

TUBERCULOSIS EXPOSURE CONTROL PLAN
TABLE OF CONTENTS

I. PURPOSE: 2

II. OBJECTIVES: 2

III. ABBREVIATIONS USED IN THE TBEC: 3

IV. BACKGROUND INFORMATION:..... 4

 A. *Hospital Epidemiology and Infection Control (HEIC):..... 5*

 B. *Office of Environmental Health and Safety (OEH&S) and the Medical Center’s Safety Officer .. 5*

 C. *Occupational Health Services (OHS) 6*

 D. *Department Managers 6*

 E. *Students, Staff and Faculty 6*

 F. *Engineering/Facilities Services 6*

 G. *Program Evaluation..... 7*

V. EXPOSURE PREVENTION AND HIERARCHY OF CONTROLS 7

 A. *Risk Assessment 7*

 B. *Administrative Controls..... 8*

 1. *Prompt Identification of Suspect TB cases 8*

 2. *Screening of Patients 9*

 3. *Skin Testing:..... 9*

 C. *Engineering and Work Practice Controls, and Personal Protective Equipment 9*

 1. *Airborne/AFB Precautions 9*

 2. *Airborne Infection Isolation Rooms (AIIR) 10*

 3. *Patient Issues 11*

 4. *Family/Visitors 11*

 5. *Pregnancy and Breastfeeding..... 11*

 6. *Facilities Management will perform an Environmental Assessment..... 11*

 7. *Local Exhaust Ventilation (LEV)..... 12*

 8. *General Ventilation in Airborne Infection Isolation Room 13*

 9. *Outpatient Facilities..... 13*

 10. *High Risk Medical Procedures (HRMP)..... 14*

 11. *Containment of Mycobacterium tuberculosis specimens and cultures..... 16*

 12. *Discontinuation of Airborne/AFB Precautions 17*

 13. *Discharge from hospital..... 18*

 14. *Respiratory Protection Program/Roles and Responsibilities:..... 19*

 15. *Education and Training..... 23*

VI. TB SURVEILLANCE 24

 A. *Purposes..... 24*

 B. *Surveillance of Patients 24*

 C. *Surveillance of Healthcare Providers..... 24*

VII. EXPOSURE INVESTIGATION..... 29

 A. *Policy for Follow-up and Testing 29*

 B. *Surveillance Data..... 29*

 C. *Reporting and Record Keeping..... 30*

REFERENCES..... 31

GLOSSARY..... 32

CONTENTS OF RESPIRATORY PROTECTION CART..... 39

HISTORY OF TUBERCULOSIS EXPOSURE CONTROL PLAN 40

APPENDICES 41

TUBERCULOSIS EXPOSURE CONTROL PLAN

I. PURPOSE:

It is the policy of the Medical Center at UCSF to provide care to patients with tuberculosis (TB) in a manner that minimizes the risk of transmission of TB. Key components of this policy include: early diagnosis; timely and effective treatment of active pulmonary TB; effective use of administrative, work practice and engineering controls; the use of respiratory protection; and a comprehensive healthcare worker (HCW) surveillance program.

The Tuberculosis Exposure Control Plan (TBECP) serves as the guidance document for preventing transmission of pulmonary and laryngeal tuberculosis in healthcare settings. Extrapulmonary TB is not addressed except when aerosolization is a risk. The policies and procedures in the document are consistent with the current recommendations from the Centers for Disease Control, American Thoracic Society, California Department of Health Services, and Cal/OSHA compliance guidelines.

II. OBJECTIVES:

- A. To provide basic background on respiratory tuberculosis
- B. To define a process for the prompt identification of suspect TB cases
- C. To prevent the transmission of TB to personnel, other patients or the community
- D. To define high-risk procedures for TB transmission
- E. To provide protocols that reduce an employees risk of exposure to TB
- F. To outline TB screening criteria for patients and health-care workers
- G. To provide a mechanism for follow-up in the event of a TB exposure

III. ABBREVIATIONS USED IN THE TBEC:

ABBREVIATION	STANDS FOR	ABBREVIATION	STANDS FOR
ACH	Air changes per hour	LTBI	Latent tuberculosis infection
AFB	Acid-fast bacilli	LEV	Local exhaust ventilation
AII	Airborne Infection Isolation	MTB	Mycobacterium Tuberculosis
AIIR	Airborne Infection Isolation Rooms	MDR TB	Multidrug-resistant tuberculosis
BCG	Bacille Calmette-Guérin	NIOSH	National Institute for Occupational Safety and Health
BSC	Biological safety cabinet	OHS	Occupational Health Services
CD4 T-cell	Helper T-lymphocytes	OEHS	Office of Environmental Health and Safety (OEHS)
CFM	Cubic feet per minute	OSHA	Occupational Safety and Health Administration
CXR	Chest x-ray	OR	Operating room
DOT	Directly observed therapy	PAPR	Powered air-purifying respirator
EOC	Environment of Care Committee	PEP	Positive expiratory pressure
HCW	Health care worker	PPE	Personal protective equipment
HEPA	High-efficiency particulate air	SFDPH	San Francisco Department of Public Health
HRMP	High risk medical procedure	SHS	Student Health Services
HEIC	Hospital Epidemiology and Infection Control	TBEC	TB Exposure Control Plan
HIV	Human immunodeficiency virus	TB	Tuberculosis
ICC	Infection Control Committee	TST	Tuberculin skin test
ICP	Infection Control Practitioner	UCSF	University San Francisco Medical Center
IPPB	Intermittent positive pressure breathing	UVGI	Ultraviolet germicidal irradiation

IV. BACKGROUND INFORMATION:

TB is a disease caused by bacteria (*Mycobacterium tuberculosis*) which is spread by people who have active pulmonary TB (TB bacteria in the lungs or larynx). *M. tuberculosis* is carried in airborne particles called droplet nuclei that can be generated when people who have pulmonary or laryngeal TB disease cough, sneeze talk, shout, or sing. The particles are so small (1-5 microns in diameter) that normal air currents can keep them airborne for hours, and spread them throughout a room or building. Infection occurs when a susceptible person inhales droplet nuclei containing TB bacteria, and the bacteria become established in the lungs and then spread throughout the body. Person-to-person transmission of TB is determined by certain characteristics of the person with TB (“source”) and of the person exposed to the source and by the environment in which the exposure takes place. Prolonged exposure to the source case increases the risk of becoming infected, although transmission can occur after brief exposures. Infectivity is greatest in those whose sputum smear contains visible bacteria (“AFB smear positive”); this group may include those with cavitory disease or tuberculosis of the larynx. Coughing further enhances shedding. Persons with tuberculosis who are AFB smear-negative (and culture positive) are thought to be less infectious than AFB smear-positive patients but may still transmit tuberculosis.

Factors Determining Transmission of *M. Tuberculosis*

Characteristics of the person with TB (“source”)

- Concentration of organisms in sputum
- Presence of cavitory disease on CXR
- Frequency and strength of cough

Characteristics of the exposed person

- Previous *M. tuberculosis* infection
- Innate resistance to *M. tuberculosis* infection
- Genetic susceptibility to *M. tuberculosis* infection or disease or both

Characteristics of the exposure

- Frequency and duration of exposure
- Dilution effect (i.e., the volume of air containing infectious droplet nuclei)
- Ventilation (e.g., the turnover of air in a space)
- Exposure to ultraviolet light, including sunlight
- Virulence of the infecting strain of *M.tuberculosis*

Two to ten weeks after initial infection, the body's immune response usually limits further multiplication and spread of TB bacteria. However, in a small proportion of cases (usually <1%), initial infection rapidly progresses to clinical illness or active TB. For another group (approximately 5-10%), active TB develops after an interval of months, years or decades. The risk of progression to active TB is markedly increased for people infected with the human immunodeficiency virus (HIV). Latent tuberculosis infection (LTBI) is a condition that develops after exposure to a source with infectious TB disease, and subsequent infection with *M. tuberculosis* occurs where the bacilli are alive but inactive in the body. People who have LTBI but who do not have TB disease are asymptomatic, do not feel sick, and cannot spread TB to other people. Multiple clinical conditions are associated with increased risk for progression from LTBI to TB disease. HIV infection is the strongest known risk factor. Other risk factors include diabetes, acquisition of LTBI in infancy or early childhood, and apical fibronodular changes on CXR.

V. PROGRAM MANAGEMENT

The policies and procedures in the TBECP are applicable to Medical Center personnel and to campus personnel with potential contact with patients with infectious tuberculosis, including employees, volunteers, house staff, fellows, physicians, dentists, and students. Personnel at non-UCSF facilities who have potential for exposure to TB will follow that facility's TBECP.

The Infection Control Committee (ICC) with the Environment of Care Committee (EOC) shall have joint responsibility for the establishment, implementation, oversight, and evaluation of the TBECP. The ICC and EOC must review and approve the TBECP annually.

The TBECP applies to all personnel who reasonably anticipate coming into contact with people suspected or diagnosed active pulmonary or laryngeal tuberculosis while in the work environment or performing work-related tasks.

A. Hospital Epidemiology and Infection Control (HEIC):

1. Assist in the revision/review of the TBECP.
2. Assist in an annual institutional risk assessment for healthcare associated transmission of TB to determine infection control strategies. The risk assessment will be conducted by hospital specialists in epidemiology, infectious disease, with assistance from Infection Control Practitioners (ICPs), healthcare administrators, occupational health services personnel, industrial hygienists, engineers, department/unit managers, and public health authorities.
3. Act as a resource to Occupational Health Services (OHS).
4. Act as a resource to department managers for training, clarification and review of TB-related departmental policies and procedures and/or concerns.
5. Report any observed deficiencies in compliance with the TBECP to the appropriate department manager and to the Office of Environmental Health and Safety (OEH&S) Department.
6. Coordinate with OHS to confirm employee exposures and initiate follow-up when unprotected exposure to *M. tuberculosis* occurs.
7. Collaborate with house staff, Infectious Disease physicians, microbiology, and the Public Health Department to identify suspect cases.
8. Conduct follow-up of patients exposed.

