should be improved. In addition, several employees expressed concern over the abundance of flies and gnats in the building. Although insects are not involved in the transmission of TB, efforts should be made to identify and eliminate the source of the insects.

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



**TABLE 1**  
**Environmental Measurements**

Food Stamp Office  
HETA 93-0891  
Newark, New Jersey  
September 1, 1993

Location	Time	CO <sub>2</sub> (ppm)	Temp (°F)	RH (%)	Comments
AFOM Office	7:45	700	76	49	sm. private office
	10:45	1875	78	58	2 people present
Waiting Area	7:48	475	73	48	no clients
	11:10	1675	78	64	approx. 75 clients
	2:15	1425	78	57	approx. 65 clients
Waiting Area - new cases	11:15	1675	81	48	approx. 30 clients
Reception Area	7:50	475	71	52	
	11:08	1600	76	63	
	2:10	1425	77	58	
FOM Office	7:54	525	72	52	private office
Recon Reception	8:05	500	73	51	
	12:05	1500	76	54	
	2:48	1325	74	60	
Open Office Area - 1015, front	7:52	500	71	53	
	11:23	1550	76	62	
	2:27	1250	77	57	
Open Office Area - 1013, front	8:04	525	73	53	
	11:20	1675	76	62	
DCI	8:12	575	73	47	Mezzanine
	2:55	1075	76	51	
Open office Area- 1015, rear	7:58	500	72	52	
	11:32	1650	74	59	
	2:35	1500	77	51	
Open office Area - 1013, rear	8:02	500	72	52	

TABLE 1 (continued)

Environmental Measurements

Food Stamp Office  
 HETA 93-0891  
 Newark, New Jersey  
 September 1, 1993

Location	Time	CO <sub>2</sub> (ppm)	Temp (°F)	RH (%)	Comments
	11:54	1575	75	53	
	2:41	1350	76	54	
Storage/eating Area	8:05	475	74	48	
	11:45	1450	77	50	
	2:38	1275	77	50	
Control Room	8:00	525	74	50	2 person office
DCU	8:10	500	75	43	window open
	2:57	1000	78	53	
Outside	8:08	400	77	92	front entrance
	10:50	---	85	63	
	2:18	375	95	41	

\* Clients were allowed into the building at 7:50am.