B. Office of Environmental Health and Safety (OEH&S) and the Medical Center's Safety Officer

1. Coordinate with assistance from OHS and HEIC, the implementation and overall program management of the TECP.
2. Assist in the revision/review of Plan.
3. Monitor facility and departmental compliance with respiratory fit testing.
4. Report any observed deficiencies in compliance with the TBECP to appropriate department managers and to HEIC.
5. Provide education and training to departments and staff upon request.
6. Act as consultant to OEH&S in UCSF campus exposure investigations.

C. Occupational Health Services (OHS)

1. Assist in the revision/review of the TECP.
2. Conduct monitoring, tracking, and documentation for ongoing (annual) TB surveillance program (tuberculin skin test [TST] or questionnaire).
3. Report campus and medical center surveillance trends and post-exposure conversion data to the ICC at least annually.
4. Conduct post-exposure evaluation and TB screening for staff and faculty.
5. Report observed deficiencies in compliance with the TECP to appropriate department managers and to HEIC and OEH&S.
6. Communicate with Public Health Department when appropriate.

D. Department Managers

1. Each Department/Unit Manager is responsible for incorporating the relevant aspects of the TBECP into departmental/unit policies and procedures, and shall have the responsibility for ensuring implementation of the TBECP.
2. Ensure that annual department-specific TB prevention related education is provided and documented.
3. Assist with student, staff and faculty exposure follow-up process.
4. Monitor compliance of employees with exposure follow-up and annual TB screening; document non-compliance, counsel, re-educate and apply progressive discipline to non-compliant employees.
5. Ensure that identified students, staff and faculty who may work with suspected or confirmed TB patients are fit tested.

E. Students, Staff and Faculty

1. Wear respiratory protection as described in this plan (Section C.14)
2. Complete TB screening per policies
3. Complete TB education per policies
4. Report all incidents of exposure to TB to supervisor, OHS Manager and HEIC
5. Communicate with Facilities/Engineering regarding the need to convert a regular patient room into a negative pressure isolation room.
6. The attending MD of record must complete the patient's discharge treatment plan as soon as possible, at least 48 hours prior to patient discharge.
7. Assure compliance with respiratory protection by visitors.

F. Engineering/Facilities Services

1. Wear a minimum of an N95 respirator when changing ventilation system filters (Section C.14).
2. Ensure quarterly maintenance of negative pressure isolation rooms.
3. Check negative pressure rooms quarterly using a smoke test or other method.
4. Assure annual certification of the negative pressure rooms.
5. Maintain all necessary records/documentation regarding assessments of negative pressure rooms for three years.

G. Program Evaluation

The evaluation of the TECP shall be the responsibility of the chair(s) of the EOC and ICC. The evaluation shall include, but not be limited to, the extent to which elements of the TECP have been successfully implemented, including:

1. prompt identification of smear-positive specimens
2. inpatient screening procedures
3. outpatient clinical management
4. engineering controls
5. high-risk medical procedures
6. respiratory protection program
7. employee screening
8. education and training

V. EXPOSURE PREVENTION AND HIERARCHY OF CONTROLS

A. Risk Assessment

The TB risk assessment determines the types of administrative, environmental, and respiratory protection controls needed for a setting and serves as an ongoing evaluation tool of the quality of TB infection control and to identify needed improvements in infection control measures.

The initial and ongoing risk assessment will consist of the following steps:

1. Review the community profile of TB disease including the epidemiologic surveillance data in collaboration with SFDPH.
2. Review the number of patients with suspected or confirmed TB disease who have been encountered in the medical center and campus within the previous 5 years.
3. Determine if people with unrecognized TB disease have been admitted or were encountered in the medical center and campus within the previous 5 years.
4. Determine the HCW categories to include in a TB screening program and the frequency of screening.
5. Determine which HCWs need to be included in the respiratory protection program.
6. Ensure the prompt recognition and evaluation of suspected episodes of healthcare-associated transmission of *M. tuberculosis*.
7. Identify areas in the setting with an increased risk for healthcare-associated transmission of *M. tuberculosis*.
8. Assess the number of airborne infection isolation rooms (AIIR) needed for the medical center.
9. Determine the types of environmental controls needed other than AIIR (Work Practice and Personal Protective Equipment).
10. Conduct periodic reassessments annually if possible.
11. Recognize and correct lapses in infection control.

TB infection control efforts utilize a hierarchy of measures recommended by the CDC which have proven effective in preventing healthcare-associated transmission of tuberculosis. Atop this hierarchy are administrative controls, which include measures to reduce the risk for

exposure to people with infectious TB, including screening of patients for symptoms and signs of TB, isolating those with suspected disease, and prompt diagnosis and initiation of effective treatment. Engineering controls and respiratory protection constitute the second and third tiers of the hierarchy of control measures.

B. Administrative Controls

1. Prompt Identification of Suspect TB cases
([Algorithm for Airborne Infection Isolation Precautions](#))

The diagnosis of suspect TB must be based on clinical findings from the patient both adult and pediatric patients. Consider TB in a differential diagnosis if findings based on history, physical examination, chest x-ray and sputum are suspicious.

- a. Maintain a high index of suspicion for TB should be maintained for the following populations:
 - i. Close contacts of infectious TB cases
 - ii. Known positive TST
 - iii. People with HIV infection
 - iv. People with medical conditions that increase their risk of acquiring TB, such as elderly, debilitated, malnourished individuals, or people receiving immunosuppressive therapies
 - v. Foreign-born people from high prevalence countries
 - vi. Residents of long-term care facilities (including psychiatric and correctional institutions)
- b. Patients who have suspected or confirmed TB
- c. TB disease may present with the following clinical, radiologic, and laboratory findings:
 - i. A patient with primary disease may be asymptomatic, have an infiltrate and hilar adenopathy
 - ii. A patient with disease may have fever, coughing for > 3 weeks, loss of appetite, night sweats, hemoptysis, unexplained weight loss, or fatigue
 - iii. Undiagnosed pneumonia in a patient at risk, or pneumonia that is unresponsive to conventional antibacterial treatment
 - iv. Pneumonia in a patient who has had recent contact with a person with respiratory TB
 - v. Readmission of or outpatient follow-up visit for patient recently diagnosed with TB
 - vi. Chest x-ray (CXR)
 - Location of disease - apical posterior segments
 - Type of disease - cavitation, infiltrates, fibrosis
 - vii. Sputum
 - Suspect: AFB smear-positive
 - Confirmed: AFB smear-positive or negative **AND** AFB culture positive for *M. tuberculosis*
 - initial positive results for *M. tuberculosis* identified in sputum samples represents a public health concern, and is on the microbiology laboratory's list of "panic values" to report urgently

- d. Patients who have suspected or confirmed TB disease and who are not on antituberculosis treatment will be **considered infectious** if any of the following characteristics are present:
 - i. Presence of cough
 - ii. Cavitation on CXR
 - iii. AFB smear-positive
 - iv. Pulmonary or laryngeal TB
 - v. Undergoing cough-inducing or aerosol-generating procedures
 - vi. MDR TB (Section C.12 &13)

2. Screening of Patients

- a. CXRs: A CXR is indicated:
 - i. New conversion of a TST (Prior to treatment of LTBI)
 - ii. Clinical syndrome is consistent with respiratory process in high risk group
- b. Sputum examination for Acid-Fast Bacilli Smear Microscopy (AFB): Ideally, three sputa for AFB will be collected on separate days preferably in the early morning, from patients meeting the following criteria:
 - i. Positive TST and symptoms suggestive of TB
 - ii. Respiratory symptoms (lung, pleura, or larynx) of unknown etiology with TB as a possible diagnosis
 - iii. CXR findings consistent with TB disease (current, previous, or healed TB)
 - iv. HIV infected people, especially those with advanced disease and low CD4⁺ T cell counts, with any respiratory symptoms regardless of CXR findings
- c. AFB Smear Microscopy cannot be performed on gastric aspirate specimens (which are usually obtained in pediatric patients). Gastric aspirates will be sent for AFB cultures.

3. Skin Testing:

Routine TST is suggested for patients at higher risk of progression from LTBI to disease, or with a high index of suspicion or exposure to TB as outlined above.

C. **Engineering and Work Practice Controls, and Personal Protective Equipment**

Because respiratory TB is transmitted by the airborne route, TB control emphasizes decreasing droplet nuclei at the patient source and minimizing inhalation of droplet nuclei by those individuals who share the air space with the infectious patient. Engineering control measures are designed to reduce dissemination of droplet nuclei containing TB from infectious patients and include the use of airborne infection isolation rooms.

1. Airborne/AFB Precautions

Shall be initiated when active pulmonary/laryngeal TB is diagnosed or suspected. This includes patients re-admitted with persistent or recurrent symptoms and those whose duration of drug therapy has been inadequate to render the individual non-infectious.

Pediatric patients are assessed on a case-by-case basis by Infection Control and Infectious Disease regarding the need for Airborne/AFB precautions:

- a. Patients who have suspected or confirmed TB will be masked with a surgical mask as soon as a tentative diagnosis is made unless medically contraindicated, and placed in Airborne/AFB Precautions. Once precautions are in place, the patient may remove the mask. Isolation must continue until there is a medical determination that the patient is no longer infectious.
- b. Airborne/AFB Precautions will be initiated for any patient who has documented infectious TB.
- c. If TB is low on the list of differential diagnoses Airborne/AFB Precautions need NOT always be instituted when sputum for AFB is ordered. However, one sputum for AFB will promptly be obtained to support NOT instituting precautions. If the specimen is AFB smear-positive, precautions will be instituted immediately.
- d. Nurses may institute Airborne/AFB Precautions for patients exhibiting signs and symptoms of TB without a physician order.

2. *Airborne Infection Isolation Rooms (AIIR)*

- a. The patient will be placed in a private room.
- b. Airborne/AFB precautions signage will be posted on or directly adjacent to the door of the isolation room by the nursing staff.
- c. Air pressure within the AIIR will be negative to surrounding rooms and hallways.
- d. A minimum of 6 air changes per hour (ACH) will be provided. Exhausted air or ambient air will not be recirculated. Local exhaust ventilation (LEV) devices may be utilized as an adjunct to, or instead of general ventilation.
- e. Keep windows and doors closed except for entry/exit.
- f. Trash, linen, and soiled equipment will be handled according to Standard Precautions.
- g. Housekeeping duties will occur as for any occupied patient room. Staff will wear respiratory protection as per Section C.14.
- h. Room Turnover
 - i. Room Cleaning: If the room IS a negative pressure room the door needs to be closed for 30 minutes before entering to clean, once a patient is discharged. If the room IS NOT a negative pressure room (e.g. patient is placed in the room on an interim basis until negative pressure room is ready), upon discharging the patient the door needs to be closed for 1 hour before entering to clean
 - ii. The room may be cleaned if a worker is masked and the door is closed
 - iii. A new patient may not be placed in the room until it has been cleaned until the time stated above has elapsed

3. Patient Issues

- a. Patients will only leave room when medically necessary.
- b. Patient must wear a surgical mask over mouth and nose when outside the isolation room.
- c. Patient transport/transfer within the facility will be accomplished efficiently to minimize the time the patient is out of airborne infection isolation (AII).
- d. Nursing will notify the receiving department or unit of the TB diagnosis and the required precautions that must occur prior to patient transport. The individual transporting a masked patient does not need to wear a mask.
- e. Nursing will educate the patient regarding TB transmission and the need for isolation.
- f. HEIC, Care Coordination or the patient's physician will report of each TB case to public health authorities (415-206-8524).
- g. A Department of Public Health (DPH)-Authorized Discharge and Treatment Plan must be completed, submitted to DPH and approved by the TB Control Officer prior to patient discharge. The physician is responsible for completing the required forms ([Appendix 1](#)).
- h. Patients who are non-compliant with Airborne/AFB precautions will be reported to the TB Control Office of the San Francisco Department of Public Health.
- i. Exposure of other patients to an unisolated or unmasked TB patient will be managed as described in section VIII.

4. Family/Visitors

- a. Symptomatic household or other contacts of the patient will not visit until medically cleared. If obtaining medical clearance is problematic for symptomatic family members or visitors, Infection Control must be consulted.
- b. If symptomatic contact(s) must visit, a well-fitting surgical mask will be worn continuously while in the facility.
- c. All visitors including family members to AII rooms will wear a surgical mask and will be instructed by a HCW on its use prior to entering the AII room

5. Pregnancy and Breastfeeding

- a. Treatment during pregnancy:
<http://www.ctca.org/guidelines/IIA1treatmentactivetb.pdf>
- b. Women who have pulmonary TB can infect the infant after delivery
 - i. Place mother in Airborne/AFB Precautions if TB disease is suspected or confirmed
 - ii. Separate mother and infant after birth
 - iii. Consult Pediatric Infectious Disease Service for duration of separation

6. Facilities Management will perform an Environmental Assessment

Which will precede implementation of ventilation system modifications or use of ventilation adjuncts. Environmental assessment should consider the following:

- a. Air handling system currently in place
- b. Building's design and the feasibility of structural modification
- c. Patient and staff mobility needs
- d. Characterization of the at-risk population

7. Local Exhaust Ventilation (LEV)

LEV is a source control method that prevents or reduces the spread of infectious droplet nuclei into general air circulation. LEVs include partial or complete patient enclosure such as a hood, booth, or tent with a high volume exhaust fan and a HEPA filter (e.g., biological safety cabinet (BSC), Emerson Booth and Biosafety Aerostar Aerosol Protection Cart).

- a. Purpose of LEV is to capture airborne contaminants at or near their source (source control method) and to remove them without exposing people in the area.
- b. LEV shall be used for the performance of high-risk medical procedures (HRMP), unless the patient is in an Airborne/AFB Precautions isolation room or in relation to laboratory specimens as defined in, Section C.11 under "Exceptions."
- c. LEV must be positioned close enough to the patient's head to maximize the capture of contaminated air. If the LEV system is not a complete patient enclosure, the air intake must be positioned sufficiently close to the patient's airway to capture all exhaled air and cough generated particles. The LEV device will be positioned so as to direct air from the patient and through the HEPA filtration device.
- d. Departments using and servicing local exhaust ventilation (LEV) devices must have written policies and procedures governing their use and maintenance, to include the following:
 - i. Pre-filter and HEPA filter changes
 - ii. Maintenance log shall be kept
 - iii. Specially trained personnel, who are capable of recertifying the machine at the time of HEPA filter change, shall be utilized for that process
 - iv. Contracted maintenance staff shall wear appropriate PPE including Tyvek suit, gloves, and N95 respirator during change-out of HEPA filters
 - v. Spent filters will be placed into red bags and disposed of as a biohazardous waste
 - vi. HEPA filters will be certified annually
- e. Before using LEV equipment, personnel must be trained in the proper use and cleaning/disinfection of the equipment.
- f. Specific personnel will be assigned responsibility for assuring LEV equipment is properly maintained. Filter replacement is to be performed by qualified personnel according to policy and procedures.
- g. Air exhausted from source control devices shall be:
 - i. Discharged directly to the outside of the building, away from air intakes, open windows, and people; **OR**
 - ii. If recirculated, HEPA filtered

8. General Ventilation in Airborne Infection Isolation Room

Dilution reduces the concentration of contaminants by supplying clean air that mixes with and displaces the contaminated room air. Air removal occurs when the diluted contaminated air is exhausted.

- a. General ventilation will be managed in a manner that contains and reduces the concentration of contaminants in the air by the following methods.
- b. A minimum of 6-12 ACH for AII (inpatient and outpatient) is required. Higher ventilation rates result in greater reduction in the concentration of contaminants.
- c. Directional air flow/"Negative Pressure" will:
 - i. Provide optimal air flow patterns by preventing stagnation or "short circuiting" of air
 - ii. Contain contaminated air in designated areas and prevent its spread to uncontaminated areas (Anteroom may be used to reduce escape of droplet nuclei. Enclosures (booths or tents) with HEPA filtered exhaust may be used.)
 - iii. Provide air flow from less contaminated areas (hallways and adjacent rooms) to more contaminated areas (AIIR)
 - iv. Create a "negative" pressure environment (exhaust > supply)
[Pressure differential is based on a closed space and will be altered by opening doors and windows. Doors and windows must remain closed except for room access. Surrounding air spaces may be pressurized (supply > exhaust).]
- d. Monitoring: Air flow and velocity (ACH) in rooms used for Airborne/AFB Precautions or for cough-inducing treatments or procedures will be assessed regularly. Facilities management staff measure air exchanges and flow in patient rooms and report to HEIC if problems arise. OEH&S staff conduct bi-annual checks of free-standing induction or tabletop LEV systems which are found in Respiratory Therapy and Pulmonary Services Research areas

9. Outpatient Facilities

In areas where patients with undiagnosed TB may be present, an individual with symptoms of TB will be managed in a manner that minimizes risk of transmission.

- a. Patient reception, admitting, and waiting areas have ventilation that provides a minimum of 3 ACH.
- b. Coughing patients are instructed to effectively cover their coughs using respiratory hygiene:
<http://www.cdc.gov/flu/images/CoverCgh-hcp-view.gif>
- c. Respiratory hygiene signage with this request (non-verbal/pictograph and/or in several languages) is prominently posted. Tissues and masks are readily available in waiting areas.
- d. Patients with symptoms suggestive of TB are removed from common waiting areas as soon as possible and placed in a private exam room with the door closed to await evaluation. If the patient is suspected or known to have infectious TB, the room must remain vacant for one hour after the patient leaves. For questions or additional information, contact OEH&S at 476-1300.

- e. The HCW who shares air space (e.g., exam room) with an unmasked patient must wear appropriate respiratory protection (Section C.14).
- f. Communicate any possibility of TB as a diagnosis verbally to receiving departments prior to transport.
- g. High risk medical procedures will be managed according to Section C.10.

10. High Risk Medical Procedures (HRMP)

Procedures that involve instrumentation of the lower respiratory tract or induction of sputum can increase the likelihood that droplet nuclei will be expelled into the air.

- a. Cough inducing and aerosol generating procedures include:
 - i. Aerosolized pentamidine administration and nebulized treatments
 - ii. Diagnostic sputum induction (a procedure in which the patient inhales an irritant aerosol [e.g. water, saline, or hypertonic saline] to induce a productive cough)
 - iii. Operative procedures such as tracheotomy, thoracotomy, or open lung biopsy
 - iv. Respiratory care procedures such as tracheostomy, intubation or endotracheal tube care
 - v. Diagnostic procedures such as bronchoscopy and pulmonary function testing
 - vi. Resuscitative procedures performed by emergency personnel
 - vii. Autopsies performed on bodies with suspected or confirmed TB disease can pose a high risk for transmission of TB, particularly during the performance of aerosol-generating procedures
 - viii. Laboratory and research procedures performed on tissues or body fluids known or suspected to be infected with TB can aerosolize TB-contaminated fluids
- b. HRMP, to the extent possible and consistent with sound medical practice, will be performed in a manner which minimizes the risk of transmission of TB.
 - i. Bronchoscopy
 - If possible, bronchoscopy will be avoided in patients with a clinical syndrome consistent with pulmonary or laryngeal TB disease, including in people with AFB smear-negative results
 - If a bronchoscopy must be performed, whenever feasible perform in an AIIR
 - ii. Operative Procedures-Special Considerations in the Perioperative Area
 - As many pre-operative procedures as possible will be performed in an AIIR
 - When possible, postpone non-urgent surgical procedures on patients with suspected or confirmed TB disease until the patient is determined to be noninfectious or determined to not have TB disease
 - If it is not possible to postpone a surgical procedure, schedule the procedure for the last case of the day
 - Procedures will be scheduled with a minimum number of HCWs attending the surgery

- Surgical staff, particularly those close to the surgical field will use a valveless N95 disposable respirator to protect themselves and the patient undergoing surgery
 - If the patient is to be mechanically ventilated, the patient will be intubated as soon as possible after entry into the surgical suite
 - If the patient is to be mechanically ventilated, a ventilator with an exhalation filter will be used to prevent the escape of TB droplet nuclei
 - Keep OR doors closed except when bringing a patient in and out of the room
 - Postoperative recovery will occur in the OR or with appropriate postanesthesia recovery personnel in an AIIR
- iii. Autopsies
- Settings in which autopsies are performed will meet or exceed the requirements of an AIIR
 - Doors to the room shall remain closed throughout the procedure
 - HCWs performing an autopsy will wear a PAPR (Section C.14)
 - Limit the number of people attending the procedure
 - Utilize UVGI air cleaning after the procedure
 - After an autopsy is performed on a body with suspected or confirmed TB disease, allow adequate time (according to manufacturing design guidelines of UVGI system) to elapse to ensure removal of *M. tuberculosis*-contaminated room air before performing another procedure in the same room. If time delay is not feasible or if there is insufficient time for the use of UVGI air-cleaning, HCWs will perform the following autopsy using PAPRs
- c. HRMP shall be performed with dilution ventilation to affect a rate of greater than 12 ACH.
- d. The LEV device will be turned on prior to beginning the procedure and left on until after coughing has subsided.
- e. If suitable equipment and trained personnel are not available, all personnel present during the HRMP will wear mask/respirators.
- f. The following cough-producing procedures require LEV if performed on a suspect or confirmed infectious TB case when performed outside of a Airborne/AFB Precautions room:
- i. coughing (voluntary, assisted, or induced) for therapeutic mobilization of secretions or diagnostic sputum induction
 - ii. suctioning (pharyngeal or endotracheal)
 - iii. aerosol therapy (bronchodilator, antibiotics or hypertonic saline)
 - iv. artificial airway placement, repositioning or removal (e.g., bronchoscopy, intubation, extubation, repositioning of oropharyngeal or nasopharyngeal airways, endotracheal, or tracheostomy tubes)
 - v. pulmonary function testing (bedside or laboratory) in which a forced expiratory effort is required

- vi. Intermittent positive pressure breathing (IPPB) or positive expiratory pressure (PEP) therapy
- vii. chest physical therapy (postural drainage & percussion)

11. Containment of *Mycobacterium tuberculosis* specimens and cultures

To prevent laboratory personnel from incurring unprotected exposure to cultures and specimens known or suspected to contain *Mycobacterium tuberculosis*.

- a. Collection and Transport
 - i. Specimens will be collected in rigid plastic containers labeled with patient's name and unit number
 - ii. Containers will be securely closed to prevent leakage
 - iii. Containers will be placed in plastic Bio Hazard zip-lock bags at the patient bedside
 - iv. Specimens will be transported to the laboratory in a sealed plastic Bio Hazard zip-lock bag
 - v. Appropriate Microbiology request form must accompany specimen. DO NOT place form inside specimen portion of Bio Hazard zip lock bag
- b. Laboratory handling/processing:
 - i. All specimen and culture media containers will be opened within a biological safety cabinet (BSC)
 - ii. While working with specimens in a BSC, gloves and a gown, which ties in the back, must be worn, a face mask/respirator need not be worn
- c. Laboratory Spills
 - i. Definitions
 - A specimen spill is defined as a spill of the contents from an open specimen container
 - A culture spill is defined as a broken tube or bottle containing inoculated medium for the isolation of mycobacteria.
 - Exceptions:
 - Specimens known to be acid-fast smear-negative
 - Culture media that contains a species of *Mycobacterium* other than tuberculosis
- d. Procedure
 - i. Instruct people in the immediate area to evacuate or put on N95 or PAPRs
 - ii. Immediately confine area, sealing it from rest of the area, by closing doors and windows
 - iii. Only people with HEPA respirators shall be allowed to enter area until clean up is completed and for one hour thereafter
 - iv. Contact UCPD at 9-911. Provide your name and callback number and location, quantity, and identity of spilled material
 - v. In the case of a natural disaster resulting in spills of multiple cultures in the *Mycobacteria* laboratory, attend to any injured person(s) and then follow the above procedure. Before re-entry without HEPA face masks, area must be sealed off from the surrounding rooms and the air intake ventilation and the spill area and decontaminated with a tuberculocidal agent

12. Discontinuation of Airborne/AFB Precautions:

At physician discretion, precautions may be continued for longer than the TECP requires. A patient may be removed from isolation in the following circumstances with notification to HEIC:

- a. Undiagnosed pulmonary process in which TB risk assessment and clinical course indicate
 TB is not highly suspected, and one direct or concentrated AFB smear-negative,
 OR
 TB is suspected, but three consecutive AFB smear-negative results collected on different days with at least one being an early-morning specimen.
- b. TB is confirmed or cannot be ruled out and TB standard drug therapy has been initiated for the appropriate amount of time (12.c & d).
- c. Sputum smears are positive for AFB **AND**
 - i. Patient has completed at least two weeks of standard multi-drug anti-TB therapy; **AND**
 - ii. There is evidence of a bacteriologic response (decreased organisms on sputum smear); **AND**
 - iii. Patient demonstrates clinical improvement (decreased fever, decreased cough)
 - iv. Patient is discharged with provisions for appropriate monitoring and directly observed therapy (DOT)
- d. Sputum smears are negative for AFB on 3 consecutive specimens at least 24^oapart **AND**
 - i. Patient has completed 4 days of adequate chemotherapy, **AND**
 - ii. Patient demonstrates clinical improvement
- e. Patients with known or suspected multi-drug resistant TB (MDR TB) should be considered infectious, and remain in AII regardless of initial smear until all of the following criteria are met **AND**:
 - i. An appropriate MDR TB treatment regimen has been initiated and tolerated for at least two weeks **AND**
 - ii. A favorable clinical response to therapy has been demonstrated by resolution of fever, resolution or near-resolution of cough, no further progression in weight loss, and absence of any other new or progressive sign/symptoms that may be attributable to TB disease, **AND**
 - iii. Three consecutive smears from sputa collected on different days are documented as AFB negative

13. Discharge from hospital:

Patients with confirmed pulmonary or laryngeal TB may be discharged when **ALL** of the following criteria are met:

- a. To home
 - i. It is deemed medically appropriate **AND**
 - ii. The Department of Public Health with jurisdiction in the county of residence has been notified in compliance with State statutes (California Tuberculosis Law) and household contacts have been evaluated for TB infection/disease **AND** written authorization for discharge has been received from SF DPH ([Appendix 1](#))
 - iii. Patient does not reside in a congregate living facility
 - iv. Patient will not be in close contact with immunocompromised individuals or with children under three years of age
 - v. Patient demonstrates understanding of the transmission of and precautions for TB
 - vi. Arrangements for DOT have been made, when appropriate, or patient demonstrates understanding of need for and demonstrates compliance with medication regimen
- b. To a congregate living facility
 - i. Patient fulfills the criteria for discontinuation of Airborne/AFB Precautions
 - ii. Three consecutive, sputum specimens collected on different days were AFB smear-negative
 - iii. Patient demonstrates understanding of the transmission of TB
 - iv. Patient demonstrates understanding of the need for and demonstrates compliance with medication regimen
 - v. Department of Public Health with jurisdiction in the county of residence and for the county in which the congregate living center exists have been notified in compliance with State statutes (California Tuberculosis Law) **AND** written authorization for discharge has been received from SF DPH
- c. To a long-term care facility (Notification of the facility shall be done as early in the discharge planning process as possible).
 - i. Receiving facility can accommodate patient requiring Airborne/AFB Precautions, **OR**
 - ii. Patient fulfills the criteria for discontinuation of Airborne/AFB precautions
 - iii. Public Health in the county of residence and for the county in which the long-term care facility exists has been notified in compliance with State statutes (California Tuberculosis Law) **AND** written authorization for discharge has been received from Public Health

- d. If patient has MDR TB, refer to the Algorithm for MDR TB Cases and Hospital Discharge ([Appendix 2](#)).
- e. In the event a patient with suspected or confirmed TB requests to leave the hospital **Against Medical Advice (AMA)**, the following steps will be taken.
 - i. Try to convince the patient that it is in their interest as well as that of the public, that they remain hospitalized until their physician has made the decision to discharge them
 - ii. Prior to discharging the patient, call the SF DPH TB Controller to apprise them of the situation.
 - Phone: 206-8524 or 206-3398.
 - On weekends, holidays and after-hours call the TB Controller at (415) 218-4211 or Dr. Kawamura at (415) 497-2030
 - iii. Call HEIC at (415) 353-4343. If necessary, leave a message and page the Infection Control Practitioner On Call at (415) 443-2644

14. Respiratory Protection Program/Roles and Responsibilities:

OEHS&S Respiratory Protection Program (www.ehs.ucsf.edu).

The most effective way to control respiratory hazards is to follow correct work practices and prescribed engineering controls. When additional protection is needed, respiratory protection (respirator) will be used to further ensure that individuals are not exposed to TB.

- a. Respirators will be worn by HCWs in the following situations:
 - i. When entering a room/enclosure where a patient with known or suspected TB is in Airborne/AFB Precautions
 - ii. When entering an isolation room or other air space that has been occupied by an unmasked source case in the last hour
 - iii. When sharing other air space with an unmasked infectious TB patient (e.g., ED or clinic exam room)
 - iv. When performing any HRMP or when in a room in which a HRMP is being performed (Section C.10)
 - v. In settings where administrative and engineering controls are not likely to protect individuals from inhaling droplet nuclei (e.g., transporting an unmasked patient in a vehicle)
 - vi. When changing filters from air filtration devices or ventilation ducts when those filters were used to remove TB bacteria
- b. Respiratory Protection Cart for HCWs (see pg 40) will be obtained from Material Services.
- c. Facial hair impairs fit and seal of masks/respirators. Individuals with facial hair will be trained in the use of PAPR.
- d. Respirators must be approved by NIOSH. Other higher protection respirators such as PAPR with HEPA filtration can also be used.
- e. Staff will be fit tested for different facial sizes/characteristics.
- f. Staff are instructed to perform a fit check, in accordance with OSHA standards and good industrial hygiene practice, each time the respirator is worn (performed only for tight fitting respirators other than N95). HCW must undergo annual N95 TB respirator fit-testing annually.

g. Responsibilities:

- i. The individual will comply with this program. This involves but is not limited to the following:
 - Informing OHS of personal health problems that could interfere with the use of respiratory protective equipment
 - Attending training programs
 - Using the respirator as instructed
 - Checking respirator before each use to ensure that it is clean and free of damage or alteration HCW must undergo annual N95 TB respirator fit-testing annually
 - Performing a fit check of the respirator before each use for tight fitting respirators only
 - Leaving a contaminated area, as soon as patient safety permits, if the respirator is malfunctioning, not providing protection, or is significantly interfering with the wearer's ability to breathe
 - Reporting observed or suspected respirator malfunctions of PAPR Respirators to the supervisor, obtaining a replacement device or parts from the supervisor
 - When appropriate, cleaning/disinfecting respirator after each use
 - Storing respirator in a clean, dry, sanitary, and convenient location
- ii. Supervisors are responsible for administering the program in their work area. This involves the following:
 - Ensuring that employees are current with medical evaluations, training, and fit testing
 - Verifying that their employees have been fit tested at the time of hire and annually thereafter
 - Ordering respirators from Materials Management, and if appropriate: cartridges/filters, replacement parts, and cleaning items from Environmental Services
 - Ensuring that employees are using, inspecting, and cleaning respirators properly
 - Supervising contract personnel for safe practice. Contract personnel who have not been fit tested with supplied N95 respirators must wear a PAPR
 - Reporting to OEH&S problems related to respirator use and changes in equipment or procedures which may affect employee exposures or respiratory suitability
 - Ensure that staff who wear N95 respirators undergo fit-testing annually
- iii. The Office of Environmental Health and Safety (OEH&S) and the medical center Safety Office are responsible for overall administration of the Respiratory Protection Program, with support from Occupational Health Services and Infection Control. This includes the following:
 - Evaluating potential hazards with Infection Control, whether respiratory protection is needed, and (if so) what type
 - Monitoring of supervisors' enforcement of the programs

- Performing respirator training, respirator selection, and respirator fit testing
- iv. Occupational Health Services is responsible for:
 - Conducting the employee's medical screening and/or examination to determine the individual's ability to wear a respirator
 - Advising OEH&S in writing of the employee's ability or lack of ability to wear a mask/respirator
 - Maintaining confidential medical records
- v. Hospital Epidemiology and Infection Control (HEIC) is responsible for:
 - Communicating observed problems with respirator use or compliance
 - Supportive education
- h. Obtaining a respirator
Individuals who need fit testing for a mask/respirator must undergo medical screening and obtain a respirator medical clearance from OHS.
- i. Each individual must complete a respiratory medical screening form. The screening form will be reviewed by OHS to determine the employee's ability to wear a respirator.
- j. Employees who report cardiopulmonary disease or history of claustrophobia may receive a physical examination and/or spirometry.
- k. Respirator Training
 - i. Individuals who receive respirator medical clearance must then complete respirator training and be fit tested by OEH&S (476-1300)
 - ii. Respirator fit testing and training conducted initially and then annually thereafter
 - iii. Respirator training must include the following elements:
 - Reasons why a respirator is worn in contaminated environments
 - Types of respirators available
 - Limitations and capabilities of each respirator
 - Purpose of the medical screening/examination
 - Conditions that prevent a good face seal
 - Necessity of wearing the respirator as instructed, without modification
 - When to change mask/respirator or PAPR filter, battery
 - Sanitary care of respirators
 - Proper way to don and fit check a respirator
 - Proper way to store a respirator
 - Proper way to dispose of a respirator
 - Individual and supervisor responsibility
- l. Types of Air-Purifying Respirators
 - i. Negative pressure respirators (N95 or cartridge type) filters contaminants when inhalation creates negative pressure within the device and air flows through the filter material
 - ii. Powered Air Purification Respirator (PAPR) are powered by a portable battery pack which pumps air through a filter unit and then distributes the filtered air into the hood of the respirator

- m. Selection of respirators
 - i. NIOSH approved respirators that meet the CDC criteria stated in Section C.14.i will be used
 - ii. Employees will be informed that a PAPR affords greater protection than disposable N95 devices
- n. Fit testing
 - i. OEHS or OHS will perform qualitative fit testing using an OSHA approved method
 - ii. Fit Test Report: After the correct respirator is determined, the employee will be given a sticker with name/size of respirator to attach to ID card. OEHS or OHS will provide a written report to the employee that is to be given to her/his supervisor. The report is designed to assist the supervisor in her/his record keeping responsibilities and contains the following information:
 - Employee's name
 - Size and type of the employee's respirator
 - iii. A respirator may be assigned for the employee's individual use, when appropriate
 - iv. By the end of the fitting session, the employee will know how and when to:
 - Inspect the respirator
 - Put on and adjust the respirator
 - Perform fit checks
 - Store the respirator, when appropriate
 - Return for training, fit testing, and medical surveillance
 - Discard and replace the respirator
 - v. Beards and Facial Hair: OEHS may perform a fit test on individuals who have hair where the respirator touches the face. A PAPR will be worn by individuals in whom no face seal is achieved
- o. Respirator maintenance and storage
 - i. The respirator must be inspected before and after each use to ensure that it is clean and intact. The respirator will be discarded and/or replaced if soiled, distorted, or in disrepair or if outside of the respirator is wet
 - ii. Respirators, if not disposable, will be stored in a clean, sanitary, convenient location
 - iii. Disposable respirators (cannot be used by more than one person) must be discarded if they are soiled or physically damaged (e.g., creased or torn) and will be discarded as regular waste
 - iv. Routine maintenance for non-disposable respirators must be replaced and properly maintained
 - v. PAPRs must be flow checked prior to each use to verify minimum flow of 6 cfm
 - vi. Respirator usage: N95 respirators are disposable, but can be used repeatedly throughout a work shift unless they become wet or damaged. Masks must be discarded at the end of the shift. PAPRs are also available on the respiratory protection cart

- vii. Program evaluation: OEH&S and the Safety Office will periodically perform work area evaluations to ensure that the Respiratory Protection Program is enforced properly at the unit/department level. During the evaluation, recommendations on respirator usage, maintenance, and storage techniques may be made

15. Education and Training

The goal is to provide TB education and training to Medical Center and campus personnel who have potential contact with patients or specimens that may transmit TB. Records of training will be maintained by OEH&S for a period of 3 years.

- a. Training will be presented in a manner appropriate to the individual's or group's job category, educational level and language ability, literacy skills and commonality of participants.
- b. Initial training must be given upon hire or prior to assignment in areas where exposure to TB is anticipated.
- c. Review and update will be provided annually thereafter.
- d. Attendance at both the initial training and annual updates is mandatory.
- e. The teaching methods will be varied to allow for diverse audiences (lecture, videotape).
- f. Content for training sessions includes:
 - i. Basic concepts of TB transmission, pathogenesis and diagnosis, including:
 - ii. Signs and symptoms
 - iii. Possibility of reinfection in people with a positive TST test
 - iv. Identification of individuals at increased risk for TB
 - v. Differences between latent TB infection and active disease
 - vi. Diagnostic procedures
- g. Potential for occupational exposure to infectious TB within the healthcare facility, including:
 - i. Prevalence of TB in the community and in the facility
 - ii. Ability of the facility to appropriately isolate patients with active TB
 - iii. "At risk" situations for exposure to TB
- h. Exposure Control Plan/Infection Control principles, practices and limitations, including:
 - i. Early identification of infectious patients
 - ii. Site specific control measures and their limitations
 - iii. Airborne/AFB Precautions (engineering controls and respiratory protection devices)
 - iv. Employee screening/occupational health/workers' compensation
- i. Employee Surveillance:
 - i. Purpose
 - ii. Importance of participation in skin testing
 - iii. Frequency of TST screening
 - iv. Significance of a positive TST
 - v. Importance of ongoing screening of people with positive TSTs
 - vi. Effect of HIV and other medical conditions on the interpretation of the result/energy testing

(j-m) Included in annual nursing review only

- j. Principles of treatment include:
 - i. Preventative therapy
 - ii. Therapy for active TB
 - iii. Difficulty of treating MDR TB
- k. Healthcare workers' responsibility to prevent transmission to patients and other healthcare workers, including:
 - i. To seek medical evaluation if symptoms of TB develop or if TST test conversion occurs
 - ii. To notify Occupational Health Services if diagnosed with active TB to enable the appropriate investigation and screening of contacts
- l. The immunosuppressed worker, including:
 - i. Higher risk for progression from infection to disease
 - ii. Differences in the TST interpretation and clinical presentation
 - iii. High mortality associated with MDR TB in immunocompromised individuals
- m. Confidentiality of healthcare worker

VI. TB SURVEILLANCE

A. Purposes

1. Prevention of transmission of tuberculosis from HCW to patients and to other HCW.
2. Accumulation of data on the risks of infection to hospital personnel.
3. Assistance in the early detection of infection among employees, thereby facilitating consultation, treatment, and referral.
4. Identification of healthcare-associated transmission.

B. Surveillance of Patients

1. The Clinical Laboratories, and Microbiology Section, will notify HEIC staff of inpatient and outpatient sputum (lower respiratory tract) specimens read as smear positive for AFB and specimens found to be culture positive for *Mycobacterium tuberculosis* (MTB).
2. Infection Control and Occupational Health Services will maintain documentation for patients and HCWs with pulmonary/laryngeal cultures positive for MTB.
3. Summary reports of the numbers and characteristics of inpatients and outpatients with infectious TB will be presented to the Infection Control Committee at least annually. Problems will be identified, and corrective action taken as needed.

C. Surveillance of Healthcare Providers

1. At risk Medical Center and campus personnel included in the OHS screening program who do not have a current TB test will be excluded from work. Work exclusion will be enforced by the manager of the noncompliant worker's department.
2. At risk Medical Center and campus personnel will participate in the surveillance program.

The following are HCWs who should be included in the TB screening program:

INCLUSION IN TB SCREENING PROGRAM	
Administrators or managers	Morgue staff
Bronchoscopy staff	Nurses
Chaplains	Outreach staff
Clerical staff	Pathology laboratory staff
Computer programmers	Patient transport staff, including EMS
Construction staff	Patient Service Assistant
Correctional officers	Pediatric staff
Craft or repair staff	Pharmacists
Dental staff	Phlebotomists
Dietician or dietary staff	Physical and occupational therapists
ED staff	Physicians (assistant, attending, fellow, resident, or intern), including: - Anesthesiologist - Pathologists - Psychiatrists - Psychologists
Engineers	Public health educators or teachers
Food service staff	Public safety staff
Health aides	Radiology staff
Health and safety staff	Registry and contract employee
Housekeeping or custodial staff	Respiratory therapists
Homeless shelter staff	Scientists
Infection-control staff	Social workers
ICU staff	Students (e.g., medical, nursing, technicians, and allied health)
Janitorial staff	Technicians (e.g., health, laboratory, radiology, and animal)
Laboratory staff	Unit Assistants
Maintenance staff	Veterinarians

2. Surveillance will be carried out according to approved OHS procedures. Accountability for documenting the surveillance for each group will be assigned to the appropriate Medical Center or University department (e.g., OHS, Student Health).
3. OHS will maintain a confidential data base of surveillance information using established procedures for Medical Center employees, and other groups as assigned. An annual report focusing on high risk areas will be submitted to the ICC by OHS and will include:
 - a. The number of employees in the department (n).
 - b. The number of employees evaluated (skin test or questionnaire) (e).
 - c. Rate of compliance (e/n).
 - d. The number who were previously skin test negative (y).
 - e. The number of documented conversions (x).
 - f. The conversion rate (x/y).
 - g. The number of individuals found to have active disease.
4. **UCSF and MEDICAL CENTER STAFF MUST BE SCREENED FOR TB AT LEAST ANNUALLY.** Additional screening shall be required by HEIC and OHS based on surveillance data, and assessment of risk of exposure to TB (Section VIII).

5. Individuals (including volunteers) who have patient contact or handle body fluid specimens that may contain *Mycobacterium tuberculosis* shall undergo TB screening at the time of their pre-placement examination and periodically as required in the TBECF. TST shall be administered and the results read and recorded by Occupational Health Services or by a designated agent.

6. Pre-placement Screening
 - a. Individual has no history of TST, has a history of prior negative TST, or is unable to describe undocumented results of prior positive TST.
 - i. Individual will have 2-step testing performed unless able to document one negative TST within the previous 12 months
 - ii. If documentation of negative TST within 1 year is produced, only a single TST will be administered
 - b. Individual has documented history or presents accurate verbal description of positive TST or medical history of TB.
 - i. If the individual has had a chest x-ray within the last year, a copy of the report shall be obtained for the Occupational Health Services chart
 - ii. If the individual has not had a chest x-ray within the last year or if the results are unavailable, a chest x-ray shall be obtained
 - iii. A symptom review shall be performed
 - iv. Patients with a negative chest x-ray will be educated to report symptoms suggestive of TB to Occupational Health
 - v. If symptoms or chest x-ray are suggestive of TB, a referral will be made for evaluation and treatment. The individual will be placed on medical hold until deemed non-infectious
 - vi. For employees with a history of TB, information shall be obtained regarding the age at diagnosis, duration of treatment, and medication
 - c. History of BCG Vaccination
 - i. History of BCG vaccination shall be noted in the Occupational Health Services chart. If BCG was received within the last two years, a TST will not be placed until a full 2 years has elapsed. Individual will be screened periodically with his/her department or work group
 - ii. If the individual has a documented past positive TST or is able to describe a positive TST, proceed as indicated in Section C.7
 - iii. If no documentation or description of a positive TST is available, a two-step TST shall be placed

7. Interpretation of positive TSTs
 - a. TST result ≥ 5 mm induration is positive
 - i. people who are HIV-infected or with risk factors for HIV infection but status is unknown
 - ii. people who have had recent household or other prolonged contact with an infectious tuberculosis case
 - iii. people who have chest x-rays consistent with previous TB
 - iv. Organ transplant recipients and other immunosuppressed people (e.g., people receiving ≥ 15 mg/day prednisone for ≥ 1 month)
 - v. TB suspects

- b. TST result ≥ 10 mm induration is positive
 - i. Recent immigrants (i.e., within the previous 5 years) from countries with a high incidence of TB disease
 - ii. People who inject illicit drugs
 - iii. Residents and employees (including healthcare workers [HCWs]) of the following congregate settings
 - hospitals and other health-care facilities
 - long term care facilities (e.g., hospices and skilled nursing facilities)
 - residential facilities for patients with AIDS or other immunocompromising conditions
 - correctional facilities
 - homeless shelters
 - iv. Mycobacteriology laboratory personnel
 - v. People with any of the following clinical conditions or immunocompromising conditions that place them at high risk for TB disease
 - diabetes mellitus
 - silicosis
 - chronic renal failure
 - certain hematologic disorders (e.g., leukemias and lymphomas)
 - other specific malignancies (e.g., carcinoma of the head, neck, or lung)
 - unexplained weight loss of $>10\%$ of ideal body weight
 - gastrectomy
 - jejunioileal bypass
 - vi. People living in areas with high incidence of TB disease
 - vii. Children aged <4 years
 - viii. Infants, children, and adolescents exposed to adults at high risk for developing TB disease
 - ix. Locally identified groups at high risk
 - c. TST result ≥ 15 mm induration is positive
 - i. People with no known risk factors for TB disease
 - ii. HCWs who are otherwise at low risk for TB disease and who received baseline testing at the beginning of employment as part of a TB screening program
8. Assessing TST conversion: Conversion from a negative to positive TST shall be defined as follows:
- a. Baseline: ≥ 10 mm induration (either first or second-step) in the immunocompetent host.
 - b. Serial testing without known exposure: Increase of ≥ 10 mm induration
 - c. Known exposure (close contact): ≥ 5 mm induration in people who have a baseline TST result of 0 mm; an increase of ≥ 10 mm is considered a positive result in people with a negative baseline TST result or previous follow-up screening TST result of ≥ 0 mm

- d. ≥ 5 mm induration (regardless of the change since prior testing) in those employees who
 - i. Are known to be HIV positive or who have risk factors for HIV with unknown HIV status
 - ii. Are immunocompromised due to other medical conditions, including long-term use of corticosteroids or other immunosuppressive medication
 - iii. Have had close contact with a known case of infectious tuberculosis
 - iv. Have had chest x-rays consistent with old healed TB
9. Written notification of the TST result and its interpretation will be provided to each employee tested. Notification shall include the following statement.

"HIV infection and other medical conditions may cause a TB skin test to be negative even when TB infection is present."
10. Follow-up for positive TST or TST conversion
 - a. Individuals will be counseled and referred for follow-up/treatment.
 - b. A chest x-ray is to be obtained.
 - c. A Confidential Morbidity Report is to be completed for active cases of TB and sent to the SF DPH.
 - d. If the chest x-ray is positive for suspected active TB, or if the employee has a negative chest x-ray with symptoms of TB, the employee shall be immediately removed from work. If the employee is found to have active TB, the employee shall remain off work until documentation from the employee's treating health care provider is received stating that the employee is noninfectious after (4 days of treatment for smear-negative and at least 14 days of treatment for smear-positive). Return to work clearance must be verified by OHS.
 - e. When appropriate, forms shall be filed with the workers' compensation insurance carrier.
 - f. If worker is determined to have an active case of TB that is deemed infectious, an exposure investigation (section VIII) will be completed.
11. Immunocompromised healthcare workers
Health care workers (HCW) are encouraged to know their immune/HIV status and to voluntarily seek counseling (Occupational Health Services and Employee Rehabilitation).

Severely immunocompromised HCWs will be advised to avoid exposure to TB. HCW will be advised of options for severely immunocompromised HCWs to voluntarily transfer to areas and activities in which there is a reduced risk of exposure to TB. This will be a personal decision for a HCW after being informed of their risk and evaluating the job commitment and satisfaction. Confidentiality will be maintained.

VII. EXPOSURE INVESTIGATION

An exposure investigation shall be initiated for employees and patients who have face-to-face or same room contact with the TB positive source without personal respiratory protection. HEIC and OHS will determine the definitions and scope of exposure follow-up activities. Notification will occur via UCSF exposure Policy and Procedure: [UCSF Communication Emergency Notification for Exposure](#)

A. Policy for Follow-up and Testing

1. OHS will maintain HCW data.
2. OHS will manage staff, faculty and volunteer notification and follow-up; OEHS and SHS will manage student notification and follow-up.
 - a. Employees who have had a documented negative past TST shall be notified to report to OHS for follow-up testing eight to ten weeks following the exposure.
 - b. Exposed employees, including those with a prior positive TST, shall be advised to report to OHS for a symptom review.
3. HEIC will manage patient and visitor notification, including patient education. Unprotected exposures to patients or other employees with infectious TB will be reported to HEIC by an individual who suspects such exposure.
 - a. Exposure Investigation (Problem Evaluation):
A problem is defined as:
 - i. Suspected patient-to-patient transmission
 - ii. Greater than 5% conversion rate in one area or department in a surveillance period (6, 12, or 24 months)
 - iii. Conversion rate for one or more departments/work groups that is significantly higher than for other departments
 - b. If a problem is identified, HEIC, OEHS, OHS, and personnel from other departments as appropriate will work with the manager involved to develop a plan for evaluating and addressing the problem.
4. HEIC, OHS, OEHS, and others as appropriate will investigate the exposure. The investigation may include the following components:
 - a. Administrative controls, such as time interval from admission to beginning Airborne /AFB Precautions.
 - b. Identify undiagnosed infectious person (patient or staff).
 - c. Engineering controls, such as isolation room quality assurance and functioning.
 - d. HCW training documentation.
 - e. Compliance by HCWs, family/visitors, and patient with infection control procedures.

B. Surveillance Data

1. Data will be maintained in a confidential manner.
2. OHS will report conversion rates by job classification to the ICC annually.
3. Employee compliance with annual TB screening and respirator fit testing will be reported at least monthly to department managers.

C. Reporting and Record Keeping

1. Public health notification
 - a. HEIC will coordinate reporting suspect or confirmed cases of TB to the SF DPH in accordance with reporting requirements. Treating physician will communicate with Public Health Department as required.
2. Employee TB surveillance data
 - a. TB skin tests, including the name or other identifier of the person tested, the date of the test, the result of the test in millimeters of induration, and the interpretation of the result, shall be recorded and maintained in the Occupational Health Services database.
 - b. TB skin test conversions shall be recorded on the log of occupational injuries and illnesses (CalOSHA 300 Log) unless there is significant evidence of non-occupational exposure.
3. Exposure events will be reported to ICC.

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GLOSSARY

This glossary contains many of the terms used in the TBECPP, as well as others that are encountered frequently by people who implement TB infection-control programs. The definitions given are not dictionary definitions but are those most applicable to usage relating to TB.

Acid-fast bacilli (AFB):

Bacteria that retain certain dyes after being washed in an acid solution. Most acid-fast organisms are mycobacteria. When AFB are seen on a stained smear of sputum or other clinical specimen, a diagnosis of TB will be suspected; however, the diagnosis of TB is not confirmed until a culture is grown and identified as *M. tuberculosis*.

Aerosol:

The droplet nuclei that are expelled by an infectious person (e.g., by coughing or sneezing); these droplet nuclei can remain suspended in the air and can transmit *M. tuberculosis* to other people.

Air changes:

The ratio of the volume of air flowing through a space in a certain period of time (i.e., the airflow rate) to the volume of that space (i.e., the room volume); this ratio is usually expressed as the number of air changes per hour (ACH).

Airborne infection isolation (AII):

The isolation of patients infected with organisms spread through airborne droplet (AII) precautions nuclei 1–5 µm in diameter. This isolation area receives substantial ACH (>12 ACH for new construction since 2001 and >6 ACH for construction before 2001) and is under negative pressure (i.e., the direction of the air flow is from the outside adjacent space [e.g., the corridor] into the room). The air in an AII room is preferably exhausted to the outside, but can be recirculated if the return air is filtered through a high efficiency particulate respirator (HEPA) filter.

AII room (AIIR):

A room designed to maintain AII. Formerly called negative pressure isolation room, an AII room is a single-occupancy patient-care room used to isolate people with suspected or confirmed infectious TB disease. Environmental factors are controlled in AII rooms to minimize the transmission of infectious agents that are usually spread from person-to-person by droplet nuclei associated with coughing or aerosolization of contaminated fluids. AII rooms will provide negative pressure in the room (so that air flows under the door gap into the room), an air flow rate of 6–12 ACH, and direct exhaust of air from the room to the outside of the building or recirculation of air through a HEPA filter.

Air mixing:

The degree to which air supplied to a room mixes with the air already in the room, usually expressed as a *mixing factor*. This factor varies from 1 (for perfect mixing) to 10 (for poor mixing), and it is used as a multiplier to determine the actual airflow required (i.e., the recommended ACH multiplied by the mixing factor equals the actual ACH required).

Anergy:

The inability of a person to react to skin-test antigens (even if the person is infected with the organisms tested) because of immunosuppression.

Bacillus of Calmette and Guerin (BCG) vaccine:

A TB vaccine used in many parts of the world.

Booster phenomenon:

A phenomenon in which some people (especially older adults) who are skin tested many years after infection with *M. tuberculosis* have a negative reaction to an initial skin test, followed by a positive reaction to a subsequent skin test. The second (i.e., positive) reaction is caused by a boosted immune response. Two-step testing is used to distinguish new infections from boosted reactions (see Two-step testing).

Bronchoscopy:

A procedure for examining the respiratory tract that requires inserting an instrument (a bronchoscope) through the mouth or nose and into the trachea. The procedure can be used to obtain diagnostic specimens.

Chemotherapy:

Treatment of an infection or disease by means of oral or injectable drugs.

Contact:

A person who has shared the same air with a person who has infectious TB for a sufficient amount of time to allow possible transmission of *M. tuberculosis*.

Conversion, PPD:

See PPD test conversion.

Culture:

The process of growing bacteria in the laboratory so that organisms can be identified.

Directly observed therapy (DOT):

An adherence-enhancing strategy in which a HCW or other designated person watches the patient swallow each dose of medication.

Droplet nuclei:

Microscopic particles (i.e. 1-5µm in diameter) produced when a person coughs, sneezes, shouts, or sings. The droplets produced by an infectious TB patient can carry tubercle bacilli and can remain suspended in the air for prolonged periods of time and be carried on normal air currents in the room.

Drug resistance, acquired:

A resistance to one or more anti-TB drugs that develops while a patient is receiving therapy and which usually results from the patient's nonadherence to therapy or the prescription of an inadequate regimen by a healthcare provider.

Drug resistance, primary:

A resistance to one or more anti-TB drugs that exists before a patient is treated with the drug(s). Primary resistance occurs in people exposed to and infected with a drug-resistant strain of *M. tuberculosis*.

Drug-susceptibility tests:

Laboratory tests that determine whether the tubercle bacilli cultured from a patient are susceptible or resistant to various anti-TB drugs.

Exposure:

The condition of being subjected to something (e.g., infectious agents) that could have a harmful effect. A person exposed to *M. tuberculosis* does not necessarily become infected (see Transmission).

High-efficiency particulate air (HEPA) filter:

A specialized filter that is capable of removing 99.97% of particles $\geq 0.3 \mu\text{m}$ in diameter and that may assist in controlling the transmission of *M. tuberculosis*. Filters may be used in ventilation systems to remove particles from the air or in personal respirators to filter air before it is inhaled by the person wearing the respirator. The use of HEPA filters in ventilation systems requires expertise in installation and maintenance.

Human immunodeficiency virus (HIV) infection:

Infection with the virus that causes acquired immunodeficiency syndrome (AIDS). HIV infection is the most important risk factor for the progression of latent TB infection to active TB.

Immunosuppressed:

A condition in which the immune system is not functioning normally (e.g., severe cellular immunosuppression resulting from HIV infection or immunosuppressive therapy). Immunosuppressed people are at greatly increased risk for developing active TB after they have been infected with *M. tuberculosis*. No data are available regarding whether these people are also at increased risk for infection with *M. tuberculosis* after they have been exposed to the organism.

Induration:

An area of swelling produced by an immune response to an antigen. In tuberculin skin testing or anergy testing, the diameter of the indurated area is measured 48-72 hours after the injection, and the result is recorded in millimeters.

Infection:

The condition in which organisms capable of causing disease (e.g., *M. tuberculosis*) enter the body and elicit a response from the host's immune defenses. TB infection may or may not lead to clinical disease.

Infectious:

Capable of transmitting infection. When people who have clinically active pulmonary or laryngeal TB disease cough or sneeze, they can expel droplets containing *M. tuberculosis* into the air. People whose sputum smears are positive for AFB are probably infectious.

Intradermal:

Within the layers of the skin.

Isoniazid (INH):

A first-line, oral drug used either alone as preventive therapy or in combination with several other drugs to treat TB disease.

Latent TB infection:

Infection with *M. tuberculosis*, usually detected by a positive PPD skin-test result, in a person who has no symptoms of active TB and who is not infectious.

Local exhaust ventilation (Portable room-air HEPA) units:

Free-standing portable devices that remove airborne contaminants by circulating air through a HEPA filter.

Multidrug-resistant tuberculosis (MDRTB):

Active TB caused by *M. tuberculosis* organisms that are resistant to more than one anti-TB drug; in practice, often refers to organisms that are resistant to both INH and rifampin with or without resistance to other drugs (see Drug resistance, acquired and Drug resistance, primary).

***M. tuberculosis* complex:**

A group of closely related mycobacterial species that can cause active TB (e.g., *M. tuberculosis*, *M. bovis*, and *M. africanum*); most TB in the United States is caused by *M. tuberculosis*.

N95

A disposable respirator mask which is capable of 95% minimum efficiency when tested according to the criteria described in NIOSH 42 CFR, Part 84.

Negative pressure:

The relative air pressure difference between two areas in a healthcare facility. A room that is at negative pressure has a lower pressure than adjacent areas, which keeps air from flowing out of the room and into adjacent rooms or areas.

Nosocomial:

An occurrence, usually an infection, that is acquired in a hospital or as a result of medical care.

PAPR (Positive Air Pressure Respirator)

Has an air supply and blower. This respiratory protection is used for:

1. Staff who are not fit tested for N95.
2. Staff with beards/facial hair.

Positive PPD reaction:

A reaction to the purified protein derivative (PPD)-tuberculin skin test that suggests the person tested is infected with *M. tuberculosis*. The person interpreting the skin-test reaction determines whether it is positive on the basis of the size of the induration and the medical history and risk factors of the person being tested.

Preventive therapy:

Treatment of latent TB infection used to prevent the progression of latent infection to clinically active disease.

Purified protein derivative (PPD)-tuberculin:

A purified tuberculin preparation that was developed in the 1930s and that was derived from old tuberculin. The standard Mantoux test uses 0.1mL of PPD standardized to 5 tuberculin units.

Purified protein derivative (PPD)-tuberculin test:

A method used to evaluate the likelihood that a person is infected with *M. tuberculosis*. A small dose of tuberculin (PPD) is injected just beneath the surface of the skin, and the area is examined 48-72 hours after the injection. A reaction is measured according to the size of the induration. The classification of a reaction as positive or negative depends on the patient's medical history and various risk factors.

Purified protein derivative (PPD)-tuberculin test conversion:

A change in PPD test results from negative to positive. A conversion within a 2-year period is usually interpreted as new *M. tuberculosis* infection, which carries an increased risk for progression to active disease. A booster reaction may be misinterpreted as a new infection (see Booster phenomenon and Two-step testing).

Recirculation:

Ventilation in which all or most of the air that is exhausted from an area is returned to the same area or other areas of the facility.

Resistance:

The ability of some strains of bacteria, including *M. tuberculosis*, to grow and multiply in the presence of certain drugs that ordinarily kill them; such strains are referred to as drug-resistant strains.

Room-air HEPA recirculation systems and units:

Devices (either fixed or portable) that remove airborne contaminants by recirculating air through a HEPA filter.

Single-pass ventilation:

Ventilation in which 100% of the air supplied to an area is exhausted to the outside.

Smear (AFB smear):

A laboratory technique for visualizing mycobacteria. The specimen is smeared onto a slide and stained, then examined using a microscope. Smear results will be available within 24 hours. In TB, a large number of mycobacteria seen on an AFB smear usually indicates infectiousness. However, a positive result is not diagnostic of TB because organisms other than *M. tuberculosis* may be seen on an AFB smear (e.g., nontuberculous mycobacteria).

Source case:

A case of TB in an infectious person who has transmitted *M. tuberculosis* to another person or people.

Source control:

Controlling a contaminant at the source of its generation, which prevents the spread of the contaminant to the general work space.

Specimen:

Any body fluid, secretion, or tissue sent to a laboratory where smears and/or cultures for *M. tuberculosis* will be performed.

Sputum:

Phlegm coughed up from deep within the lungs. If a patient has pulmonary disease, an examination of the sputum by smear and culture can be helpful in evaluating the organism responsible for the infection. Sputum will not be confused with saliva or nasal secretions.

Sputum induction:

A method used to obtain sputum from a patient who is unable to cough up a specimen spontaneously. The patient inhales a saline mist, which stimulates a cough from deep within the lungs.

Symptomatic:

Having symptoms that may indicate the presence of TB or another disease.

TB case:

A particular episode of clinically active TB. This term will be used only to refer to the disease itself, not the patient with the disease. By law, cases of TB must be reported to the local health department.

TST conversion:

A change in the result of a test for *M. tuberculosis* infection wherein the condition is interpreted as having progressed from uninfected to infected. An increase of >10 mm in induration during a maximum of 2 years is defined as a TST conversion for the purposes of a contact investigation. A TST conversion is presumptive evidence of new *M. tuberculosis* infection and poses an increased risk for progression to TB disease. See also conversion.

TB infection:

A condition in which living tubercle bacilli are present in the body but the disease is not clinically active. Infected people usually have positive tuberculin reactions, but they have no symptoms related to the infection and are not infectious. However, infected people remain at lifelong risk for developing disease unless preventive therapy is given.

TB risk assessment:

An initial and ongoing evaluation of the risk for transmission of *M. tuberculosis* in a particular healthcare setting. To perform a risk assessment, the following factors will be considered: the community rate of TB, number of TB patients encountered in the setting, and the speed with which patients with TB disease are suspected, isolated, and evaluated. The TB risk assessment determines the types of administrative and environmental controls and respiratory protection needed for a setting.

Transmission:

The spread of an infectious agent from one person to another. The likelihood of transmission is directly related to the duration and intensity of exposure to *M. tuberculosis* (see Exposure).

Tuberculosis (TB):

A clinically active, symptomatic disease caused by an organism in the *M. tuberculosis* complex (usually *M. tuberculosis* or, rarely, *M. bovis* or *M. africanum*).

Tuberculin skin test (TST):

A diagnostic aid for finding *M. tuberculosis* infection. A small dose of tuberculin is injected just beneath the surface of the skin (in the United States by the Mantoux method), and the area is examined for induration by palpation 48–72 hours after the injection. The indurated margins will be read transverse (perpendicular) to the long axis of the forearm.

Two-step testing:

A procedure used for the baseline testing of people who will periodically receive tuberculin skin tests (e.g., HCWs) to reduce the likelihood of mistaking a boosted reaction for a new infection. If the initial tuberculin-test result is classified as negative, a second test is repeated 1-3 weeks later. If the reaction to the second test is positive, it probably represents a boosted reaction. If the second test result is also negative, the person is classified as not infected. A positive reaction to a subsequent test would indicate new infection (i.e., a skin-test conversion) in such a person.

Ultraviolet germicidal irradiation (UVGI):

The use of ultraviolet radiation to kill or inactivate microorganisms.

Ventilation, dilution:

An engineering control technique to dilute and remove airborne contaminants by the flow of air into and out of an area. Air that contains droplet nuclei is removed and replaced by contaminant-free air. If the flow is sufficient, droplet nuclei become dispersed, and their concentration in the air is diminished.

Ventilation, local exhaust:

Ventilation used to capture and remove airborne contaminants by enclosing the contaminant source (i.e., the patient) or by placing an exhaust hood close to the contaminant source.

CONTENTS OF RESPIRATORY PROTECTION CART

<u>ITEM</u>	<u>QTY</u>	
TOP DRAWER		
AIRBORNE (AFB) PRECAUTION SIGN	1	
PAPR UNIT INSTRUCTIONS		1
PICK LIST SHEET		1
N95 INSTRUCTIONS		1
PERSONNEL FIT TEST RESULTS	1	
DRAWER #2		
REGULAR PAPR HEAD COVERS	3	
SANIWIPES		18TL
DISPOSABLE WASHCLOTHS		1PKG
DRAWER #3		
PAPR UNIT	1	
BLACK PAPR HOSE		2
AIR FLOWMETER (BULLET)		1
SPARE PAPR BATTERY	1	
DRAWER #4		
SOFT TOUCH II MASK	1BX	
3-M #1860 REGULAR MASK		1BX
3-M #1860 SM. MASK (ZIP LOCK BAG)	10ea	
TECHNOL N95 REGULAR MASK	1BX	
TECHNOL N95 SM. MASK	10ea	
BOUFFANT SURGICAL CAP		10ea
DRAWER #5		
EMPTY, TO BE USED FOR DIRTY HOODS, PAPR UNITS		

HISTORY OF TUBERCULOSIS EXPOSURE CONTROL PLAN

DEVELOPED BY:

Department of Medicine
Department of Infectious Diseases
Occupational Health Service
Office of Environmental Health and Safety
Infection Control
Laboratory Medicine
Mount Zion
Nursing Education
Respiratory Care

APPROVED BY:

Infection Control Committee (Parnassus) 10/95,
Infection Control Committee (Mt. Zion)
Safety Committee 10/95
Revised 1996

1997 Revision approved by IC/Environment of Care Committees 2/98
2000 Revision approved by IC/Environment of Care Committees 11/00
2003 Revision approved by IC/Environment of Care Committees 01/04
2007 Revision approved by IC/Environment of Care Committees 7/07

¹ Reference to Fonts

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¹ This document was done in a Times New Roman font because similar looking fonts in Arial caused mis-representation in abbreviations.

APPENDICES

Located separately from this document.

1. SF City/County form “Hospital Discharge and Treatment Plan for Patients with Suspected or Confirmed Tuberculosis”
2. SF Department of Public Health Treatment and Follow-up Plan Summary
3. Algorithm for MDR-TB Cases and Hospital Discharge